1997 Inventory of Toxic Air Emissions

Point, Area, and Mobile Sources

April 2001

The 1997 inventory is an update of the full 1996 regional inventory which is an ongoing initiative of the air regulatory agencies in the eight Great Lake states and the province of Ontario.

Submitted by:
Great Lakes Commission
400 Fourth Street
Ann Arbor, MI 48103-4816

Submitted to:
U.S. Environmental Protection Agency
Region 5
77 West Jackson Blvd.
Chicago, IL 60604

On behalf of:
Illinois Environmental Protection Agency, Bureau of Air
Indiana Department or Environmental Management, Office of Air Management
Michigan Department of Environmental Quality, Air Quality Division
Minnesota Pollution Control Agency, Environmental Outcomes Division
New York Department of Environmental Conservation, Division of Air Resources
Ohio Environmental Protection Agency, Division of Air Pollution Control
Ontario Ministry of Environment, Environmental Monitoring and Reporting Branch
Pennsylvania Department of Environmental Protection, Air Quality Control
Wisconsin Department of Natural Resources, Bureau of Air Management

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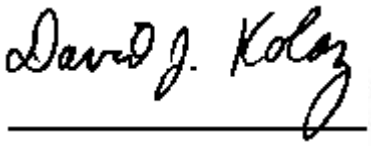
Acronyms and Abbreviations

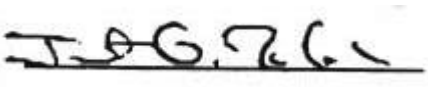
AIRS	Aerometric Information Retrieval System
AMS	Area and Mobile Source
BTU	British Thermal Unit
BW10	Break Wear less than 10 microns
CAA	Clean Air Act
CAR	California Air Resources Board
CAS	Chemical Abstract Service
DVMT	Daily Vehicle Miles Traveled
EET	Emission Estimating Techniques
EIIP	Emission Inventory Improvement Program
EIS	Emission Inventory System
ESP	Electrostatic Precipitator
EVHC	Evaporation Hydrocarbon
EXHC	Exhaust Hydrocarbon
EXPM	Exhaust Particulate Matter
FAEED	FAA Aircraft Engine Emission Database
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
HDGV	Heavy-Duty Gasoline Vehicles
HDDV	Heavy-Duty Diesel Vehicles
IDEM	Indiana Department of Environmental Management
IEPA	Illinois Environmental Protection Agency
IJC	International Joint Commission
IMS	Information Management System
INDOT	Indiana Department of Transportation
LDDV	Light-Duty Diesel Vehicles
LDDT	Light-Duty Diesel Trucks
LDGV	Light-Duty Gasoline Vehicles
LDGT1	Light-Duty Gasoline Trucks
LDGT2	Light-Duty Gasoline Trucks
MACT	Maximum Achievable Control Technology
MC	Motorcycles
MCEI	Minnesota Criteria Pollutant Emission Inventory
MDEQ	Michigan Department of Environmental Quality
MOBILE5	U.S. EPA's Vehicle Emissions Model
MPCA	Minnesota Pollution Control Agency
MSDS	Material Safety Data Sheet
NATA	National Air Toxics Assessment
n.e.c.	Not Elsewhere Classified
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NEVES	Non-road Engine and Vehicle Emission Study
NO_x	Nitrogen Oxides
NTI	National Toxic Inventory

NYDEC	New York Department of Environmental Conservation
OEPA	Ohio Environmental Protection Agency
OMS	Office of Mobile Standards
PAH	Polycyclic Aromatic Hydrocarbons
PART5	U.S. EPA's Highway Vehicle Particulate Emission Factor Model
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
RFG	Reformulated Gasoline
SAMS	SIP Air Pollutant Inventory Management System
SCC	Source Classification Code
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SSD	Source Summary Database
STEPS	State Environmental Programs Systems
TANKS	Storage Tank Emissions Software
TOG	Total Organic Gases
TRI	Toxic Release Inventory
TW10	Tire Wear less than 10 microns
U.S. EPA	United States Environmental Protection Agency
USDA	United States Department of Agriculture
VOC	Volatile Organic Compound
WDNR	Wisconsin Department of Natural Resources

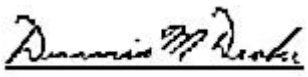
Great Lakes Regional Air Directors



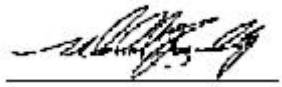
David J. Kolaz
Bureau Chief
Bureau of Air
Illinois EPA



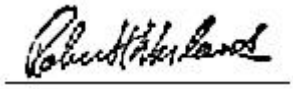
Janet McCabe
Assistant Commissioner
Office of Air Management
Indiana DEM



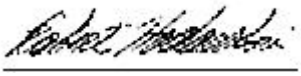
Dennis M. Drake
Chief
Air Quality Division
Michigan DEQ



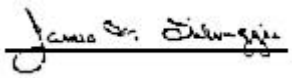
Michael J. Sandusky
Director
Environmental Outcomes Division
Minnesota PCA



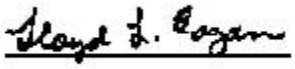
Robert Warland
Director
Division of Air Resources
New York DEC



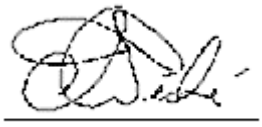
Robert F. Hodanbosi, P.E.
Chief
Division of Air Pollution Control
Ohio EPA



James M. Salvaggio
Director
Bureau of Air Quality
Pennsylvania DEP



Lloyd L. Eagan
Director
Bureau of Air Management
Wisconsin DNR



Edward Piche
Director
Environmental Monitoring &
Reporting Branch
Ontario ME

Acknowledgments

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

** Buzz Asselmeier
Bureau of Air
IL Environmental Protection Agency

Chun-Yi Wu
Chris Nelson
Environmental Outcomes Division
MN Pollution Control Agency

Gary Baker
Dennis McGeen
Air Quality Division
MI Dept. of Environmental Quality

Robert McDonough
Kevin Watts
Kevin McGarrity
Division of Air Resources
NY Dept. of Environmental Conservation

Jon Bates
Office of Air Management
IN Dept. of Environmental Management

* Orlando Cabrera-Rivera
Joseph Tarter
Chris Bovee
Jie Quan
Bureau of Air Management
WI Dept. of Natural Resources

Tom Velalis
Harry Judson
Louidajean Holloway
Division of Air Pollution Control
OH Environmental Protection Agency

Peter Wong
George Georgakopoulos
Envir. Monitoring & Reporting Branch
ON Ministry of Environment

Rob Altenburg
Bureau of Air Quality
PA Dept. of Environmental Protection

* Denotes Steering Committee Chair
** Denotes Steering Committee Vice Chair

Observer

Dr. Suzanne King
U.S. EPA Region 5

The Great Lakes Regional Air Toxic Emissions Inventory has been a challenging endeavor for all involved. As an unprecedented effort to compile a regional inventory of toxic air emissions, a multitude of complex issues had to be resolved to ensure that the priorities of all Great Lakes jurisdictions - federal, state, and provincial - were adequately addressed.

This unique effort has benefited from the leadership of Orlando Cabrera-Rivera, chair of the Steering Committee for the Great Lakes Regional Air Toxic Emissions Inventory Project, Julie Wagemakers, project manager, Great Lakes Commission, and Buzz Asselmeier and Chun Yi Wu for administering the quality assurance and quality control checks on the inventory data. Ms. Wu conducted the Scope Study that looked at expanding the Great Lakes regional inventory to include mobile source emissions. The results of this study served as the basis for developing the mobile sources module in RAPIDS. The Steering Committee, composed of emission inventory specialists from the Great Lakes states, U.S. EPA and the province of Ontario worked together closely, making the project a team effort.

This report was written, compiled, and reviewed by all of the above project participants in addition to their staff. Editorial, report compilation and technical assistance was provided by Great Lakes Commission staff member Derek Moy. Project administration and oversight was provided by Dr. Michael J. Donahue, Commission executive director, and Julie Wagemakers, program manager, Communications and Information Management. Contractual support for software development was provided by Windsor Technologies, Inc.

1. Introduction and Inventory Objective

This 1997 inventory update, a product of the Great Lakes Regional Air Toxic Emissions Inventory Project, presents a multijurisdictional inventory of point, area and mobile sources of toxic air emissions that have the potential to impact environmental quality in the Great Lakes region. 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, region 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 1997 emissions.

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, area and mobile 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 Great Lakes Water Quality Agreememt, 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.

The inventory project is strengthening decision making capabilities in the region 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

The Great Lakes Toxic Air Emissions Inventory effort began in 1989 with primary funding provided by the U.S. EPA. Development of a *Regional Air Pollutant Inventory Development System* (RAPIDS), a regional protocol for calculating emissions and an inventory for Southwest Lakes Michigan launched this regional effort. To date we have released full inventories for the years 1993 and 1996 with 1993 including point and area sources for 49 pollutants and 1996

including point, area and mobile sources for 82 pollutants. The 1997 inventory covers point, area and mobile sources for 82 pollutants.

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* (online at http://great-lakes.net/envt/air/airtox.html.) . 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:

- Assigns responsibilities and procedures to the states, Great Lakes Commission, U.S. EPA Great Lakes National Program Office (GLNPO);
- Outlines procedures to identify and locate emission sources of target compounds;
- Guides selection of specific emission estimation techniques;
- Instructs states on compiling and updating the regional repository at GLNPO;
- Outlines quality assurance/quality control procedures for emission data and estimates; and
- Identifies and explains the full suite of automated tools available for developing the regional inventory.

Two important issues for the inventory development effort are the appropriate level of detail and the use of facility versus area approach for calculating emissions. For the inventory, the protocol defines the following level of detail as being appropriate for meeting the goals of the project:

- **Emittants included:** Include all target compounds listed in Table 1-1;
- **Spatial resolution:** By county for area and mobile sources, and to the nearest 100 meters for facility sources and associated devices;
- **Temporal resolution:** Annual emissions estimates and annual activity data; and
- **Source/device/process categorization:** By the most detailed source/device/process as identified in U.S. EPA's Source Classification Codes (SCC) and Area and Mobile Source (AMS) coding systems of process codes plus a further breakdown by Standard Industrial Classification (SIC), as appropriate, to better categorize a given source (required to prevent the problem of inconsistent aggregation of sources/devices/processes among the participating states).

The protocol describes the two emission calculation approaches as follows:

- **Facility source approach:** Separately identify each device/process at each facility source and calculate its emissions (often referred to as a facility/point source approach); and
- **Area source approach:** Aggregate all similar or identical device/processes within a defined area and calculate their total emissions directly using the appropriate surrogate activity data

(the source in this case is the area in which all of the devices are found, usually an entire county).

The area source approach is generally used for sources that are small and numerous, such as gasoline stations and dry cleaning establishments. They are not included as facility sources because the effort required to gather and estimate emissions for each individual facility is beyond the resources available for inventory development efforts. Some area sources, such as consumer products, have no analog as a facility source.

The protocol refers to certain software tools (e.g. the Regional Air Pollutant Inventory Development System (RAPIDS), 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.

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The Steering Committee is composed of representatives from each of the air management programs from the eight Great Lakes states as well as Ontario and observers from U.S. EPA. A complete list of members with contact information can be found in Appendix HH. For further information on Steering Committee functions see http://www.glc.org/air/air3.html**.**

The Steering Committee worked closely with the project software development contractor, Windsor Technologies Inc., to enhance emissions estimation and reporting capabilities in RAPIDS. RAPIDS is a client/server system developed in PowerBuilder® with an ORACLE® back-end database. The software takes full advantage of Internet/Great Lakes Information Network (GLIN) connections between the states, the Great Lakes Commission and the U.S. EPA GLNPO office in Chicago.

Finally, a Quality Assurance/Quality Control (QA/QC) Committee reviewed the inventory report, established QA/QC criteria for use by all states and the province of Ontario, and ensured the report provides an accurate and useful summary of toxic air emissions at the regional level.

*At time of publication New York state data was unavailable. This will be provided at a later date.

Next steps

Collection of 1998 data for point and area sources is already underway. For the 1999 inventory, the Steering Committee will extend the pollutant list to include all 188 hazardous air pollutants identified in Section 112(b) of the CAA.

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.

Table 1-1: List of 82 targeted toxic air pollutants.

Non-Metal Compounds (Excluding PAHs)	
Acetaldehyde	Methyl chloroform (1,1,1-Trichloroethane)
Acrolein	Methylene chloride (Dichloromethane)
Acrylamide	Methylene diphenyl diisocyanate (MDI)
Acrylonitrile	Parathion
Atrazine	Pentachloronitrobenzene (quintobenzene)
Benzene (including benzene from gasoline)	Pentachlorophenol
1,3-Butadiene	Phenol
Carbon tetrachloride	Phosgene
Chlordane	Styrene
Chloroform	2,3,7,8 -tetrachlorodibenzo -furan (TCDF)
Coke oven emissions	2,3,7,8 -tetrachlorodibenzo -p-dioxin (TCDD)
Di-n-butyl phthalate	Tetrachloroethylene (Perchloroethylene)
Di-n-octyl phthalate	Toluene
Dichloroethyl ether (bis(2-chloroethyl) ether)	2,4-Toluene diisocyanate
Diethylhexyl phthalate (Bis(2-ethylhexyl)phthalate) (DEHP)	Total polychlorinated biphenyls (PCBs)
Ethylbenzene	Total polychlorinated dibenzodioxins (PCDDs)
Ethylene dibromide (Dibromoethane)	Total polychlorinated dibenzofurans (PCDFs)
Ethylene dichloride (1,2-Dichloroethane)	Trichloroethylene
Ethylene oxide	2,4,5-Trichlorophenol
Formaldehyde	2,4,6-Trichlorophenol
Glycol ethers	Trifluralin
Heptachlor	Vinyl chloride
Hexachlorobenzene	Xylenes (Meta)
Hexachlorobutadiene	Xylenes (Ortho)
Hexachloroethane	Xylenes (Para)
Hydrazine	Xylenes (Iso)
Methoxychlor	
16 PAHs (POM)	
Acenaphthene	Chrysene
Acenaphthylene	Dibenz(a,h)anthracene
Anthracene)	Fluoranthene
Benz(a)anthracene	Fluorene
Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene
Benzo(b)fluoranthene	Naphthalene
Benzo(ghi)perylene	Phenanthrene
Benzo(k)fluoranthene	Pyrene
Metal Compounds	
Antimony	Copper
Arsenic	Lead
Beryllium	Alkylated lead
Cadmium	Maganese
Chromium	Mercury
Chromium (6)	Nickel
Cobalt	

The 1997 update and all previous inventories are available online at the Great Lakes Information Network (GLIN, http://www.great-lakes.net). Additional information, including background documents, GIS maps depicting air emissions across the region, 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 from the Great Lakes Geographic Initiative air program grant funds designated for regional projects that address air toxics and the Great Lakes.

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. Results

The following results represent emissions from point, area and mobile sources in the Great Lakes region. These results are based on 1997 data. The regional emission inventory includes emissions from 675 distinct source categories and 1467 distinct processes. The source categories include emissions from 16 area sources, 8 on-road vehicle categories, 10-non-road vehicle categories, aircraft, and locomotives. 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. 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 Illinois and Indiana. No emissions were estimated for this area source category from these states.

Emissions from All Sources

The 1997 emissions were estimated for 82 target compounds, however, data were only available to obtain emissions for 75 air toxins, including 16 polycyclic aromatic hydrocarbons (PAHs), 47 non-metal compounds and 12 metal compounds. Table 2-1 shows pollutant names and estimated emissions from point, area and mobile sources. Among the 75 pollutants, 73 pollutants are emitted from point sources, 65 pollutants are emitted from area sources, and 33 from mobile sources. Area sources dominate the 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, 22 non-metal compounds and 11 metal compounds. Mobile sources are responsible for most emissions of 11 non-metal compounds. Among the 75 pollutants, toluene was estimated to have the highest emissions at 516,504,563 pounds, while 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) emissions are the lowest recorded at about 0.12 pounds.

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 source contribution of emissions for the selected 10 pollutants was analyzed by category for area and mobile 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 2-2 and 2-3. The selected pollutants are toluene, xylenes (includes o, m, and p), benzene, formaldehyde, methyl chloroform, manganese, lead, copper, nickel and chromium.

Table 2-1 shows the total regional emissions by source category and their percent contributions to the total emissions. More than 60 percent of the regional emissions of benzene, formaldehyde, toluene, and xylenes (isomers and mixture) are attributed to mobile

sources. Emissions of methyl chloroform are dominated by area sources, with a contribution of 97%. Point sources dominate the emissions of the top five metal compounds.

The results shown in Table 2-1 indicate that on-road mobile sources are the most significant contributors to overall mobile source emissions. A close look was taken at the eight subcategories of highway vehicles. Table 2-2 shows that Light Duty Gasoline Vehicles (LDGV) is the dominant subcategory for on-road mobile source emissions, responsible for about 25% of the emissions of toluene, xylenes and benzene. LDVG and Heavy Duty Diesel Vehicles (HDDV) contribute in equal amounts (about 15% each) to the total emissions of formaldehyde. The most significant contributor to the emissions of methyl chloroform is Degreasing Equipment. This area source category accounts for about 68% of the total regional 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 90% contributions. As shown on Table 2-3, the most significant source category for manganese, lead, copper and nickel is Primary Metal Industries (SIC code 33xx). Chromium emissions are dominated by the Metal Mining industry (SIC code 10xx).

Detailed emission distributions by standard industrial classification (SIC) codes and source classification codes (SCC) are shown in tables 2-1 through 2-4 and figures 2-1 through 2-77.

Table 2-1: Summary of 1997 air toxics emissions from point, area, and mobile sources.

Pollutant Name	Cas No.	Emissions (lb)					Percent (%)			
		Point	Area	Onroad	Nonroad	Total	Point	Area	Onroad	Nonroad
PAHs										
Acenaphthene	83329	90.95	69,664.39			69,755.35	0.13	99.87	0.00	0.00
Acenaphthylene	208968	500.78	839,168.93			839,669.70	0.06	99.94	0.00	0.00
Anthracene	120127	17,045.06	85,127.58	19.04	178.42	102,370.11	16.65	83.16	0.02	0.17
Benz(a)anthracene	56553	24,255.94	134,194.83	174.43	2,045.30	160,670.50	15.10	83.52	0.11	1.27
Benzo(ghi)perylene	191242	2,652.46	62,513.18	372.79	3,999.06	69,537.49	3.81	89.90	0.54	5.75
Benzo(a)pyrene	50328	91,183.03	37,232.16	142.36	1,239.30	129,796.85	70.25	28.68	0.11	0.95
Benzo(b)fluoranthene	205992	89.68	38,540.47	199.86	1,055.58	39,885.60	0.22	96.63	0.50	2.65
Benzo(k)fluoranthene	207089	40.20	14,141.98	151.58	1,128.53	15,462.30	0.26	91.46	0.98	7.30
Chrysene	218019	35,590.09	87,722.18	1,681.77	1,555.14	126,549.18	28.12	69.32	1.33	1.23
Dibenz(a,h)anthracene	53703	6.78	21,542.32	24.70	214.59	21,788.39	0.03	98.87	0.11	0.98
Fluoranthene	206440	62,886.56	112,542.70	196.60	1,387.29	177,013.14	35.53	63.58	0.11	0.78
Fluorene	86737	263.14	131,437.01			131,700.15	0.20	99.80	0.00	0.00
Indeno(1,2,3-cd)pyrene	193395	66.91	71,865.35	31.85	213.24	72,177.34	0.09	99.57	0.04	0.30
Naphthalene	91203	936,181.85	7,905,066.66	4,710,095.98	58,068.01	13,609,412.50	6.88	58.09	34.61	0.43
Phenanthrene	85018	3,093.77	1,985,123.17	108.35	616.68	1,988,941.96	0.16	99.81	0.01	0.03
Pyrene	129000	485.09	117,994.38	248.22	902.91	119,630.59	0.41	98.63	0.21	0.75
Total PAHs		1,174,432.29	11,713,877.28	4,713,447.53	72,604.07	17,674,361.17	6.64	66.28	26.67	0.41
Non-Metal Compounds (Excluding PAHs)										
Acetaldehyde	75070	1,302,132.62	118,658.83	13,463,727.33	13,860,591.00	28,745,109.78	4.53	0.41	46.84	48.22
Acrolein	107028	142,098.68	175,565.47	1,784,374.18	890,669.56	2,992,707.88	4.75	5.87	59.62	29.76
Acrylamide	79061	1,197.00				1,197.00	100.00	0.00	0.00	0.00
Acrylonitrile	107131	433,462.18	39,298.50			472,760.68	91.69	8.31	0.00	0.00
Atrazine	1912249		6,129,361.91			6,129,361.91	0.00	100.00	0.00	0.00
Benzene	71432	4,494,373.61	36,206,508.51	76,408,249.17	32,891,567.57	150,000,698.86	3.00	24.14	50.94	21.93
1,3-Butadiene	106990	381,753.19	2,874,081.29	9,976,058.60	3,773,015.22	17,004,908.30	2.24	16.90	58.67	22.19
Carbon tetrachloride	56235	13,947.94	42,102.39			56,050.33	24.88	75.12	0.00	0.00
Chlordane	57749									
Chloroform	67663	823,423.90	244,832.36			1,068,256.26	77.08	22.92	0.00	0.00
Coke oven emissions		2,177,356.47				2,177,356.47	100.00	0.00	0.00	0.00
Dichloroethyl ether (bis(2-chloroethyl) ether)	111444									

Table 2-1: Summary of 1997 air toxics emissions from point, area, and mobile sources (continued).

Pollutant Name	Cas No.	Emissions (lb)					Percent (%)			
		Point	Area	Onroad	Nonroad	Total	Point	Area	Onroad	Nonroad
Non-Metal Compounds (Excluding PAHs) continued										
Diethylhexyl phthalate (DEHP)	117817	25,622.39	988,078.72			1,013,701.11	2.53	97.47	0.00	0.00
Di-n-butyl phthalate	84742	44,239.60	8.60			44,248.20	99.98	0.02	0.00	0.00
Di-n-octyl phthalate	117840	24,164.06	1.69			24,165.75	99.99	0.01	0.00	0.00
Ethylbenzene	100414	4,870,149.20	5,815,534.12	31,329,184.34	20,341,241.82	62,356,109.47	7.81	9.33	50.24	32.62
Ethylene dibromide (Dibromoethane)	106934	801.04	1,253.45			2,054.49	38.99	61.01	0.00	0.00
Ethylene dichloride (1,2-Dichloroethane)	107062	80,098.62	20,977.25			101,075.87	79.25	20.75	0.00	0.00
Ethylene oxide	75218	236,938.30	882,302.18			1,119,240.48	21.17	78.83	0.00	0.00
Formaldehyde	50000	11,185,664.32	1,078,485.90	34,793,296.89	29,643,401.29	76,700,848.39	14.58	1.41	45.36	38.65
Glycol ethers		9,868,531.92	10,344,701.44			20,213,233.36	48.82	51.18	0.00	0.00
Hexachlorobenzene	118741	8.91	17.73			26.65	33.45	66.55	0.00	0.00
Hexachlorobutadiene	87683	15.00				15.00	100.00	0.00	0.00	0.00
Hexachloroethane	67721	416.00	5,886.44			6,302.44	6.60	93.40	0.00	0.00
Hydrazine	302012	456.00				456.00	100.00	0.00	0.00	0.00
Methyl chloroform (1,1,1-Trichloroethane)	71556	2,358,890.09	69,640,152.94			71,999,043.03	3.28	96.72	0.00	0.00
Methylene chloride (Dichloromethane)	75092	18,415,019.15	15,284,788.17			33,699,807.32	54.64	45.36	0.00	0.00
Methylene diphenyl diisocyanate (MDI)	101688	101,127.93				101,127.93	100.00	0.00	0.00	0.00
Pentachlorophenol	87865	4.00				4.00	100.00	0.00	0.00	0.00
Phenol	108952	2,369,515.36	21,332.84		67,368.31	2,458,216.51	96.39	0.87	0.00	2.74
Phosgene	75445	161.00	0.19			161.19	99.88	0.12	0.00	0.00
Styrene	100425	13,876,674.19	117,217.12	14,521,031.18	2,072,075.76	30,586,998.25	45.37	0.38	47.47	6.77
2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	1746016	0.11	0.01			0.12	91.14	8.86	0.00	0.00
2,3,7,8-tetrachlorodibenzo-furan (TCDF)	51207319	102.49	0.61			103.10	99.41	0.59	0.00	0.00
Tetrachloroethylene (Perchloroethylene)	127184	3,240,486.61	34,557,887.51			37,798,374.13	8.57	91.43	0.00	0.00
Toluene	108883	51,148,428.01	168,329,744.72	215,684,161.15	81,342,229.72	516,504,563.59	9.90	32.59	41.76	15.75
2,4-Toluene diisocyanate	584849	4,940.29				4,940.29	100.00	0.00	0.00	0.00
Total polychlorinated biphenyls (PCBs)	1336363	243.74	0.09			243.82	99.96	0.04	0.00	0.00
Total polychlorinated dibenzodioxins (PCDDs)		6.01	3.87			9.88	60.84	39.16	0.00	0.00
Total polychlorinated dibenzofurans (PCDFs)		9.07	21.36			30.43	29.81	70.19	0.00	0.00
Trichloroethylene	79016	11,485,739.20	41,097,532.43			52,583,271.63	21.84	78.16	0.00	0.00
2,4,5-Trichlorophenol	95954	6.02				6.02	100.00	0.00	0.00	0.00
2,4,6-Trichlorophenol	188062	301.21				301.21	100.00	0.00	0.00	0.00
Trifluralin	1582098	6,371.00	1,238,431.13			1,244,802.13	0.51	99.49	0.00	0.00

Table 2-1: Summary of 1997 air toxics emissions from point, area, and mobile sources (continued).

Pollutant Name	Cas No.	Emissions (lb)					Percent (%)			
		Point	Area	Onroad	Nonroad	Total	Point	Area	Onroad	Nonroad
Non-Metal Compounds (Excluding PAHs) continued										
Vinyl chloride	75014	1,307,300.68	457,514.09			1,764,814.76	74.08	25.92	0.00	0.00
Xylenes (includes o, m, and p)	1330207	32,867,160.91	93,215,911.43	121,985,022.77	74,724,044.73	322,792,139.84	10.18	28.88	37.79	23.15
m-Xylenes	108383	139,286.37	984,495.59	62,331,029.71	1,096,502.57	64,551,314.23	0.22	1.53	96.56	1.70
o-Xylenes	95476	1,168,876.19	10,316,409.02	33,327,767.17	3,308,309.20	48,121,361.59	2.43	21.44	69.26	6.87
p-Xylenes	106423	7,914.94	616,259.32		109,607.91	733,782.18	1.08	83.98	0.00	14.94
Total Non-Metals		174,605,415	500,845,359	615,603,902	264,120,624	1,555,175,301	11.23	32.21	39.58	16.98
Metal Compounds										
Antimony	7440360	29,099.37	683.51			29,782.88	97.71	2.29	0.00	0.00
Arsenic	7440382	279,832.45	14,760.60	82.43	3.73	294,679.21	94.96	5.01	0.03	0.00
Beryllium	7440417	9,639.08	9,907.77			19,546.84	49.31	50.69	0.00	0.00
Cadmium	7440439	52,022.32	11,471.51			63,493.84	81.93	18.07	0.00	0.00
Chromium	7440473	475,509.92	15,828.84	2,327.93	8,117.82	501,784.52	94.76	3.15	0.46	1.62
Chromium (6)	18540299	21,984.29	91.42			22,075.71	99.59	0.41	0.00	0.00
Cobalt	7440484	56,142.91	937.47			57,080.38	98.36	1.64	0.00	0.00
Copper	7440508	876,892.32	2,922.24	278,930.12	357.82	1,159,102.50	75.65	0.25	24.06	0.03
Lead	7439921	1,094,050.86	29,308.66	103,533.60	4,625.03	1,231,518.14	88.84	2.38	8.41	0.38
Manganese	7439965	1,370,659.78	28,863.61	3,426.25	9,324.64	1,412,274.28	97.05	2.04	0.24	0.66
Mercury	7439976	64,769.13	10,163.46	2,059.74	2,313.40	79,305.74	81.67	12.82	2.60	2.92
Nickel	7440020	912,944.19	26,656.84	2,708.44	4,425.06	946,734.54	96.43	2.82	0.29	0.47
Total Metals		5,243,546.62	151,595.94	393,068.51	29,167.51	5,817,378.57	90.14	2.61	6.76	0.50
Total		181,023,394	512,710,832	620,710,418	264,222,396	1,578,667,041	11.47	32.48	39.32	16.74

*Ethylene oxide and Ethylene dibromide (Dibromoethane) emissions from OH industrial surface coating, 442,502 lb and 39,845 lb are removed from original data.

Table 2-2: The most significant source categories for the top five non-metal compounds.

Pollutant Name	**Cas No.**	**Emissions (lb)**	***Most Significant Source Category***	**% of Contribution**
Toluene	108883	516,504,564	Light Duty Gasoline Vehicles	26
Xylenes (includes o, m, and p)	1330207	322,792,140	Light Duty Gasoline Vehicles	23
Benzene	71432	150,000,699	Light Duty Gasoline Vehicles	31
Formaldehyde	50000	76,700,848	LDGV and Heavy Duty Diesel Vehicles	34
Methyl chloroform	71556	71,999,043	Degreasing Equipment	68

Table 2-3: The most significant source categories for the top five metal compounds.

Pollutant Name	**Cas No.**	**Emissions (lb)**	***Most Significant Source Category***	**% of Contribution**
Manganese	7439965	1,412,274	Primary Metal Industries (SIC code 33xx)	46
Lead	7439921	1,231,518	Primary Metal Industries (SIC code 33xx)	41
Copper	7440508	1,159,102	Primary Metal Industries (SIC code 33xx)	31
Nickel	7440020	501,785	Primary Metal Industries (SIC code 33xx)	34
Chromium	7440473	79,306	Metal Mining (SIC code 10xx)	56

Table 2-4: Summary of 1997 air toxics emissions by SCC/AMS codes.

Material Code	SCC	Category	IL	IN	MI	MN	NY	OH	PA	WI	ON	Regional Emissions	Regional Percentage
ACENAPHTHEN	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	28,916	41.45
ACENAPHTHEN	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	18,344	26.30
ACENAPHTHEN	2104008000	WOOD - RESIDENTIAL	X									14,476	20.75
ACENAPHTHEN	2104008050	WOODSTOVE - NONCATALYTIC				X				X	X	7,915	11.35
ACENAPHTHEN		Other										105	0.15
ACENAPHTHYL	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	613,010	73.01
ACENAPHTHYL	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	154,497	18.40
ACENAPHTHYL	2104008000	WOOD - RESIDENTIAL	X									46,324	5.52
ACENAPHTHYL		Other										25,838	3.08
ACETALDEHYDE		Other										32,224,657	91.06
ACETALDEHYDE	2270005015	AGRICULTURAL TRACTORS	X	X	X	X	X	X		X		3,163,212	8.94
ACROLEIN		Other										2,986,565	78.18
ACROLEIN	2275020000	AIRCRAFT - COMMERCIAL	X	X	X	X	X	X		X	X	635,812	16.64
ACROLEIN	2201001290	LDGV	X	X	X	X	X	X		X	X	197,678	5.17
ACRYLAMIDE		UNCLASSIFIED						X		X		695	58.06
ACRYLAMIDE	39999992	MISC MFG									X	501	41.85
ACRYLAMIDE		Other										1	0.08
ACRYLONITRIL	30101849	PLASTIC POLYMERS	X									387,000	81.86
ACRYLONITRIL		Other										46,462	9.83
ACRYLONITRIL	2620030000	LANDFILL - AREA		X		X		X		X		39,299	8.31
ANTHRACENE	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	40,482	39.53
ANTHRACENE	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	24,461	23.89
ANTHRACENE	2104008000	WOOD - RESIDENTIAL	X									13,029	12.72
ANTHRACENE		UNCLASSIFIED		X				X				9,877	9.65
ANTHRACENE	2104008050	WOODSTOVE - NONCATALYTIC				X				X	X	7,123	6.96
ANTHRACENE	39999992	MISC MFG									X	6,831	6.67
ANTHRACENE		Other										595	0.58
ANTIMONY		UNCLASSIFIED		X		X		X		X		16,843	56.55
ANTIMONY		Other										7,911	26.56
ANTIMONY	30302399	TACONITE ORE PROCESSING				X						1,719	5.77
ANTIMONY	30400414	SECONDARY LEAD	X									1,710	5.74
ANTIMONY	40202299	COATING - PLASTIC PARTS							X			1,600	5.37

Table 2-4: Summary of 1997 air toxics emissions by SCC (continued).

Material Code	SCC	Category	IL	IN	MI	MN	NY	OH	PA	WI	ON	Regional Emissions	Regional Percentage
ARSENIC	39999992	MISC MFG									X	133,698	45.37
ARSENIC		Other										81,083	27.51
ARSENIC	30300813	IRON PRODUCTION									X	62,896	21.34
ARSENIC	30302399	TACONITE ORE PROCESSING				X						17,014	5.77
ATRAZINE	2461800000	PESTICIDE	X	X	X	X		X		X		6,129,362	100.00
BENZ(A)ANTHR	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	73,378	45.58
BENZ(A)ANTHR	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	57,831	35.93
BENZ(A)ANTHR		Other										18,856	11.71
BENZ(A)ANTHR	30300101	ALUMINUM ORE	X	X								10,911	6.78
BENZ(GHI)PE	2104008000	WOOD - RESIDENTIAL	X									28,952	41.28
BENZ(GHI)PE	2104008050	WOODSTOVE - NONCATALYTIC				X				X	X	15,829	22.57
BENZ(GHI)PE	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	11,566	16.49
BENZ(GHI)PE		Other										7,667	10.93
BENZ(GHI)PE	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	6,114	8.72
BENZENE		Other										142,658,273	79.37
BENZENE	2401020000	COATING - AREA SOURCE						X				14,322,373	7.97
BENZENE	2201001290	LDGV	X	X	X	X	X	X		X	X	11,909,979	6.63
BENZENE	2201001270	LDGV	X	X	X	X	X	X	X	X	X	10,855,253	6.04
BENZO(A)PYRE	30600201	FCCU	X	X	X	X			X		X	59,900	46.08
BENZO(A)PYRE		Other										22,433	17.26
BENZO(A)PYRE	30300302	BY-PRODUCT COKE	X	X							X	15,164	11.67
BENZO(A)PYRE	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	12,229	9.41
BENZO(A)PYRE	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	11,566	8.90
BENZO(A)PYRE	2104008000	WOOD - RESIDENTIAL	X									8,686	6.68
BENZO(B)FLUO	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	17,349	43.33
BENZO(B)FLUO	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	12,229	30.54
BENZO(B)FLUO	2104008000	WOOD - RESIDENTIAL	X									5,790	14.46
BENZO(B)FLUO	2104008050	WOODSTOVE - NONCATALYTIC				X				X	X	3,166	7.91
BENZO(B)FLUO		Other										1,505	3.76
BENZO(K)FLUO	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	6,114	39.12
BENZO(K)FLUO	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	5,783	37.01
BENZO(K)FLUO	2104008000	WOOD - RESIDENTIAL	X									1,448	9.26
BENZO(K)FLUO		Other										1,492	9.54
BENZO(K)FLUO	2104008050	WOODSTOVE - NONCATALYTIC				X				X	X	791	5.06

Table 2-4: Summary of 1997 air toxics emissions by SCC (continued).

Material Code	SCC	Category	IL	IN	MI	MN	NY	OH	PA	WI	ON	Regional Emissions	Regional Percentage
BERYLLIUM	2104004000	OIL - RESIDENTIAL	X	X		X		X		X	X	8,915	45.61
BERYLLIUM		Other										4,923	25.19
BERYLLIUM	30400414	SECONDARY LEAD	X									3,349	17.13
BERYLLIUM		UNCLASSIFIED		X				X		X		1,332	6.81
BERYLLIUM	30500714	CEMENT MFG - WET		X								1,028	5.26
BUTADIENE,13		Other										16,290,241	84.74
BUTADIENE,13	2201001290	LDGV	X	X	X	X	X	X		X	X	1,516,633	7.89
BUTADIENE,13	2201001270	LDGV	X	X	X	X	X	X	X	X	X	1,417,173	7.37
CADMIUM		Other										29,949	47.17
CADMIUM	30400855	SECONDARY ZINC	X									9,657	15.21
CADMIUM	2104004000	OIL - RESIDENTIAL	X	X		X		X		X	X	9,299	14.65
CADMIUM	50100101	INCINERATION	X		X	X			X	X		5,865	9.24
CADMIUM				X		X		X		X		5,225	8.23
CADMIUM	30303015	ZINC PRODUCTION			X							3,498	5.51
CARBON TETRA	2630020000	POTW - AREA				X		X		X	X	31,365	55.96
CARBON TETRA		Other										12,424	22.17
CARBON TETRA	2630000000	POTW - AREA	X									6,552	11.69
CARBON TETRA	2401008000	TRAFFIC MARKING		X				X		X	X	2,890	5.16
CARBON TETRA	30700199	SULFATE (KRAFT) PULPING				X				X	X	2,819	5.03
CHLOROFORM		Other										283,553	26.54
CHLOROFORM	30700199	SULFATE (KRAFT) PULPING				X			X	X	X	197,484	18.49
CHLOROFORM	2630020000	POTW - AREA				X		X		X	X	139,290	13.04
CHLOROFORM	39999992	MISC MFG									X	123,635	11.57
CHLOROFORM	30788801	PAPER/WOOD FUGITIVES							X	X		115,898	10.85
CHLOROFORM	30700102	SULFATE (KRAFT) PULPING								X		90,468	8.47
CHLOROFORM	2465000000	CONSUMER SOLVENTS	X	X	X			X	X	X		61,112	5.72
CHLOROFORM	30700221	SULFITE PULPING								X		56,815	5.32
CHROMIUM		Other										172,493	34.28
CHROMIUM	30300904	STEEL PRODUCTION	X	X		X			X			128,980	25.63
CHROMIUM		UNCLASSIFIED		X		X		X		X		121,218	24.09
CHROMIUM	39999992	MISC MFG									X	80,502	16.00

Table 2-4: Summary of 1997 air toxics emissions by SCC (continued).

Material Code	SCC	Category	IL	IN	MI	MN	NY	OH	PA	WI	ON	Regional Emissions	Regional Percentage
CHROMIUM VI	30901006	CHROME PLATING	X									5,897	26.71
CHROMIUM VI		Other										4,627	20.96
CHROMIUM VI	30901098	PLATING	X									3,163	14.33
CHROMIUM VI	30901002	PLATING	X									2,527	11.45
CHROMIUM VI	30901097	PLATING	X									2,125	9.63
CHROMIUM VI	10100203	COAL COMBUSTION	X	X								2,014	9.12
CHROMIUM VI	10100202	COAL COMBUSTION	X	X		X						1,721	7.80
CHRYSENE	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	34,699	27.37
CHRYSENE	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	30,580	24.12
CHRYSENE	30300101	ALUMINUM ORE	X	X								15,438	12.18
CHRYSENE		Other										15,094	11.91
CHRYSENE	2104008000	WOOD - RESIDENTIAL	X									14,476	11.42
CHRYSENE	31502102	CREMATORY	X									8,576	6.76
CHRYSENE	2104008050	WOODSTOVE - NONCATALYTIC				X				X	X	7,915	6.24
COBALT	39999992	MISC MFG									X	28,316	49.61
COBALT		Other										17,573	30.79
COBALT		UNCLASSIFIED		X		X		X		X		11,191	19.61
COKE OVEN GS	30300308	BY-PRODUCT COKE	X	X	X				X			1,542,825	70.86
COKE OVEN GS		Other										25,739	1.18
COKE OVEN GS	30300302	BY-PRODUCT COKE	X	X					X			608,793	27.96
COPPER	39999992	MISC MFG									X	568,637	48.99
COPPER		Other										382,709	32.97
COPPER		UNCLASSIFIED		X		X		X		X		209,470	18.05
DIBENZAHAN	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	6,114	28.02
DIBENZAHAN	2104008000	WOOD - RESIDENTIAL	X									5,790	26.54
DIBENZAHAN	2104008051	WOODSTOVE - NONCATALYTIC				X						5,372	24.62
DIBENZAHAN	2104008050	WOODSTOVE - NONCATALYTIC				X				X	X	3,166	14.51
DIBENZAHAN		Other										1,375	6.30

Table 2-4: Summary of 1997 air toxics emissions by SCC (continued).

Material Code	SCC	Category	IL	IN	MI	MN	NY	OH	PA	WI	ON	Regional Emissions	Regional Percentage
DIBROMOET,12	2401070000	COATING - AREA SOURCE						X				8,674	20.70
DIBROMOET,12		Other										8,159	19.47
DIBROMOET,12	2401030000	COATING - AREA SOURCE						X				7,442	17.76
DIBROMOET,12	2401045000	COATING - AREA SOURCE						X				4,563	10.89
DIBROMOET,12	2401020000	COATING - AREA SOURCE						X				4,297	10.26
DIBROMOET,12	2401055000	COATING - AREA SOURCE						X				3,392	8.10
DIBROMOET,12	2401100000	COATING - AREA SOURCE						X				2,686	6.41
DIBROMOET,12	2401200000	COATING - AREA SOURCE						X				2,686	6.41
DIBUTYL PHTH	2425000000	GRAPHIC ARTS		X	X			X		X	X	973,554	96.04
DIBUTYL PHTH		Other										40,147	3.96
DICHLORETH12	30101817	PLASTIC POLYMERS		X								51,000	50.46
DICHLORETH12		Other										20,515	20.30
DICHLORETH12	40600136	PETROLEUM PRODUCT XPORT	X		X	X						19,529	19.32
DICHLORETH12	2630020000	POTW - AREA				X				X	X	10,032	9.93
DIEYLHEX PHT		UNCLASSIFIED		X		X		X		X		16,097	36.38
DIEYLHEX PHT		Other										12,620	28.52
DIEYLHEX PHT	39999992	MISC MFG									X	6,919	15.64
DIEYLHEX PHT	40202199	COATING - FLATWOOD							X			4,600	10.40
DIEYLHEX PHT	40200310	SURFACE COATING								X		4,012	9.07
DIOCTYL PHTH	30201601	SUGAR BEET PROCESSING				X						12,506	51.75
DIOCTYL PHTH	40200101	SURFACE COATING								X		7,180	29.71
DIOCTYL PHTH		Other										3,020	12.50
DIOCTYL PHTH		UNCLASSIFIED		X								1,460	6.04
ETHYLBENZENE		Other										56,987,783	76.59
ETHYLBENZENE	2260001020	SNOWMOBILES				X	X	X		X	X	7,966,870	10.71
ETHYLBENZENE	2201001290	LDGV	X	X	X	X	X	X		X	X	4,899,115	6.58
ETHYLBENZENE	2201001270	LDGV	X	X	X	X	X	X	X	X	X	4,553,099	6.12
ETHYLENE OXI	2465000000	CONSUMER SOLVENTS	X	X	X			X	X	X		779,865	49.94
ETHYLENE OXI		Other										422,500	27.05
ETHYLENE OXI	31502001	ETO STERILIZERS	X	X	X				X	X	X	180,448	11.55
ETHYLENE OXI	2401070000	COATING - AREA SOURCE						X				96,313	6.17
ETHYLENE OXI	2401030000	COATING - AREA SOURCE						X				82,618	5.29

Table 2-4: Summary of 1997 air toxics emissions by SCC (continued).

Material Code	SCC	Category	IL	IN	MI	MN	NY	OH	PA	WI	ON	Regional Emissions	Regional Percentage
FLUORANTHENE	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	57,831	32.63
FLUORANTHENE	30300101	ALUMINUM ORE	X	X								42,950	24.23
FLUORANTHENE	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	36,687	20.70
FLUORANTHENE		Other										15,905	8.97
FLUORANTHENE	50200504	INCINERATION	X									12,276	6.93
FLUORANTHENE	2104008000	WOOD - RESIDENTIAL	X									11,581	6.53
FLUORENE	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	69,397	52.69
FLUORENE	2104008030	WOODSTOVE - CATALYTIC		X	X	X				X	X	30,589	23.23
FLUORENE	2104008000	WOOD - RESIDENTIAL	X									20,267	15.39
FLUORENE	2104008050	WOODSTOVE - NONCATALYTIC				X				X	X	11,080	8.41
FLUORENE		Other										366	0.28
FORMALDEHYDE		Other										87,486,586	93.20
FORMALDEHYDE	2270005015	AGRICULTURAL TRACTORS	X	X	X	X	X	X		X		6,381,949	6.80
GLYCOL ETHRS		Other										6,555,356	32.43
GLYCOL ETHRS	2401050000	COATING - AREA SOURCE	X							X		4,941,654	24.45
GLYCOL ETHRS		UNCLASSIFIED	X	X		X				X		3,350,782	16.58
GLYCOL ETHRS	2465000000	CONSUMER SOLVENTS	X	X	X			X		X		1,772,366	8.77
GLYCOL ETHRS	2401990000	COATING - AREA SOURCE				X						1,380,490	6.83
GLYCOL ETHRS	40200101	SURFACE COATING	X			X				X		1,126,605	5.57
GLYCOL ETHRS	2425000000	GRAPHIC ARTS		X							X	1,085,979	5.37
HEXCHLORETH	2465000000	CONSUMER SOLVENTS							X			5,886	93.40
HEXCHLORETH		UNCLASSIFIED		X								369	5.85
HEXCHLORETH		Other										47	0.75
HEXCL-13-BUT		UNCLASSIFIED		X								15	100.00
HEXCLBENZENE	2461800000	PESTICIDE	X	X		X				X		18	66.55
HEXCLBENZENE	30500623	CEMENT MFG - DRY									X	7	26.27
HEXCLBENZENE		Other										2	7.18
HYDRAZINE	39999992	MISC MFG									X	452	99.12
HYDRAZINE		Other										4	0.88
INDN(123CDPY	2104008000	WOOD - RESIDENTIAL	X									28,952	40.10
INDN(123CDPY	2104008051	WOODSTOVE - NONCATALYTIC				X						26,860	37.20
INDN(123CDPY	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	12,229	16.94
INDN(123CDPY	2104008050	WOODSTOVE - NONCATALYTIC				X				X	X	3,777	5.23
INDN(123CDPY		Other										388	0.54

Table 2-4: Summary of 1997 air toxics emissions by SCC (continued).

Material Code	SCC	Category	IL	IN	MI	MN	NY	OH	PA	WI	ON	Regional Emissions	Regional Percentage
LEAD		Other										703,553	56.27
LEAD	39999992	MISC MFG									X	336,496	26.91
LEAD	30300813	IRON PRODUCTION		X							X	144,691	11.57
LEAD	30400413	SECONDARY LEAD	X									65,520	5.24
MANGANESE		Other										707,097	50.00
MANGANESE		UNCLASSIFIED		X		X		X		X		231,430	16.37
MANGANESE	30302399	TACONITE ORE PROCESSING				X						208,552	14.75
MANGANESE	30300908	STEEL PRODUCTION	X	X	X				X			188,627	13.34
MANGANESE	39999992	MISC MFG									X	78,410	5.54
MERCURY		Other										35,989	45.02
MERCURY	50100101	INCINERATION	X		X				X	X		14,034	17.56
MERCURY	2104004000	OIL - RESIDENTIAL	X	X		X		X		X	X	9,030	11.30
MERCURY	10100222	COAL COMBUSTION		X	X	X				X		7,036	8.80
MERCURY	10100202	COAL COMBUSTION	X	X	X	X			X	X		6,946	8.69
MERCURY	50100102	INCINERATION	X	X	X	X			X		X	6,906	8.64
METHENE(B)4-		UNCLASSIFIED		X						X		91,183	90.17
METHENE(B)4-	30999999	FABRICATED METAL PRODUCTS		X								5,602	5.54
METHENE(B)4-		Other										4,343	4.29
METHYLENE CL		Other										10,973,692	32.56
METHYLENE CL		UNCLASSIFIED		X		X		X		X		7,616,849	22.60
METHYLENE CL	2415000000	DEGREASING			X			X	X			5,576,009	16.55
METHYLENE CL	39999992	MISC MFG									X	3,817,047	11.33
METHYLENE CL	2401001000	ARCH COAT	X	X	X	X		X		X		3,720,208	11.04
METHYLENE CL	30101818	PLASTIC POLYMERS							X			1,996,000	5.92
NAPHTHALENE		Other										9,941,101	65.61
NAPHTHALENE	2465000000	CONSUMER SOLVENTS	X	X	X			X	X	X		2,292,407	15.13
NAPHTHALENE	2401005000	AUTOBODY	X	X	X	X		X	X	X		2,084,547	13.76
NAPHTHALENE	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	832,768	5.50
NICKEL	39999992	MISC MFG									X	619,092	65.32
NICKEL		Other										237,791	25.09
NICKEL		UNCLASSIFIED		X		X		X		X		90,864	9.59
PCBS	30500706	CEMENT MFG - WET								X		236	96.88
PCBS		Other										8	3.12

Table 2-4: Summary of 1997 air toxics emissions by SCC (continued).

Material Code	SCC	Category	IL	IN	MI	MN	NY	OH	PA	WI	ON	Regional Emissions	Regional Percentage
PCDD	50300103	INCINERATION	X									4	40.07
PCDD	2104008051	WOODSTOVE - NONCATALYTIC				X						4	39.14
PCDD		Other										1	14.48
PCDD	50100515	INCINERATION		X	X						X	1	6.31
PCDF	2104008051	WOODSTOVE - NONCATALYTIC				X						21	70.17
PCDF	10200902	WOOD COMBUSTION		X	X	X					X	5	16.18
PCDF		Other										4	13.65
PCP		UNCLASSIFIED		X								4	100.00
PERC		Other										14,475,288	38.30
PERC	2415000000	DEGREASING			X			X	X			7,676,717	20.31
PERC	7216	DRY CLEANER			X							6,812,564	18.02
PERC	2420010055	DRY CLEANING	X	X						X		4,765,761	12.61
PERC	2420000000	DRY CLEANING									X	4,068,044	10.76
PHENANTHRENE	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	1,495,095	75.16
PHENANTHRENE	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	225,541	11.34
PHENANTHRENE	2104008000	WOOD - RESIDENTIAL	X									170,820	8.59
PHENANTHRENE		Other										97,655	4.91
PHENOL		UNCLASSIFIED		X		X		X		X		1,132,711	45.44
PHENOL		Other										756,010	30.33
PHENOL	30599999	MINERAL PROD - OTHER	X			X						356,413	14.30
PHENOL	39999992	MISC MFG									X	247,385	9.93
PHOSGENE		UNCLASSIFIED		X								161	99.88
PHOSGENE		Other										0	0.12
PYRENE	2104008051	WOODSTOVE - NONCATALYTIC				X				X	X	69,397	57.94
PYRENE	2104008030	WOODSTOVE - CATALYTIC		X	X	X		X		X	X	30,578	25.53
PYRENE	2104008000	WOOD - RESIDENTIAL	X									11,581	9.67
PYRENE	2104008050	WOODSTOVE - NONCATALYTIC				X				X	X	6,332	5.29
PYRENE		Other										1,887	1.58
STYRENE		Other										20,629,363	60.79
STYRENE		UNCLASSIFIED	X	X		X		X		X		6,037,061	17.79
STYRENE	30800724	FIBERGLASS RESINS	X	X		X			X	X		3,316,257	9.77
STYRENE	2201001290	LDGV	X	X	X	X	X	X		X	X	2,096,051	6.18
STYRENE	2201001270	LDGV	X	X	X	X	X	X	X	X	X	1,859,491	5.48

Table 2-4: Summary of 1997 air toxics emissions by SCC (continued).

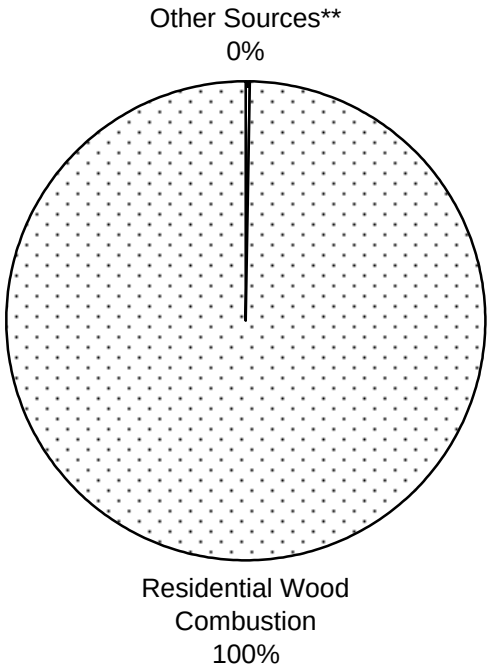
Material Code	SCC	Category	IL	IN	MI	MN	NY	OH	PA	WI	ON	Regional Emissions	Regional Percentage
TCDD,2378	10101201	SOLID WASTE COMBUSTION								X		0	82.60
TCDD,2378	2104008051	WOODSTOVE - NONCATALYTIC				X						0	8.29
TCDF,2378	10200902	WOOD COMBUSTION			X						X	102	98.86
TCDF,2378		Other										1	1.14
TCE,111	2415000000	DEGREASING			X			X	X			30,504,632	42.37
TCE,111		Other										24,520,790	34.06
TCE,111	2465000000	CONSUMER SOLVENTS	X	X	X			X		X		16,973,620	23.57
TOLUENE		Other										465,562,885	78.39
TOLUENE	2201001290	LDGV	X	X	X	X	X	X		X	X	34,119,449	5.75
TOLUENE	2260001020	SNOWMOBILES				X	X	X		X	X	32,621,019	5.49
TOLUENE	2201001270	LDGV	X	X	X	X	X	X	X	X	X	31,741,386	5.34
TOLUENE	2401990000	COATING - AREA SOURCE			X	X					X	29,845,884	5.03
TOLUENE24DII		UNCLASSIFIED		X						X		3,004	60.81
TOLUENE24DII	30101415	PAINT MANUFACTURING	X									998	20.20
TOLUENE24DII	40706404	TANK - TDI	X									612	12.38
TOLUENE24DII		Other										326	6.60
TRICHLORETHY	2415000000	DEGREASING			X			X	X			22,626,586	43.03
TRICHLORETHY		Other										19,538,997	37.16
TRICHLORETHY	40100205	DEGREASE - TCE	X	X	X	X			X	X	X	3,904,123	7.42
TRICHLORETHY	2415050000	DEGREASING								X		3,391,696	6.45
TRICHLORETHY	2415360000	DEGREASING		X								3,121,872	5.94
TRICLPHN,245	50100102	INCINERATION									X	5	83.03
TRICLPHN,245		UNCLASSIFIED		X								1	16.61
TRICLPHN,245		Other										0	0.36
TRICLPHN,246	50100102	INCINERATION									X	276	91.63
TRICLPHN,246		UNCLASSIFIED		X								25	8.30
TRICLPHN,246		Other										0	0.07
TRIFLURALIN	2461800000	PESTICIDE	X		X	X						1,238,431	99.49
TRIFLURALIN		Other										6,371	0.51
VINYL CHLOR	30101864	PLASTIC POLYMERS	X		X							993,196	56.28
VINYL CHLOR	2630020000	POTW - AREA				X		X		X	X	441,481	25.02
VINYL CHLOR		Other										125,611	7.12
VINYL CHLOR	64630001	PVC	X									106,927	6.06
VINYL CHLOR	30101899	PLASTIC POLYMERS							X			97,600	5.53

Table 2-4: Summary of 1997 air toxics emissions by SCC (continued).

Material Code	SCC	Category	IL	IN	MI	MN	NY	OH	PA	WI	ON	Regional Emissions	Regional Percentage
XYLENE,M		Other										56,795,933	66.56
XYLENE,M	2201001290	LDGV	X	X	X	X	X	X		X	X	9,970,609	11.69
XYLENE,M	2201001270	LDGV	X	X	X	X	X	X	X	X	X	9,295,584	10.89
XYLENE,M	2201001330	LDGV	X	X	X	X	X	X		X		4,867,898	5.71
XYLENE,M	2201001310	LDGV	X	X	X	X	X	X	X	X		4,394,590	5.15
XYLENE,O		Other										42,050,835	71.51
XYLENE,O	2201001290	LDGV	X	X	X	X	X	X		X	X	5,261,406	8.95
XYLENE,O	2201001270	LDGV	X	X	X	X	X	X	X	X	X	4,889,586	8.32
XYLENE,O	2401050000	COATING - AREA SOURCE	X							X		3,411,201	5.80
XYLENE,O	2401990000	COATING - AREA SOURCE			X						X	3,190,073	5.43
XYLENE,P		Other										229,712	31.31
XYLENE,P	2415000000	DEGREASING			X			X				206,947	28.20
XYLENE,P	2501060101	STAGE 2 - AREA				X					X	114,998	15.67
XYLENE,P	2501060100	STAGE 2 - AREA						X		X		86,902	11.84
XYLENE,P	2282005010	BOATS - OUTBOARDS		X								58,234	7.94
XYLENE,P	2415050000	DEGREASING								X		36,989	5.04
XYLENES ISO		Other										285,435,789	77.19
XYLENES ISO	2260001020	SNOWMOBILES				X	X	X		X	X	35,590,276	9.63
XYLENES ISO	2401005000	AUTOBODY	X	X	X	X		X	X	X		29,511,951	7.98
XYLENES ISO	2201001290	LDGV	X	X	X	X	X	X		X	X	19,226,833	5.20

Figure 2-1:

ACENAPHTHENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



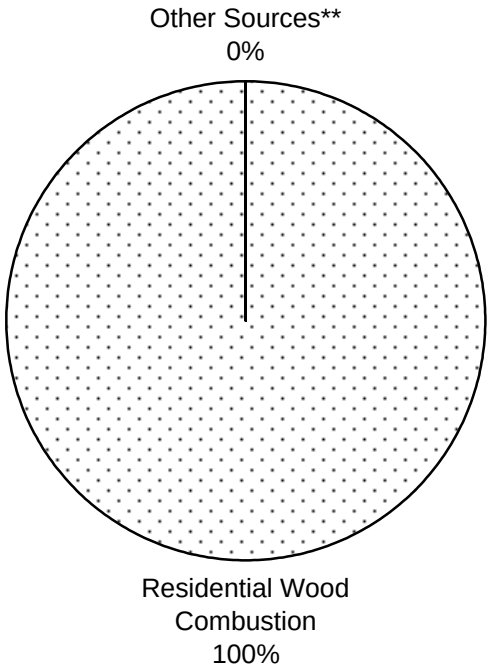
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	104.83	x	x	x	x		x	x		x
-------	Residential Wood Combustion	69,650.51	x	x	x	x		x	x		x

Total Estimated Emissions: 69,755 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-2:

ACENAPHTHYLENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



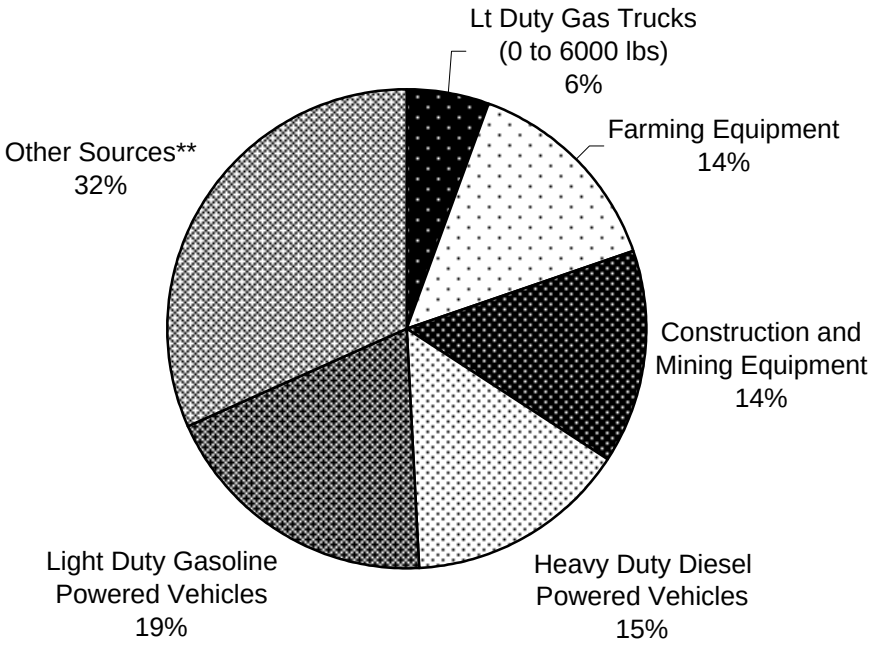
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	511.87	x	x	x	x			x		
-------	Residential Wood Combustion	839,157.84	x	x	x	x		x	x		x

Total Estimated Emissions: 839,669 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-3:

ACETALDEHYDE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



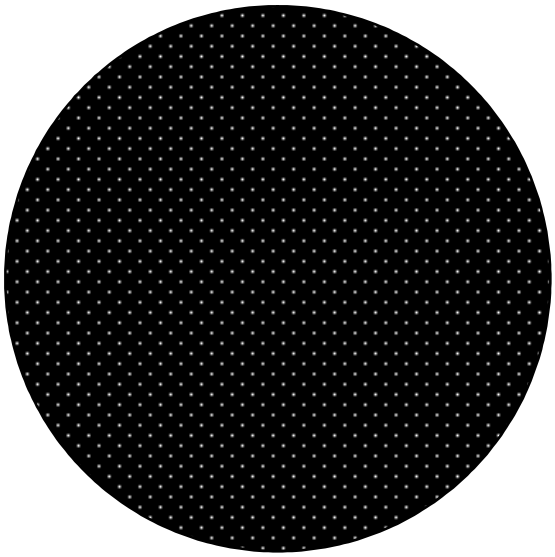
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Lt Duty Gas Trucks (0 to 6000 lbs)	1,602,423.95	x	x	x	x		x		x	x
-------	Farming Equipment	4,040,947.46	x	x	x	x		x	x		x
-------	Construction and Mining Equipment	4,161,183.10	x	x	x	x		x	x		x
-------	Heavy Duty Diesel Powered Vehicles	4,354,888.37	x	x	x	x		x	x	x	x
-------	Light Duty Gasoline Powered Vehicles	5,486,919.33	x	x	x	x		x	x	x	x
-------	Other Sources**	9,098,747.58	x	x	x	x			x	x	x

Total Estimated Emissions: 28,745,109 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-4:

ACROLEIN
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



Other Sources**
100%

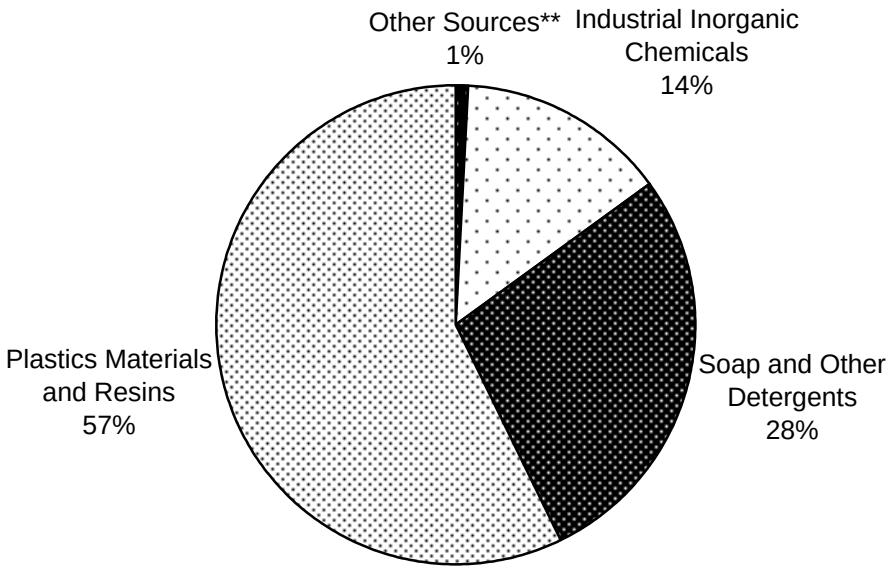
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	2,992,707.88	x	x	x	x		x	x	x	x

Total Estimated Emissions: 2,992,707 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-5:

ACRYLAMIDE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



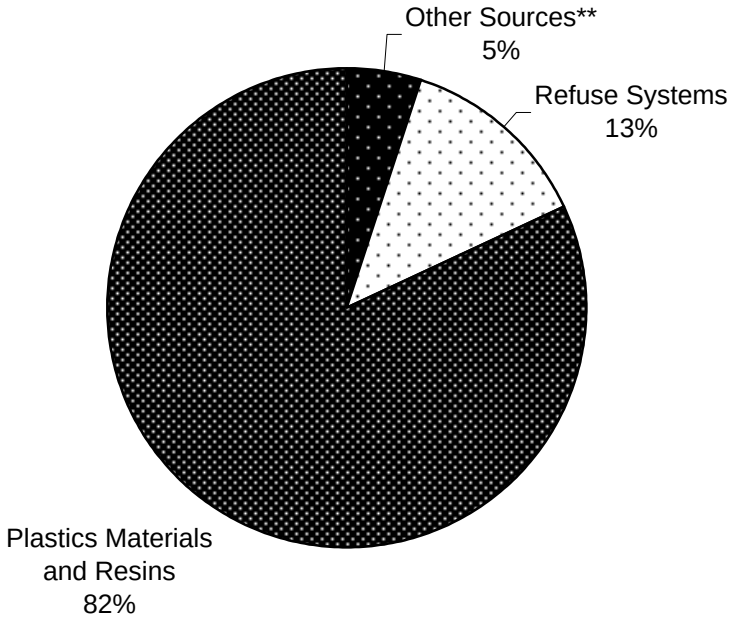
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	11.00	x								x
2819	Industrial Inorganic Chemicals	170.00							x		
2841	Soap and Other Detergents	331.00							x		
2821	Plastics Materials and Resins	685.00						x			

Total Estimated Emissions: 1,197 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-6:

ACRYLONITRILE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



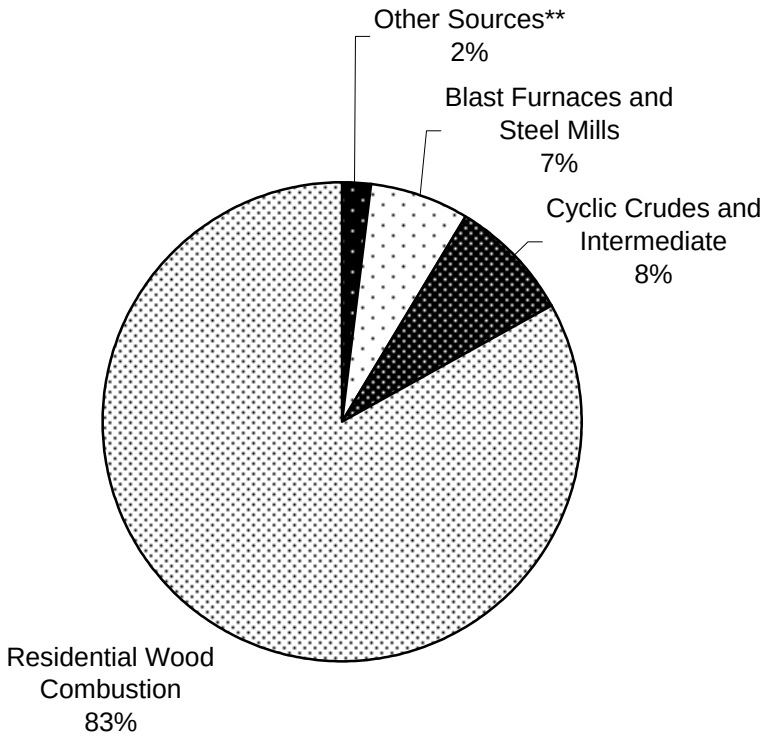
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	24,039.49	x	x	x				x		x
4953	Refuse Systems	61,093.19	x	x		x		x			x
2821	Plastics Materials and Resins	387,628.00	x	x						x	

Total Estimated Emissions: 472,760 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-7:

ANTHRACENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



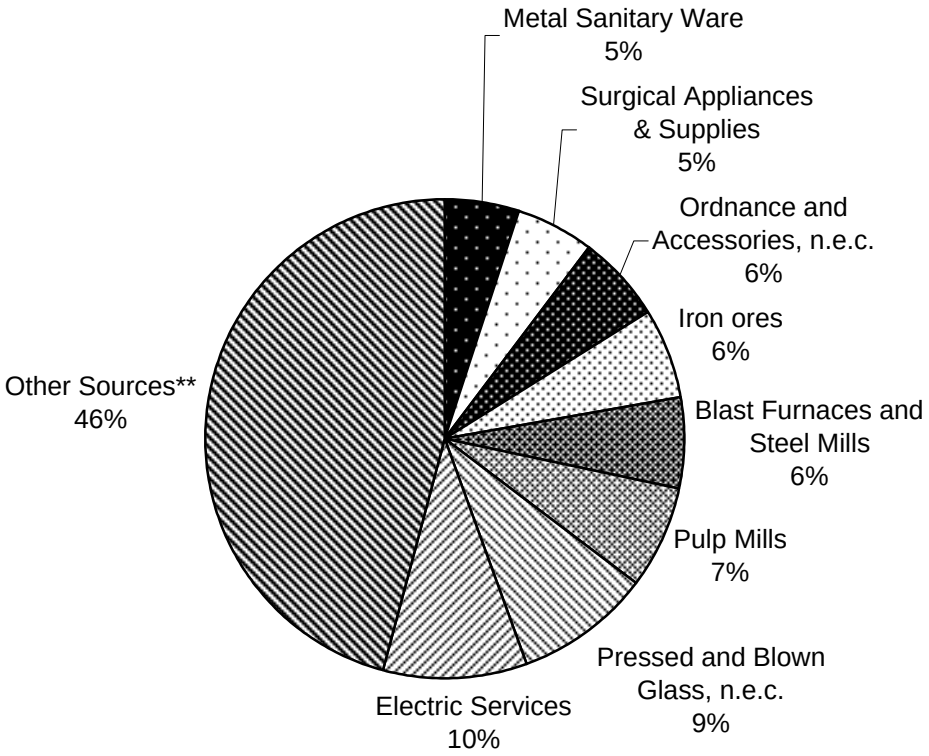
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	2,008.73	x	x	x	x		x	x		x
3312	Blast Furnaces and Steel Mills	6,890.20	x	x		x			x		
2865	Cyclic Crudes and Intermediate	8,377.01	x					x			
-------	Residential Wood Combustion	85,094.16	x	x	x	x		x	x		x

Total Estimated Emissions: 102,370 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-8:

ANTIMONY
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



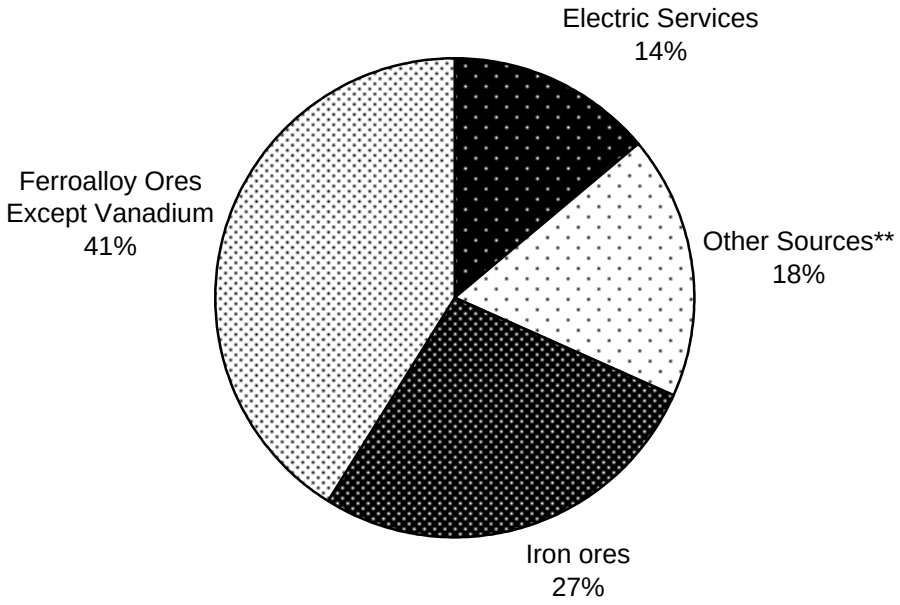
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3431	Metal Sanitary Ware	1,500.00						x			
3842	Surgical Appliances & Supplies	1,600.00								x	
3489	Ordnance and Accessories, n.e.c.	1,710.00	x								
1011	Iron ores	1,818.78				x			x		
3312	Blast Furnaces and Steel Mills	1,831.76	x	x		x					
2611	Pulp Mills	2,064.58									x
3229	Pressed and Blown Glass, n.e.c.	2,742.00						x			
4911	Electric Services	2,846.50	x	x	x	x			x	x	
-------	Other Sources**	13,669.25	x	x	x	x		x	x	x	x

Total Estimated Emissions: 29,782 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-9:

ARSENIC
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



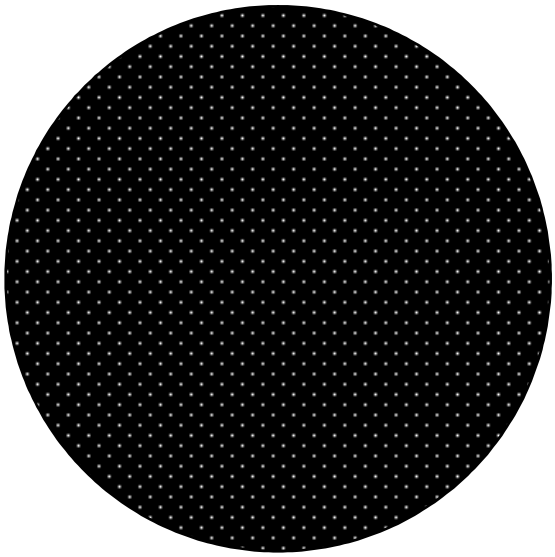
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
4911	Electric Services	40,626.34	x	x	x	x		x	x	x	x
-------	Other Sources**	52,589.63	x	x	x	x			x		
1011	Iron ores	79,910.24			x	x			x		
1061	Ferroalloy Ores Except Vanadium	121,553.00							x		

Total Estimated Emissions: 294,679 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-10:

ATRAZINE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



Pesticide
100%

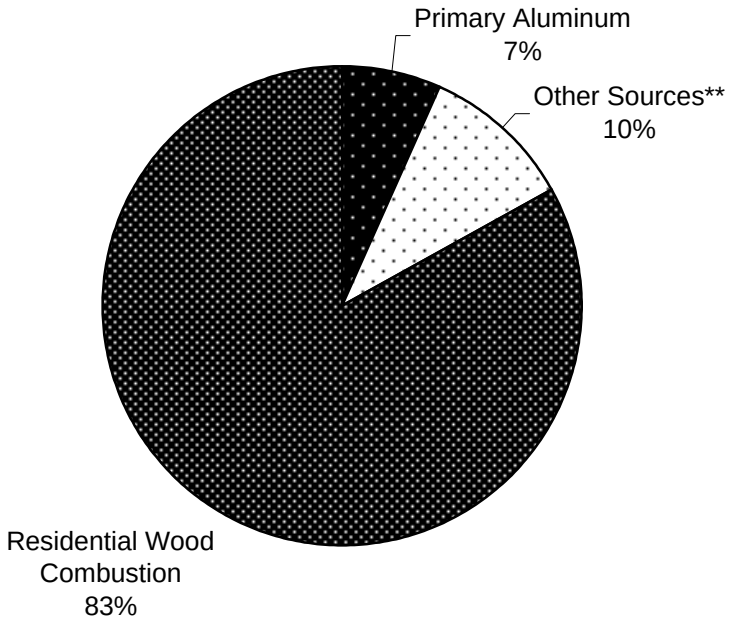
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Pesticide	6,129,361.91	x	x	x	x		x			x

Total Estimated Emissions: 6,129,361 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-11:

BENZ(A)ANTHRACENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3334	Primary Aluminum	10,910.00		x		x					
-------	Other Sources**	16,312.24	x	x	x	x		x	x		x
-------	Residential Wood Combustion	133,448.27	x	x	x	x		x	x		x

Total Estimated Emissions: 160,670 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-12:

BENZO(GHI)PERYLENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources

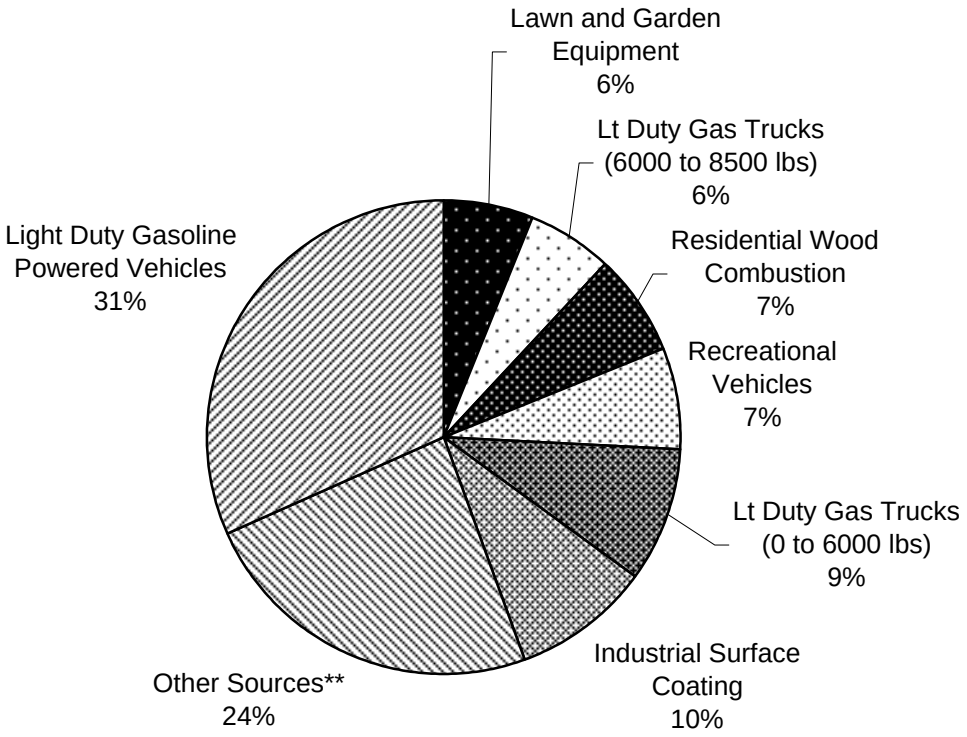
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	7,075.84	x	x	x	x		x	x	x	x
-------	Residential Wood Combustion	62,461.66	x	x	x	x		x	x		x

Total Estimated Emissions: 69,537 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-13:

BENZENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



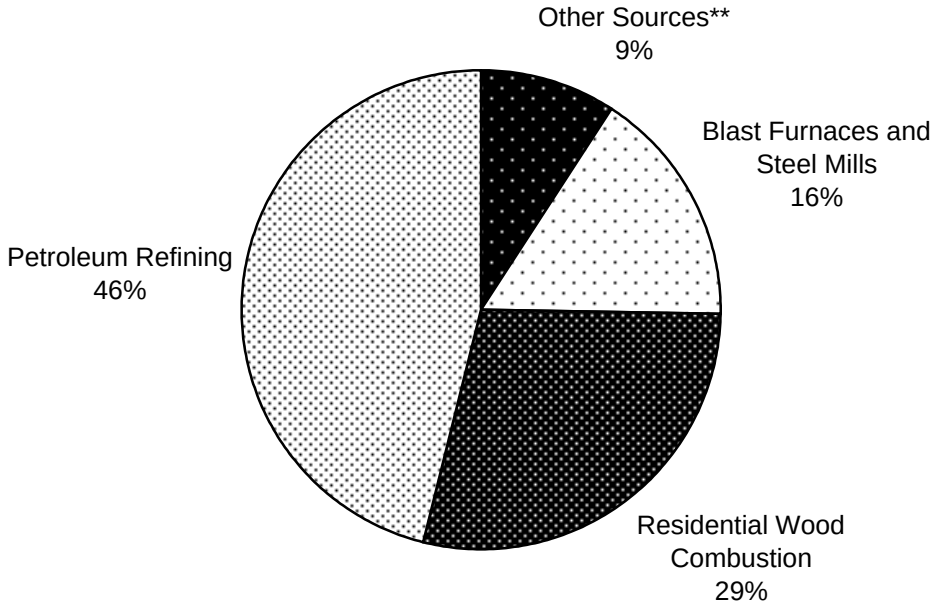
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Lawn and Garden Equipment	8,964,452.49	x	x		x		x	x	x	x
-------	Lt Duty Gas Trucks (6000 to 8500 lbs)	9,126,135.25	x	x	x	x		x		x	x
-------	Residential Wood Combustion	10,081,321.24		x	x	x		x	x		x
-------	Recreational Vehicles	10,695,919.36	x	x		x		x	x	x	x
-------	Lt Duty Gas Trucks (0 to 6000 lbs)	13,458,270.10	x	x	x	x		x		x	x
-------	Industrial Surface Coating	14,384,479.18						x			x
-------	Other Sources**	35,666,567.03	x	x	x	x		x	x	x	x
-------	Light Duty Gasoline Powered Vehicles	47,623,554.20	x	x	x	x		x	x	x	x

Total Estimated Emissions: 150,000,698 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-14:

BENZO(A)PYRENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



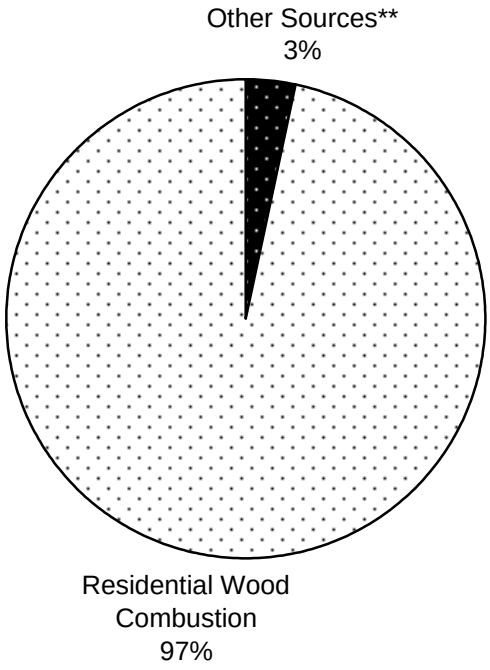
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	11,829.36	x	x	x	x		x	x		x
3312	Blast Furnaces and Steel Mills	20,800.59	x	x	x	x			x		
-------	Residential Wood Combustion	37,229.56	x	x	x	x		x	x		x
2911	Petroleum Refining	59,937.35	x	x	x	x			x	x	

Total Estimated Emissions: 129,796 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-15:

BENZO(B)FLUORANTHENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



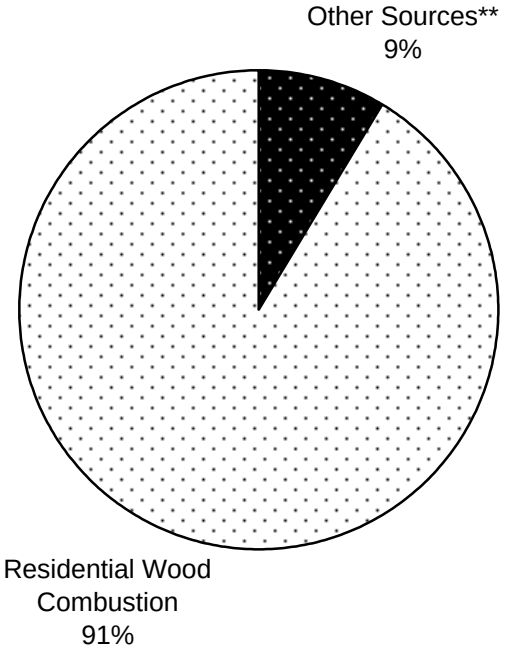
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	1,351.09	x	x		x		x	x		x
-------	Residential Wood Combustion	38,534.52	x	x	x	x		x	x		x

Total Estimated Emissions: 39,885 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-16:

BENZO(K)FLUORANTHENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



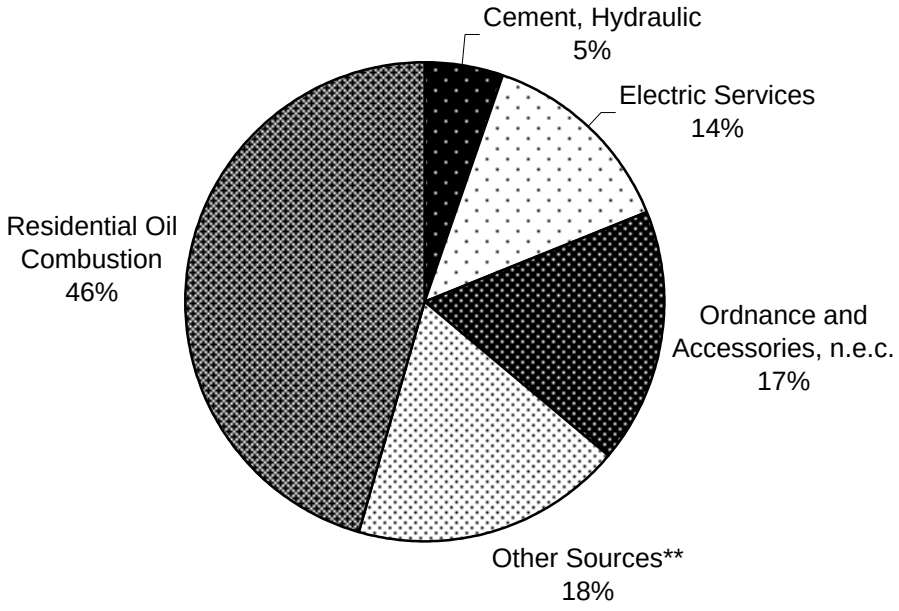
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	1,326.21	x	x	x	x		x	x		x
-------	Residential Wood Combustion	14,136.09	x	x	x	x		x	x		x

Total Estimated Emissions: 15,462 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-17:

BERYLLIUM
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



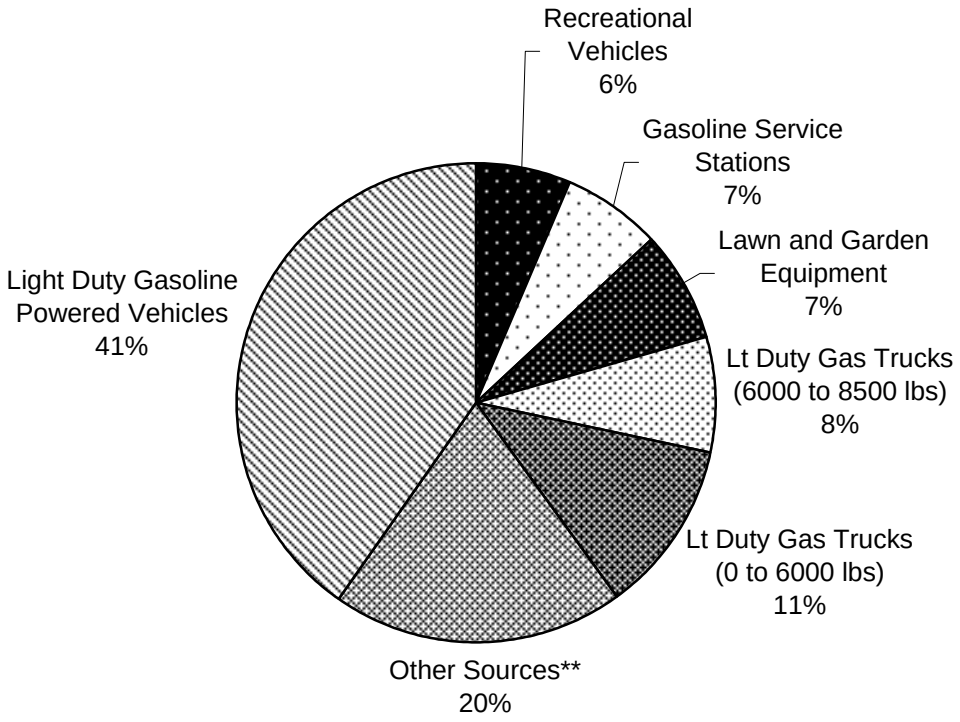
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3241	Cement, Hydraulic	1,038.78	x	x	x				x		
4911	Electric Services	2,654.42	x	x	x	x			x		x
3489	Ordnance and Accessories, n.e.c.	3,348.88	x			x					
-------	Other Sources**	3,588.78	x	x	x	x		x	x	x	x
-------	Residential Oil Combustion	8,915.98	x	x		x		x	x		x

Total Estimated Emissions: 19,546 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-18:

1,3-BUTADIENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



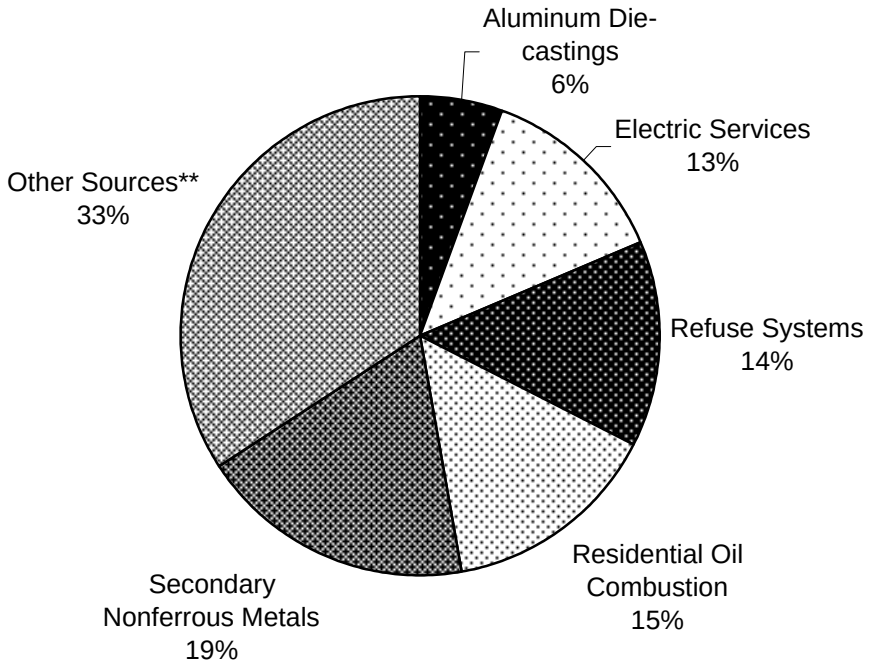
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Recreational Vehicles	955,601.05	x	x		x		x	x		x
5541	Gasoline Service Stations	1,028,637.16	x					x			
-------	Lawn and Garden Equipment	1,117,316.85	x	x		x		x	x		x
-------	Lt Duty Gas Trucks (6000 to 8500 lbs)	1,204,668.56	x	x	x	x		x		x	x
-------	Lt Duty Gas Trucks (0 to 6000 lbs)	1,736,186.58	x	x	x	x		x		x	x
-------	Other Sources**	2,987,130.23	x	x	x	x		x	x	x	x
-------	Light Duty Gasoline Powered Vehicles	6,122,637.87	x	x	x	x		x	x	x	x

Total Estimated Emissions: 15,152,178 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-19:

CADMIUM
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



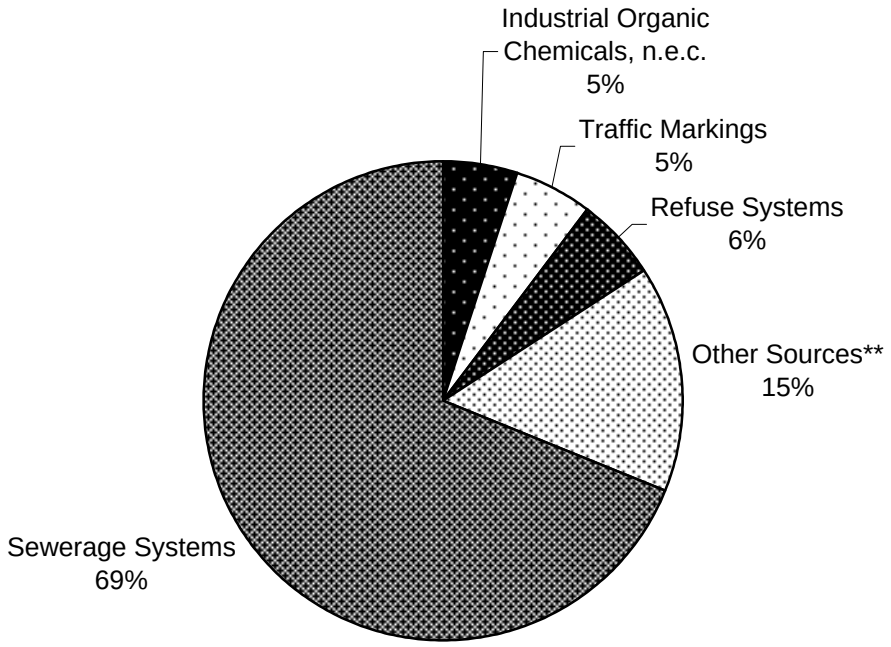
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3363	Aluminum Die-castings	3,503.86	x		x						
4911	Electric Services	8,378.00	x	x	x	x			x		x
4953	Refuse Systems	8,808.07	x	x	x	x			x	x	
-------	Residential Oil Combustion	9,303.39	x	x		x		x	x		x
3341	Secondary Nonferrous Metals	11,781.36	x	x		x				x	x
-------	Other Sources**	21,719.15	x	x	x	x		x	x	x	x

Total Estimated Emissions: 63,493 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 jurisdictions that have contributed emissions data for this pollutant.

Figure: 2-20:

CARBON TETRACHLORIDE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



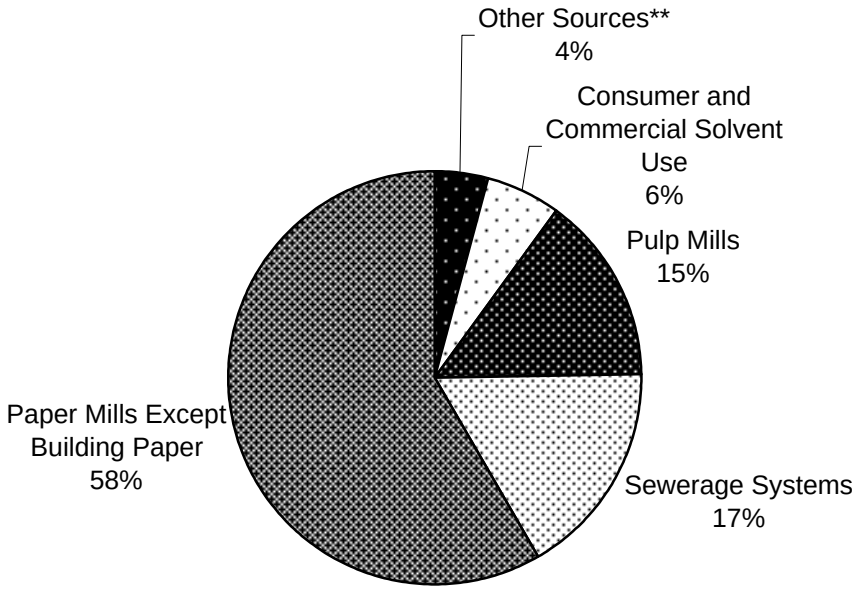
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2869	Industrial Organic Chemicals, n.e.c.	2,818.00						x		x	
-------	Traffic Markings	2,889.60		x				x	x		x
4953	Refuse Systems	3,164.75	x	x	x	x		x	x	x	x
-------	Other Sources**	8,520.66	x	x	x	x			x	x	x
4952	Sewerage Systems	38,657.31	x	x	x	x		x	x		x

Total Estimated Emissions: 56,050 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-21:

CHLOROFORM
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



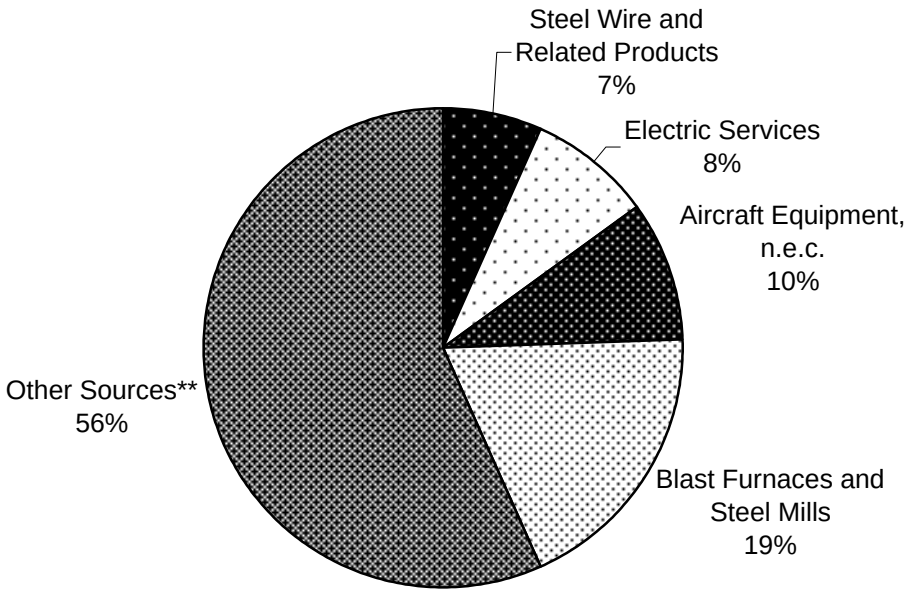
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	45,752.55	x	x	x	x		x	x	x	x
-------	Consumer and Commercial Solvent Use	61,112.18	x	x	x			x		x	x
2611	Pulp Mills	158,477.44							x		x
4952	Sewerage Systems	180,255.88	x	x	x	x		x	x	x	x
2621	Paper Mills Except Building Paper	622,658.20				x				x	x

Total Estimated Emissions: 1,068,256 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-22:

CHROMIUM
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



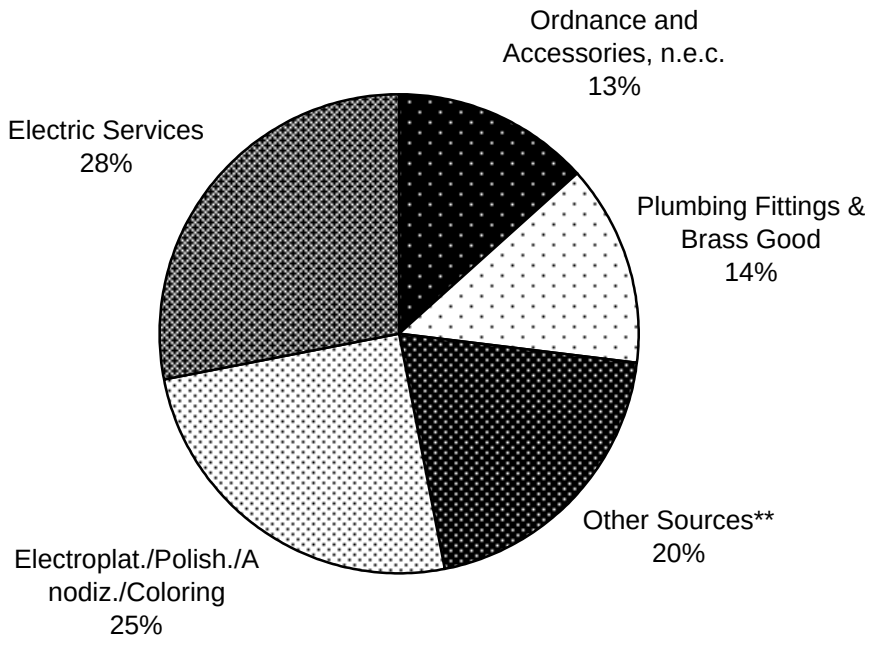
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3315	Steel Wire and Related Products	32,891.26	x	x				x			x
4911	Electric Services	42,487.02	x	x	x	x			x	x	x
3728	Aircraft Equipment, n.e.c.	47,740.63	x					x	x		
3312	Blast Furnaces and Steel Mills	94,191.97	x	x	x	x		x	x	x	x
-------	Other Sources**	284,473.65	x	x	x	x		x	x	x	x

Total Estimated Emissions: 501,784 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-23:

CHROMIUM VI
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



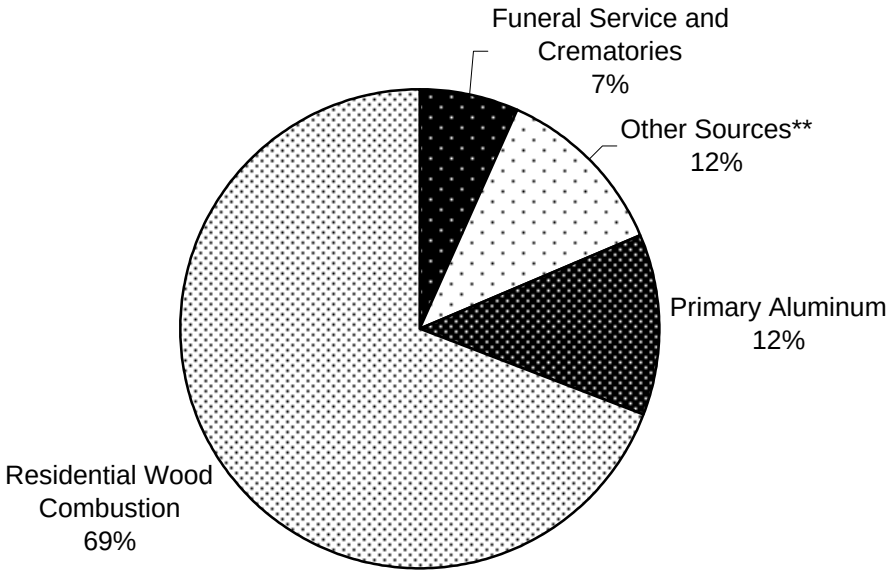
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3489	Ordnance and Accessories, n.e.c.	2,960.54	x			x					
3432	Plumbing Fittings & Brass Good	3,003.05	x								
-------	Other Sources**	4,391.21	x	x	x	x			x		
3471	Electroplat./Polish./Anodiz./Coloring	5,541.52	x	x		x					
4911	Electric Services	6,179.39	x	x	x	x			x		

Total Estimated Emissions: 22,075 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-24:

CHRYSENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



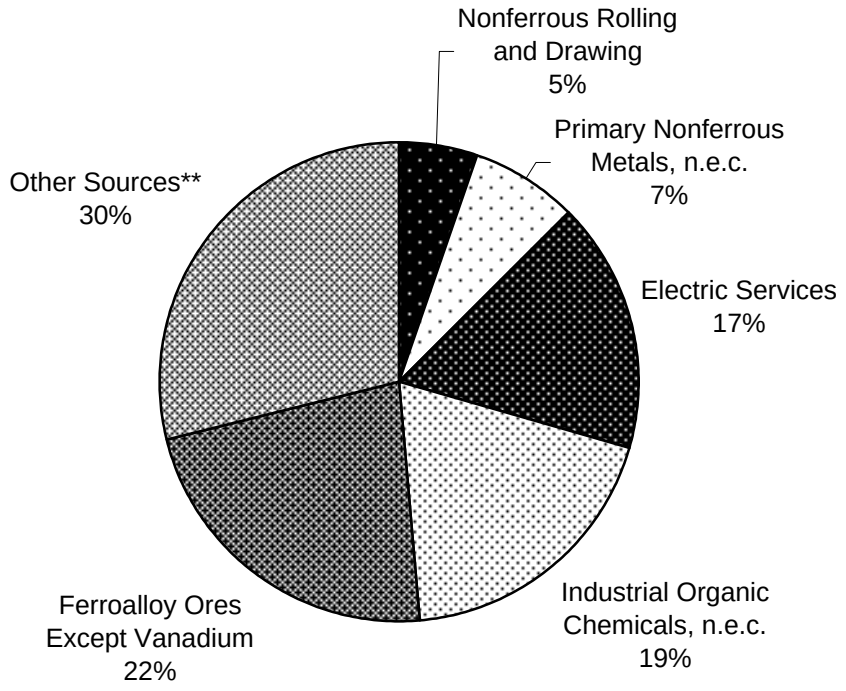
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
7261	Funeral Service and Crematories	8,397.96	x		x				x		
-------	Other Sources**	15,044.64	x	x	x	x		x	x		x
3334	Primary Aluminum	15,437.00		x							
-------	Residential Wood Combustion	87,669.59	x	x	x	x		x	x		x

Total Estimated Emissions: 126,549 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-25:

COBALT
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



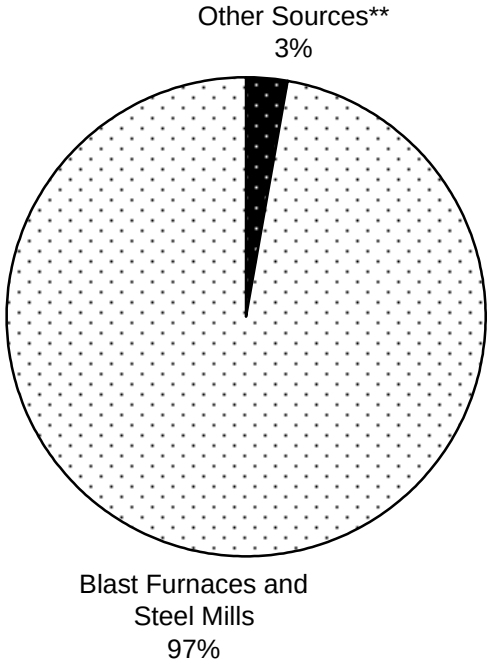
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3356	Nonferrous Rolling and Drawing	3,050.03	x	x					x		
3339	Primary Nonferrous Metals, n.e.c.	4,159.00	x					x	x		
4911	Electric Services	9,531.36	x	x	x	x			x	x	x
2869	Industrial Organic Chemicals, n.e.c.	10,997.07	x	x		x			x		
1061	Ferroalloy Ores Except Vanadium	12,820.00							x		
-------	Other Sources**	16,522.92	x	x	x	x			x	x	x

Total Estimated Emissions: 57,080 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-26:

COKE OVEN GS
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



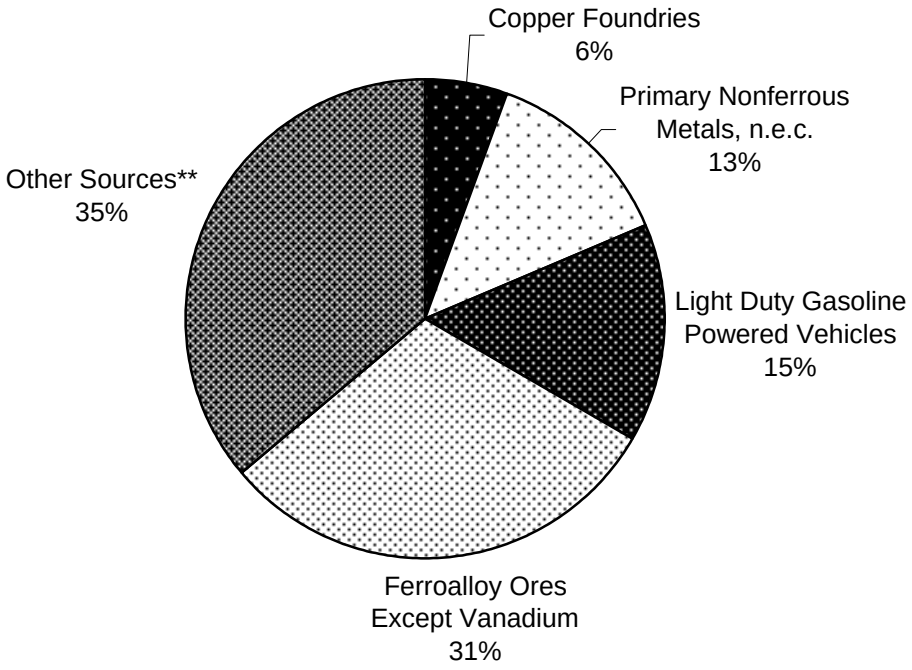
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	63,198.00		x							
3312	Blast Furnaces and Steel Mills	2,114,158.47	x	x	x					x	

Total Estimated Emissions: 2,177,356 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-27:

COPPER
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



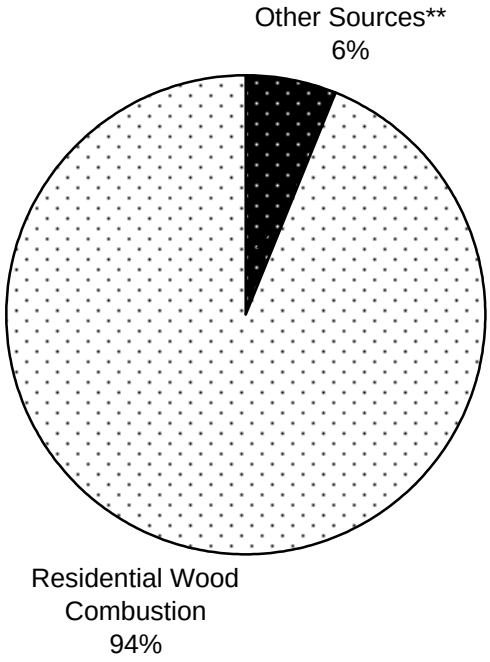
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3366	Copper Foundries	65,892.81	x	x				x	x		x
3339	Primary Nonferrous Metals, n.e.c.	150,462.01	x						x		
-------	Light Duty Gasoline Powered Vehicles	170,240.47	x	x	x	x		x	x	x	x
1061	Ferroalloy Ores Except Vanadium	353,891.00							x		
-------	Other Sources**	418,616.22	x	x	x	x		x	x	x	x

Total Estimated Emissions: 1,159,102 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-28:

DIBENZ(A,H)ANTHRACENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



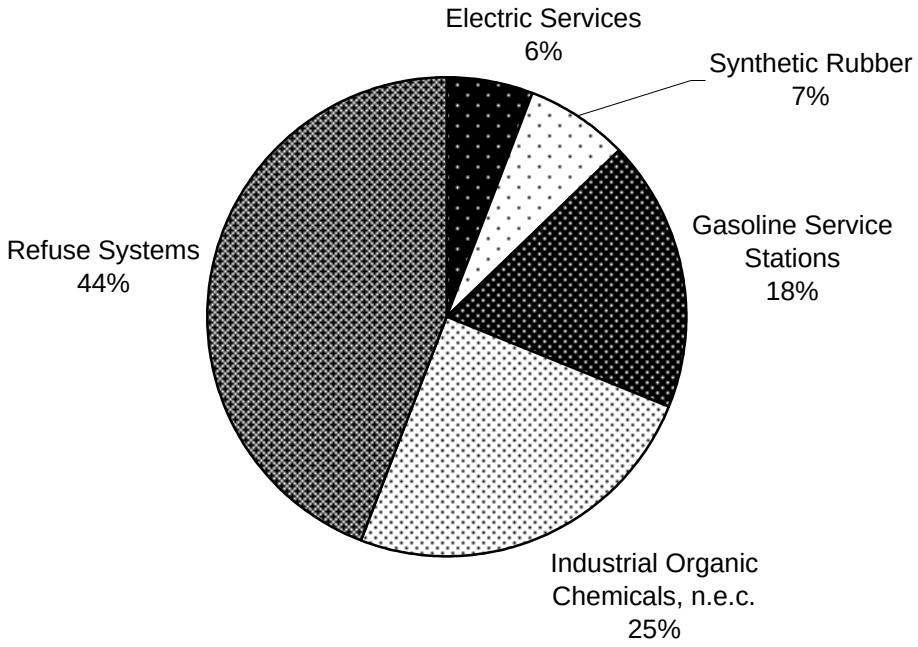
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	1,346.25	x	x	x	x		x	x		x
-------	Residential Wood Combustion	20,442.14	x	x	x	x		x	x		x

Total Estimated Emissions: 21,788 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-29:

ETHYLENE DIBROMIDE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



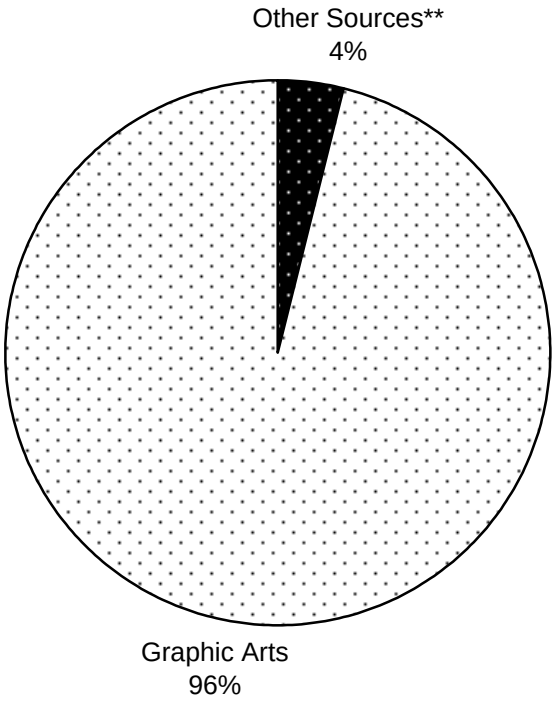
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	33.17	x	x	x	x		x	x		x
4911	Electric Services	116.73	x	x		x					
2822	Synthetic Rubber	144.00						x			
5541	Gasoline Service Stations	369.37	x		x			x	x		
2869	Industrial Organic Chemicals, n.e.c.	500.51	x	x				x			
4953	Refuse Systems	890.70	x	x	x	x			x		

Total Estimated Emissions: 2,054 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-30:

DI-N-BUTYL PHTHALATE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



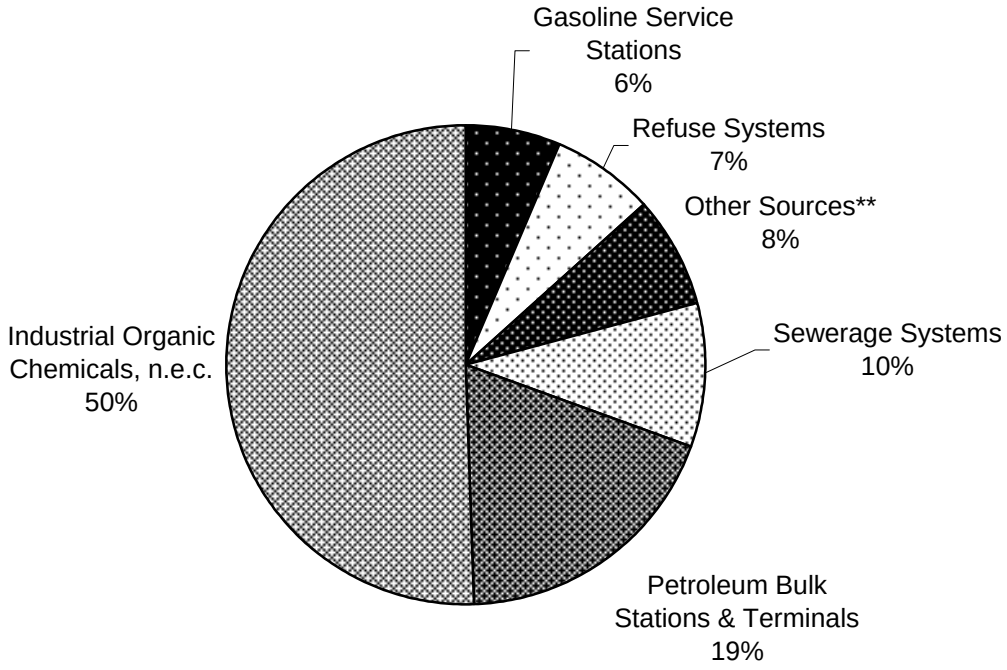
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	40,147.34	x	x	x	x		x	x	x	x
-------	Graphic Arts	973,553.78		x	x			x	x		x

Total Estimated Emissions: 1,013,701 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-31:

ETHYLENE DICHLORIDE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



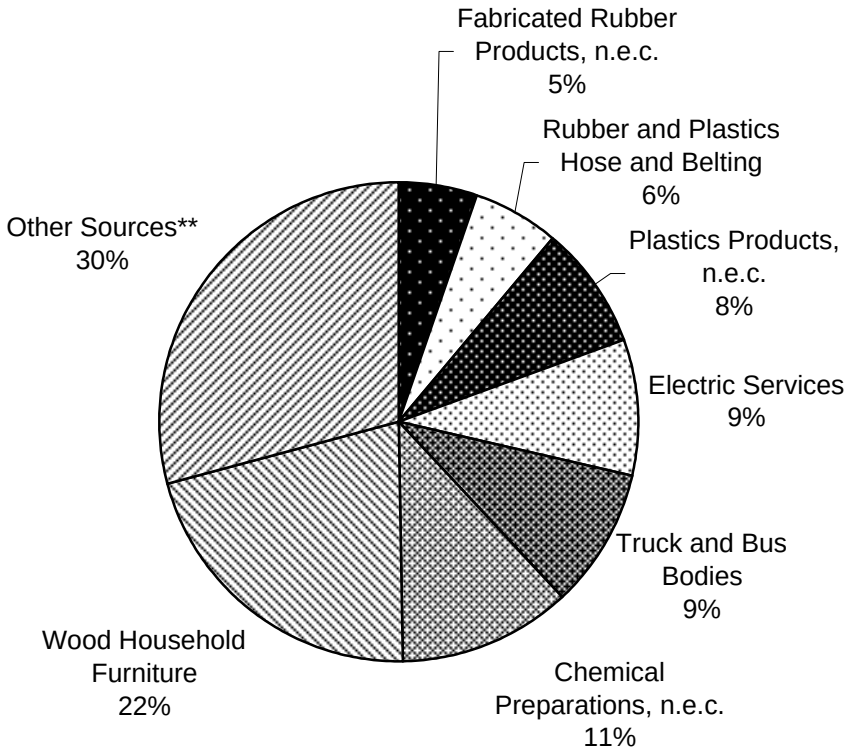
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
5541	Gasoline Service Stations	6,387.58	x		x			x	x		x
4953	Refuse Systems	6,959.49	x	x	x	x		x	x		x
-------	Other Sources**	7,607.35	x	x	x	x		x	x		x
4952	Sewerage Systems	10,036.16	x	x		x			x		x
5171	Petroleum Bulk Stations & Terminals	19,021.00	x		x						
2869	Industrial Organic Chemicals, n.e.c.	51,064.30	x	x					x		x

Total Estimated Emissions: 101,075 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-32:

DIETHYLHEXYL PHTHALATE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



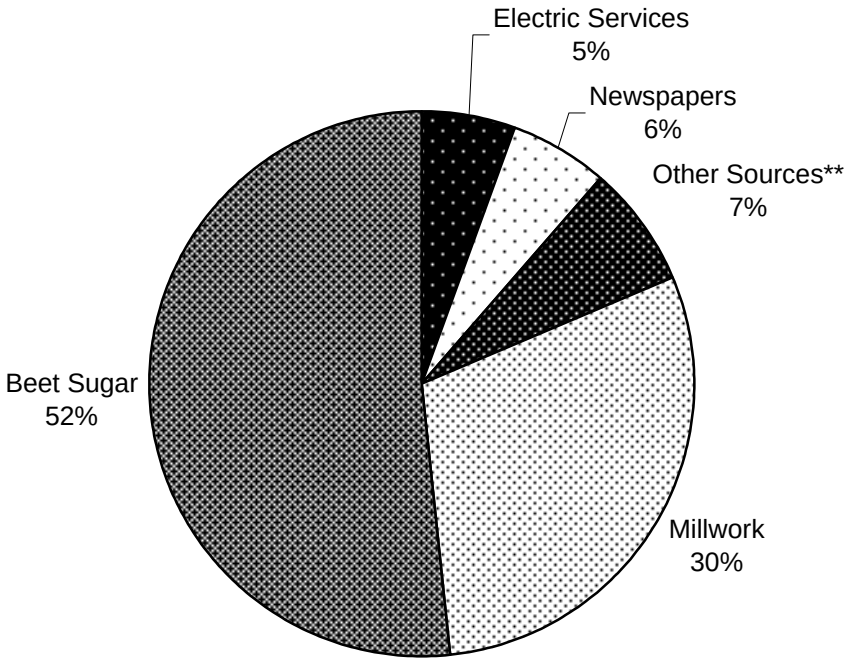
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3069	Fabricated Rubber Products, n.e.c.	2,333.00		x				x	x		
3052	Rubber and Plastics Hose and Belting	2,595.00						x	x		
3089	Plastics Products, n.e.c.	3,666.00		x		x		x	x		
4911	Electric Services	4,114.28	x	x							x
3713	Truck and Bus Bodies	4,166.00		x							
2899	Chemical Preparations, n.e.c.	5,072.00							x		
2511	Wood Household Furniture	9,412.00								x	x
-------	Other Sources**	12,889.92	x	x	x	x		x	x	x	x

Total Estimated Emissions: 44,248 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-33:

DI-N-OCTYL PHTHALATE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



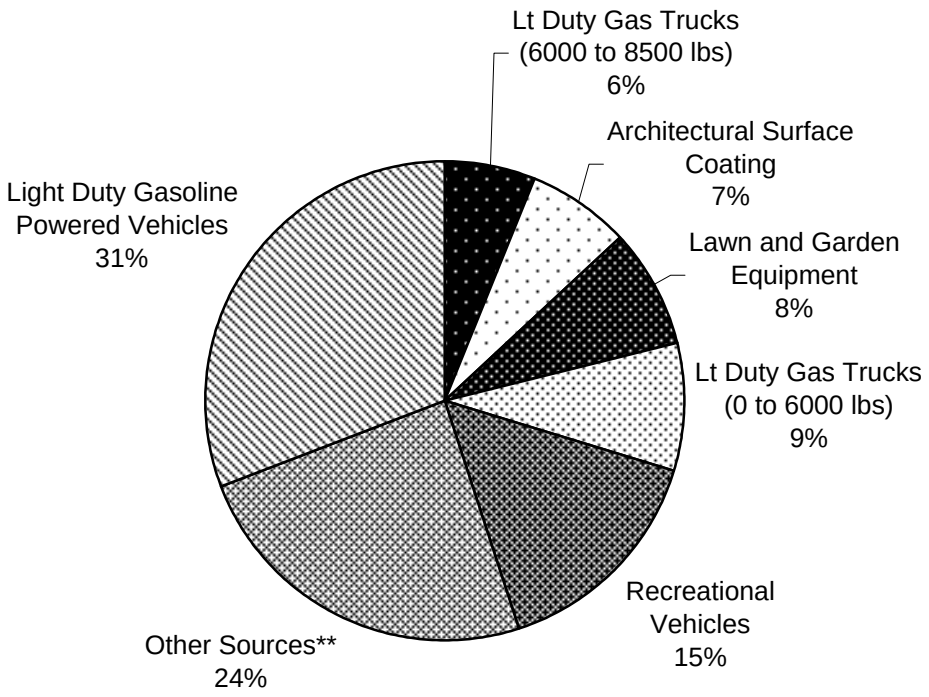
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
4911	Electric Services	1,320.46				x					
2711	Newspapers	1,460.00		x							
-------	Other Sources**	1,688.18		x	x	x			x		x
2431	Millwork	7,180.00									x
2063	Beet Sugar	12,517.10				x					

Total Estimated Emissions: 24,165 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-34:

ETHYLBENZENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



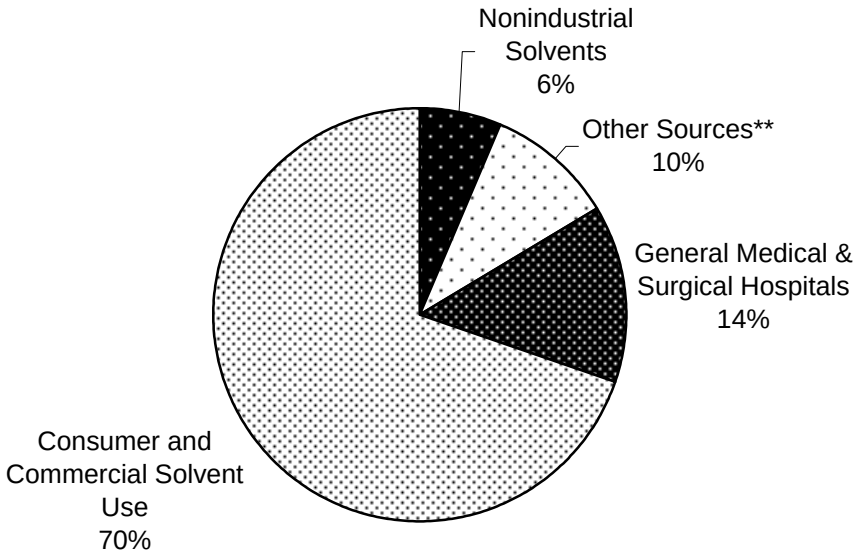
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Lt Duty Gas Trucks (6000 to 8500 lbs)	3,777,230.87	x	x	x	x		x		x	x
-------	Architectural Surface Coating	4,420,154.57		x	x	x		x	x		x
-------	Lawn and Garden Equipment	4,951,043.62	x	x		x		x	x	x	x
-------	Lt Duty Gas Trucks (0 to 6000 lbs)	5,398,064.76	x	x	x	x		x		x	x
-------	Recreational Vehicles	9,533,501.59	x	x		x		x	x	x	x
-------	Other Sources**	14,972,801.69	x	x	x	x		x	x	x	x
-------	Light Duty Gasoline Powered Vehicles	19,303,312.38	x	x	x	x		x	x	x	x

Total Estimated Emissions: 62,356,109 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-35:

ETHYLENE OXIDE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



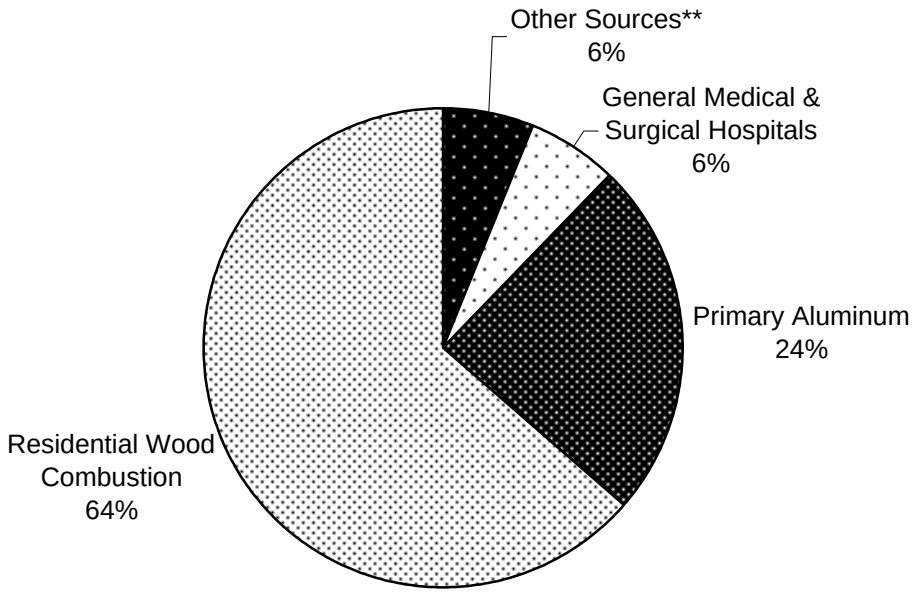
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Nonindustrial Solvents	70,779.86				x					
-------	Other Sources**	114,079.52	x	x	x	x			x	x	x
8062	General Medical & Surgical Hospitals	154,517.89	x	x	x	x				x	x
-------	Consumer and Commercial Solvent Use	779,865.20	x	x	x			x		x	x

Total Estimated Emissions: 1,119,242 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-36:

FLUORANTHENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



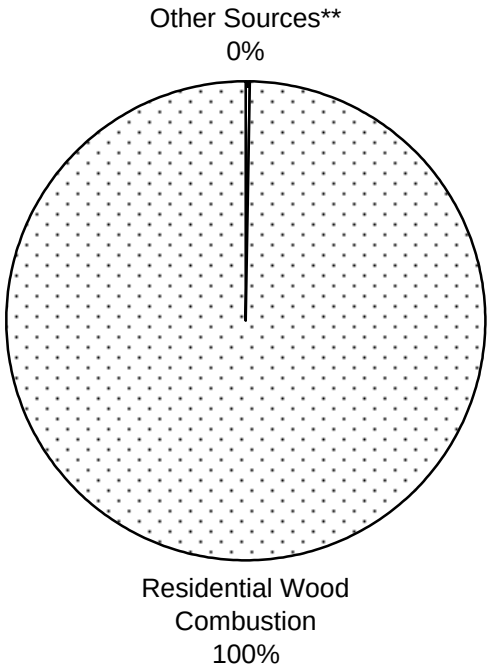
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	10,593.47	x	x	x	x		x	x		x
8062	General Medical & Surgical Hospitals	11,042.40	x	x	x	x			x		
3334	Primary Aluminum	42,947.00		x							
-------	Residential Wood Combustion	112,430.27	x	x	x	x		x	x		x

Total Estimated Emissions: 177,013 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-37:

FLUORENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



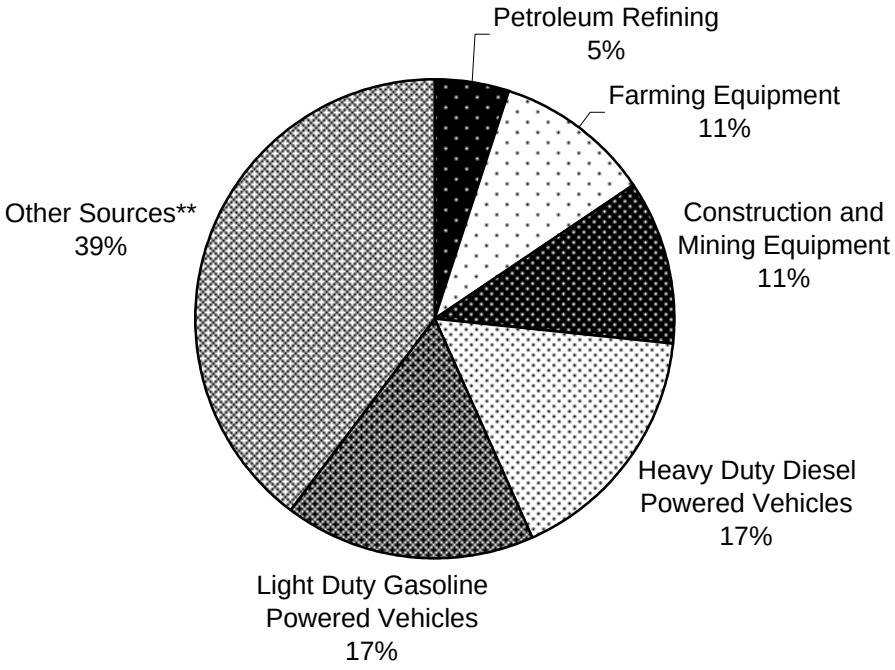
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	366.31	x	x	x	x		x	x		x
-------	Residential Wood Combustion	131,333.84	x	x	x	x			x		x

Total Estimated Emissions: 131,700 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-38:

FORMALDEHYDE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



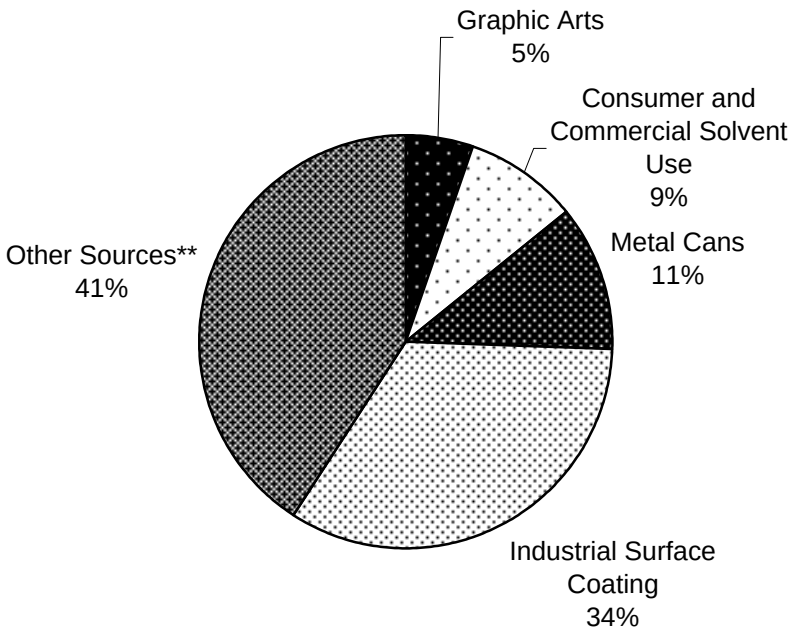
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2911	Petroleum Refining	3,862,656.25	x	x		x				x	x
-------	Farming Equipment	8,165,285.30	x	x	x	x		x	x		x
-------	Construction and Mining Equipment	8,401,505.45	x	x	x	x		x	x		x
-------	Heavy Duty Diesel Powered Vehicles	12,800,725.55	x	x	x	x		x	x	x	x
-------	Light Duty Gasoline Powered Vehicles	12,973,042.10	x	x	x	x		x	x	x	x
-------	Other Sources**	30,497,633.74	x	x	x	x		x	x	x	x

Total Estimated Emissions: 76,700,848 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-39:

GLYCOL ETHERS
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



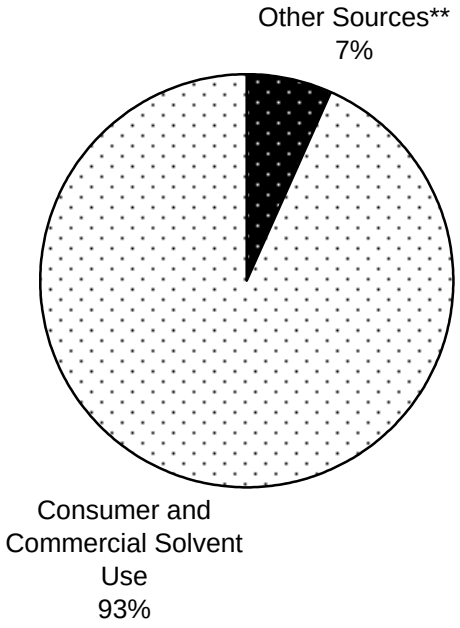
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Graphic Arts	1,085,979.41		x					x		
-------	Consumer and Commercial Solvent Use	1,772,366.40	x	x	x			x			x
3411	Metal Cans	2,307,120.21	x	x		x				x	x
-------	Industrial Surface Coating	6,803,447.90	x	x		x		x			x
-------	Other Sources**	8,244,319.44	x	x		x		x	x	x	x

Total Estimated Emissions: 20,213,233 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-40:

HEXACHLOROETHANE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



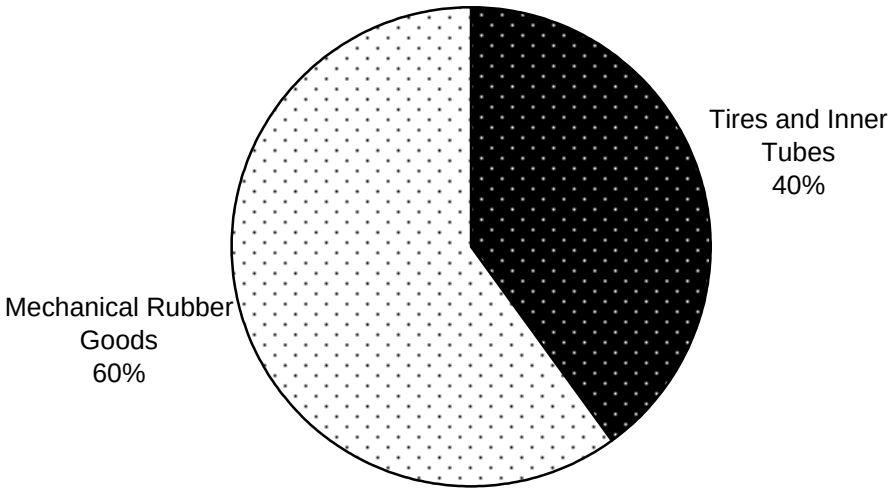
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	416.00		x							
-------	Consumer and Commercial Solvent Use	5,886.44								x	

Total Estimated Emissions: 6,302 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-41:

HEXACHLOROBUTADIENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



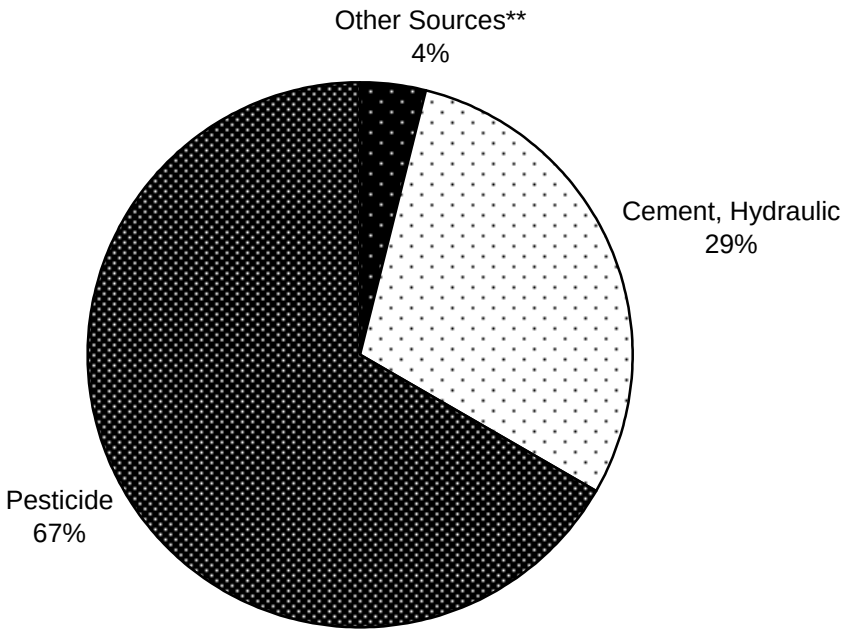
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3011	Tires and Inner Tubes	6.00		x							
3061	Mechanical Rubber Goods	9.00		x							

Total Estimated Emissions: 15 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-42:

HEXACHLOROBENZENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



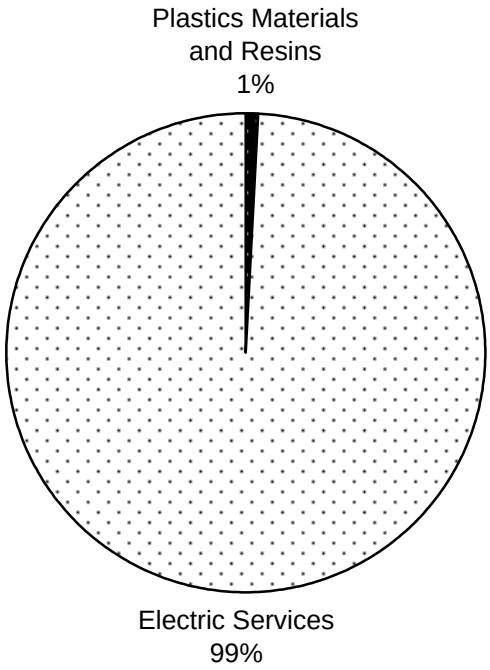
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	1.06		x					x		
3241	Cement, Hydraulic	7.86							x		
-------	Pesticide	17.73	x	x		x					x

Total Estimated Emissions: 26.65 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-43:

HYDRAZINE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



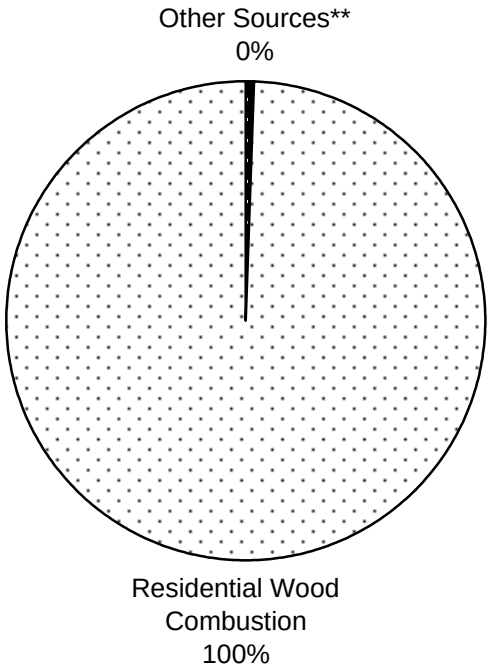
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2821	Plastics Materials and Resins	4.00	x								
4911	Electric Services	452.00							x		

Total Estimated Emissions: 456 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-44:

INDENO(1,2,3-CD)PYRENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



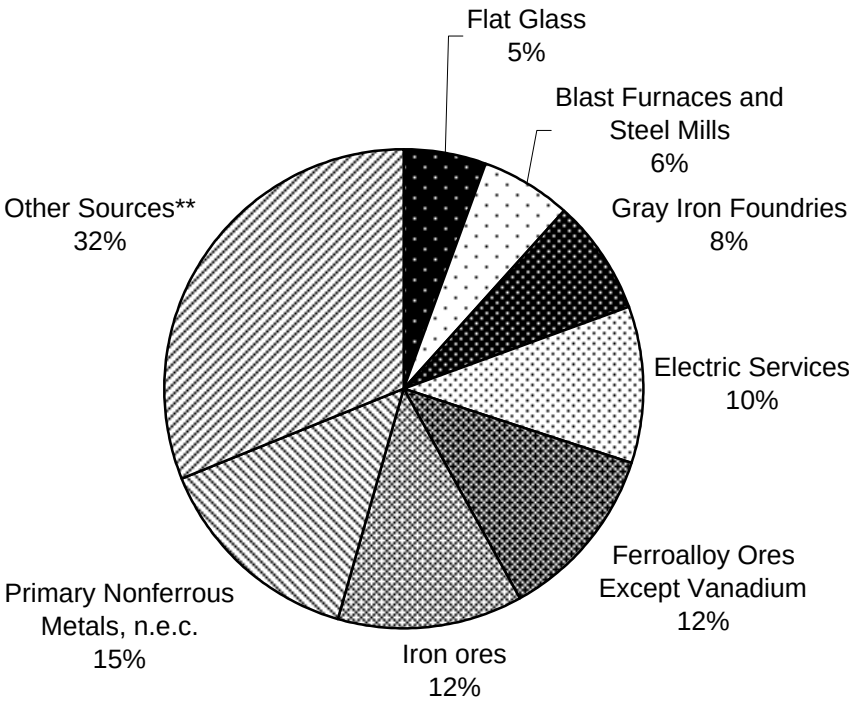
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	358.87	x	x	x	x		x	x		x
-------	Residential Wood Combustion	71,818.47	x	x	x	x		x	x		x

Total Estimated Emissions: 72,177 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-45:

LEAD
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



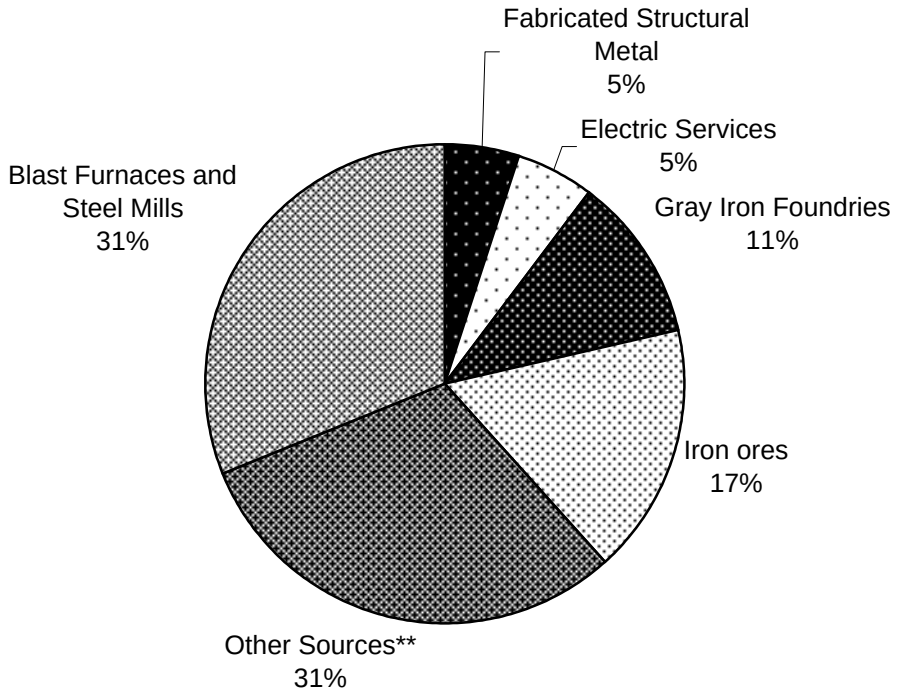
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3211	Flat Glass	67,720.26	x							x	
3312	Blast Furnaces and Steel Mills	76,693.88	x	x	x	x		x	x	x	x
3321	Gray Iron Foundries	96,435.57	x	x	x	x			x	x	x
4911	Electric Services	127,129.50	x	x	x	x			x		x
1061	Ferroalloy Ores Except Vanadium	148,381.00							x		
1011	Iron ores	152,737.80			x	x			x		
3339	Primary Nonferrous Metals, n.e.c.	177,766.01	x						x	x	
-------	Other Sources**	384,654.12	x	x	x	x		x	x	x	x

Total Estimated Emissions: 1,231,518 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-46:

MANGANESE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



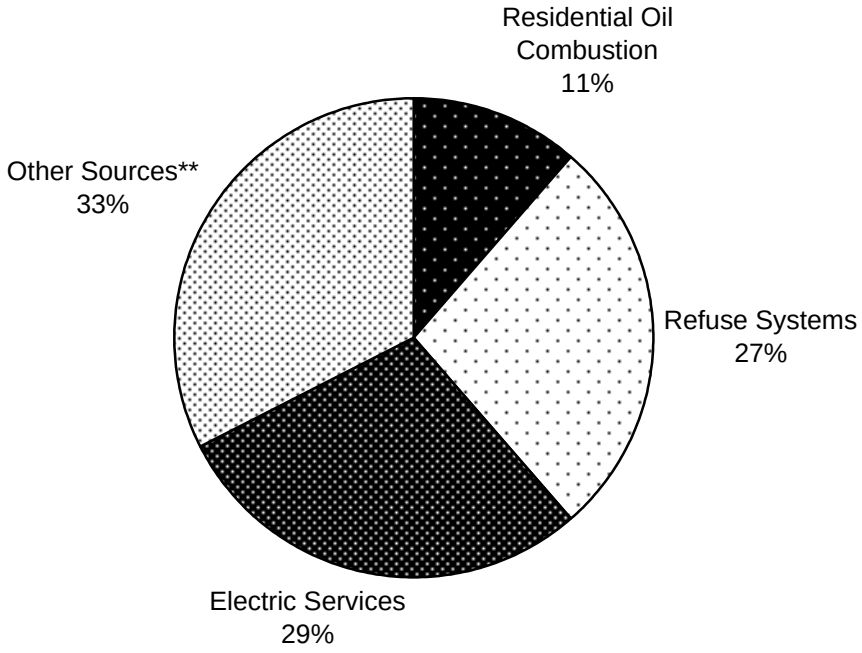
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3441	Fabricated Structural Metal	71,229.10	x	x		x		x	x		x
4911	Electric Services	74,055.55	x	x	x	x			x	x	x
3321	Gray Iron Foundries	158,729.27	x	x	x	x		x	x	x	x
1011	Iron ores	236,550.16			x	x			x		
-------	Other Sources**	432,819.30	x	x	x	x		x	x	x	x
3312	Blast Furnaces and Steel Mills	438,890.89	x	x	x	x		x	x	x	x

Total Estimated Emissions: 1,412,274 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-47:

MERCURY
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



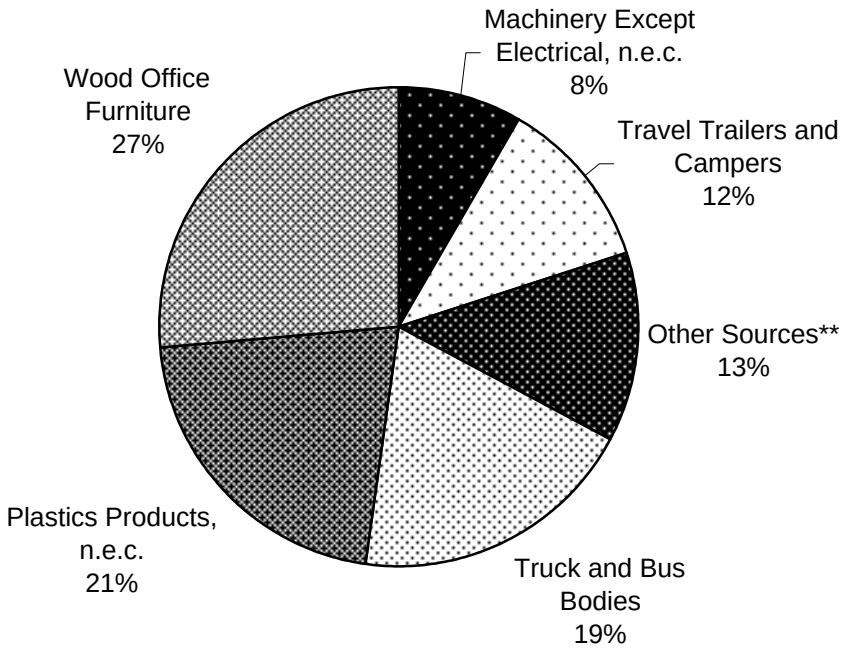
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Residential Oil Combustion	9,030.98	x	x		x		x	x		x
4953	Refuse Systems	21,693.28	x	x	x	x		x	x	x	x
4911	Electric Services	22,852.76	x	x	x	x			x	x	x
-------	Other Sources**	25,728.72	x	x	x	x		x	x	x	x

Total Estimated Emissions: 79,305 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-48:

METHYLENE DIPHENYL DIISOCYANATE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



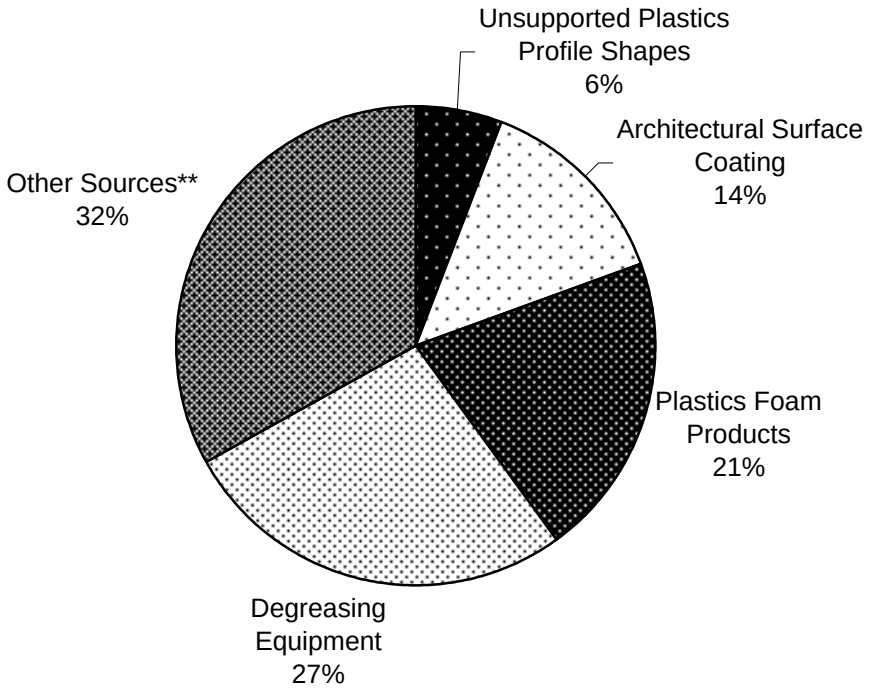
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3599	Machinery Except Electrical, n.e.c.	8,403.00		x							
3792	Travel Trailers and Campers	11,686.05		x							
-------	Other Sources**	13,011.59	x	x		x			x		x
3713	Truck and Bus Bodies	19,656.00		x							
3089	Plastics Products, n.e.c.	21,696.29		x							x
2521	Wood Office Furniture	26,675.00		x							

Total Estimated Emissions: 101,127 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-49:

METHYLENE CHLORIDE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



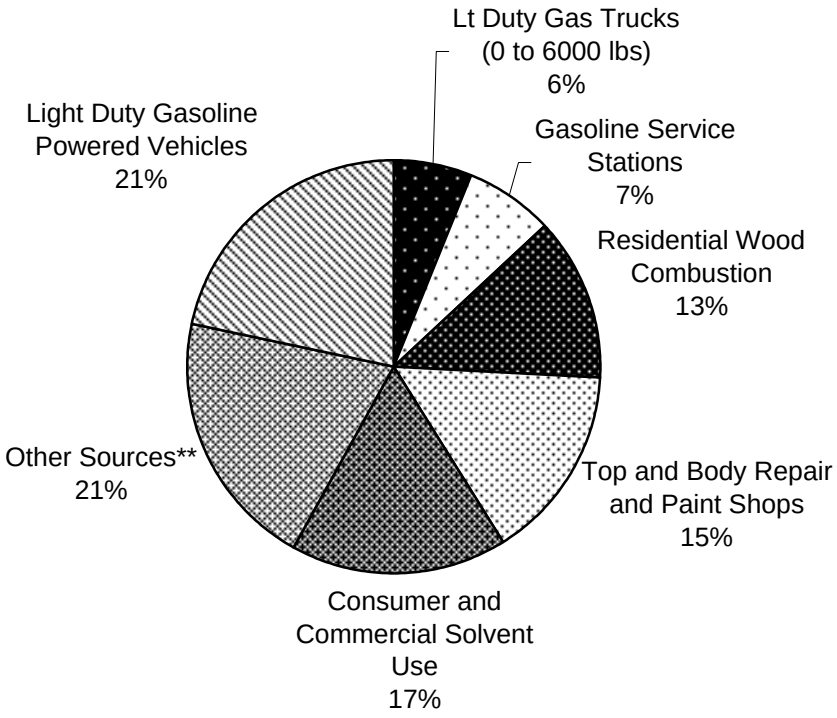
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3082	Unsupported Plastics Profile Shapes	2,008,270.00		x						x	
-------	Architectural Surface Coating	4,553,503.46	x	x	x	x		x	x		x
3086	Plastics Foam Products	6,910,890.15	x	x	x	x		x	x	x	x
-------	Degreasing Equipment	9,069,189.08	x	x	x	x		x		x	x
-------	Other Sources**	11,157,954.64	x	x	x	x		x	x	x	x

Total Estimated Emissions: 33,699,807 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-50:

NAPHTHALENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



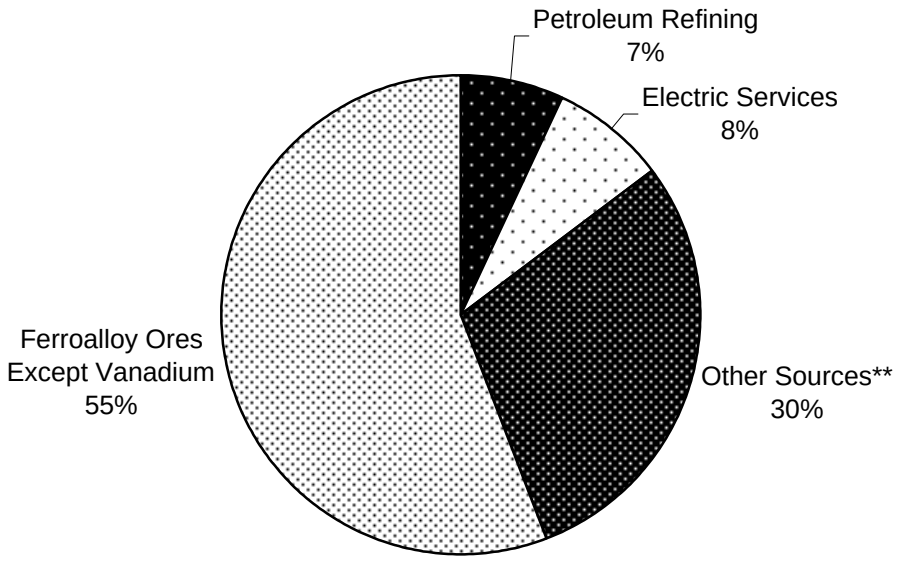
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Lt Duty Gas Trucks (0 to 6000 lbs)	828,916.67	x	x	x	x		x		x	x
5541	Gasoline Service Stations	952,947.71			x	x		x	x		x
-------	Residential Wood Combustion	1,723,881.78	x	x	x	x		x	x		x
7532	Top and Body Repair and Paint Shops	2,084,546.78	x	x	x	x		x		x	x
-------	Consumer and Commercial Solvent Use	2,292,406.95	x	x	x			x		x	x
-------	Other Sources**	2,795,143.56	x	x	x	x		x	x	x	x
-------	Light Duty Gasoline Powered Vehicles	2,931,569.04	x	x	x	x		x	x	x	x

Total Estimated Emissions: 13,609,412 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-51:

NICKEL
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



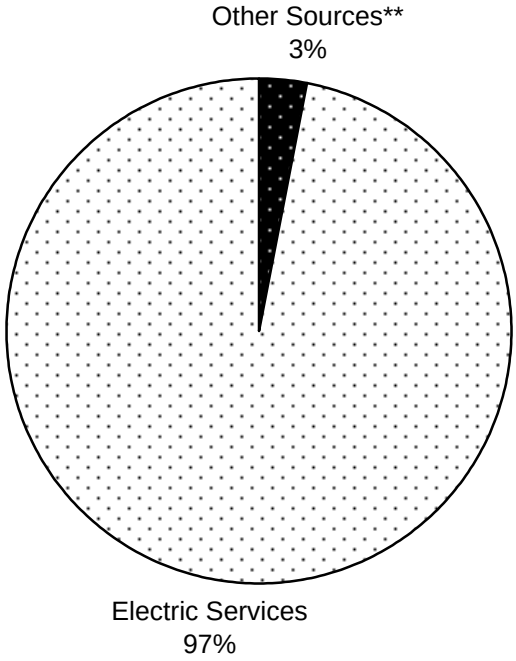
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2911	Petroleum Refining	66,021.64	x	x		x			x		x
4911	Electric Services	73,465.23	x	x	x	x			x	x	x
-------	Other Sources**	279,747.67	x	x	x	x		x	x	x	x
1061	Ferroalloy Ores Except Vanadium	527,500.00							x		

Total Estimated Emissions: 946,734 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-52:

POLYCHLORINATED BIPHENYLS (PCBS)
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



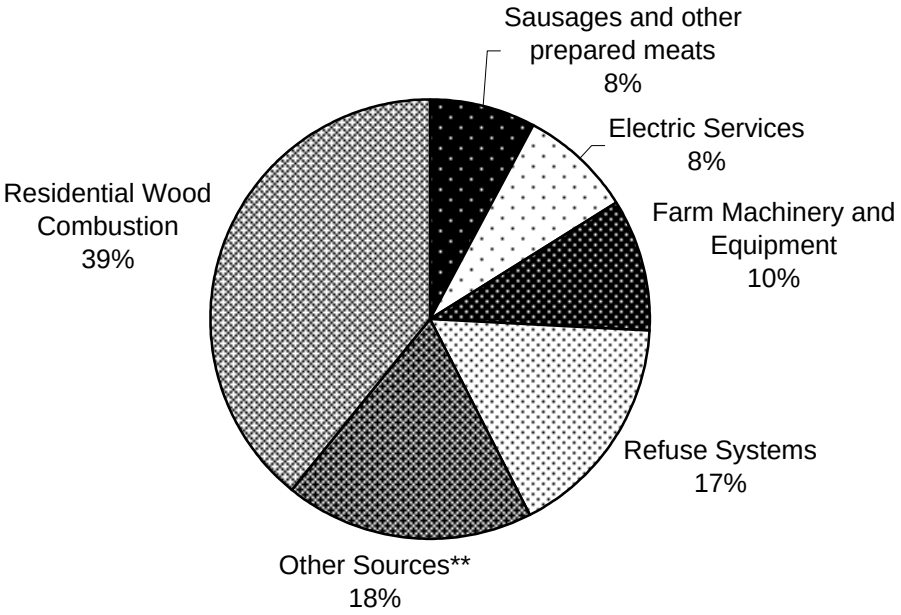
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	7.59	x	x	x	x			x		x
4911	Electric Services	236.23							x		x

Total Estimated Emissions: 243.82 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-53:

POLYCHLORINATED DIBENZODIOXINS (PCDD) 1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



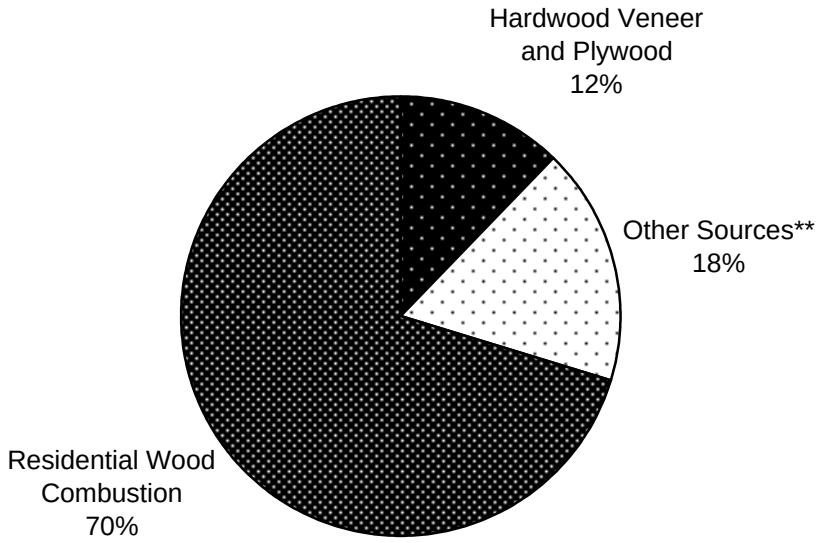
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2013	Sausages and other prepared meats	0.77	x			x					
4911	Electric Services	0.83	x	x	x	x			x		
3523	Farm Machinery and Equipment	0.94	x								
4953	Refuse Systems	1.65	x	x		x					
-------	Other Sources**	1.82	x	x	x	x			x		
-------	Residential Wood Combustion	3.87				x					

Total Estimated Emissions: 9.88 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-54:

POLYCHLORINATED DIBENZOFURANS (PCDF)
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



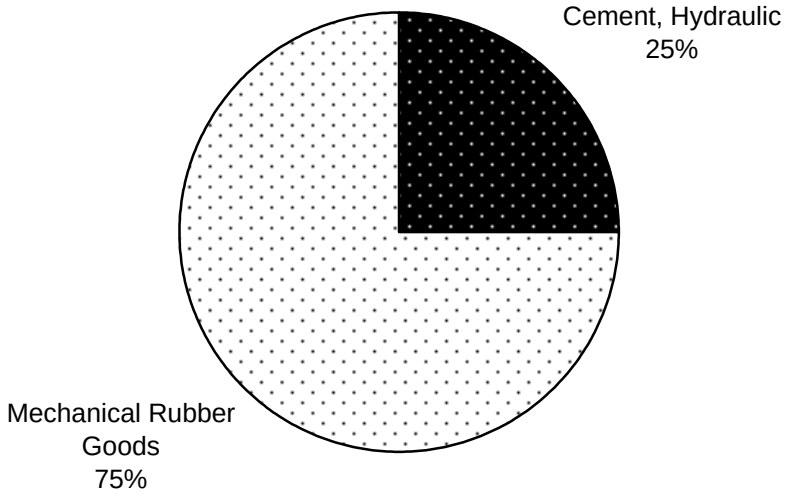
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
2435	Hardwood Veneer and Plywood	3.68	x	x	x				x		
-------	Other Sources**	5.40	x	x	x	x			x		
-------	Residential Wood Combustion	21.35				x					

Total Estimated Emissions: 30.43 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-55:

PENTACHLOROPHENOL
(PCP)
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



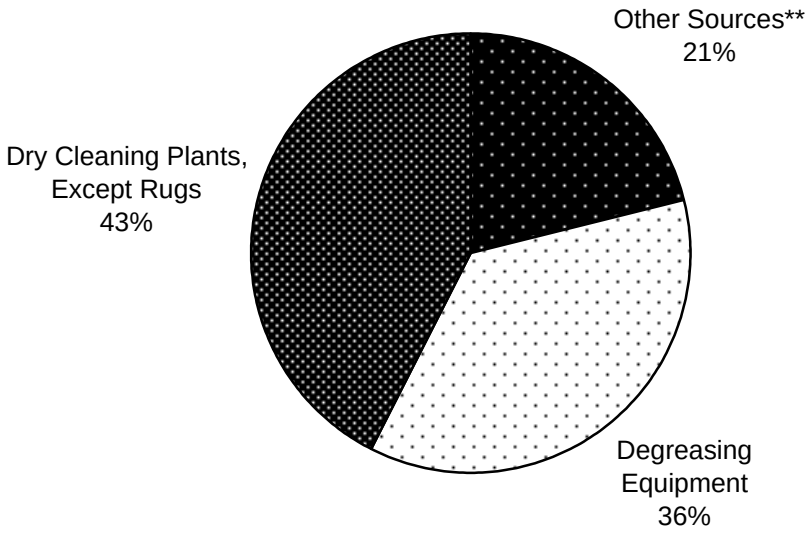
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3241	Cement, Hydraulic	1.00		x							
3061	Mechanical Rubber Goods	3.00		x							

Total Estimated Emissions: 4 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-56:

TETRACHLOROETHYLENE (PERCHLOROETHYLENE) 1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



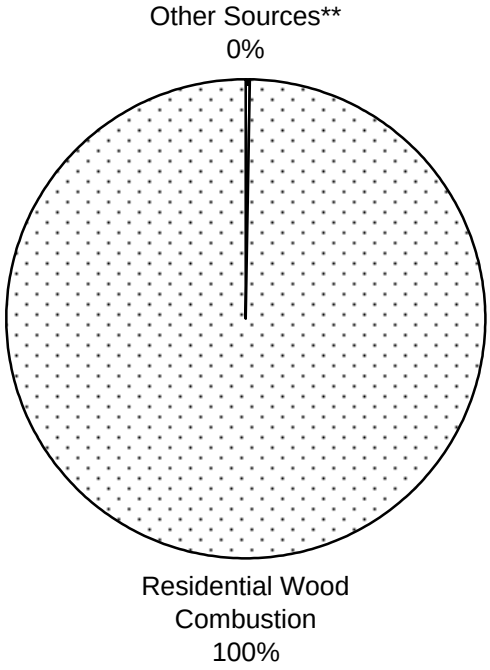
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	7,990,967.06	x	x	x	x		x	x	x	x
-------	Degreasing Equipment	13,792,445.09	x	x	x			x		x	x
7216	Dry Cleaning Plants, Except Rugs	16,014,961.98	x		x	x			x		x

Total Estimated Emissions: 37,798,374 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-57:

PHENANTHRENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



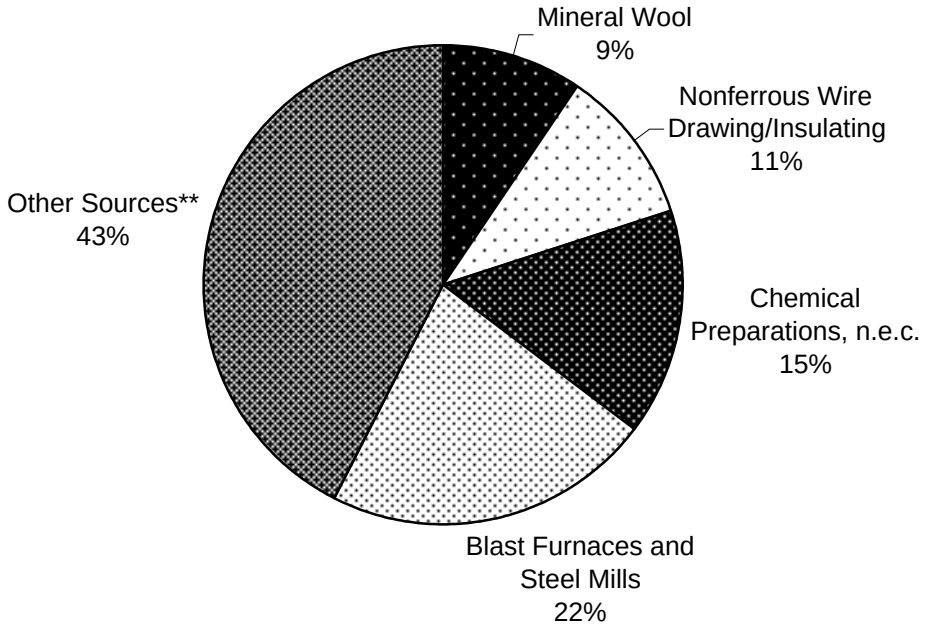
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	4,094.95	x	x	x	x		x	x	x	x
-------	Residential Wood Combustion	1,984,847.02	x	x	x	x		x	x		x

Total Estimated Emissions: 1,988,941 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-58:

PHENOL
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



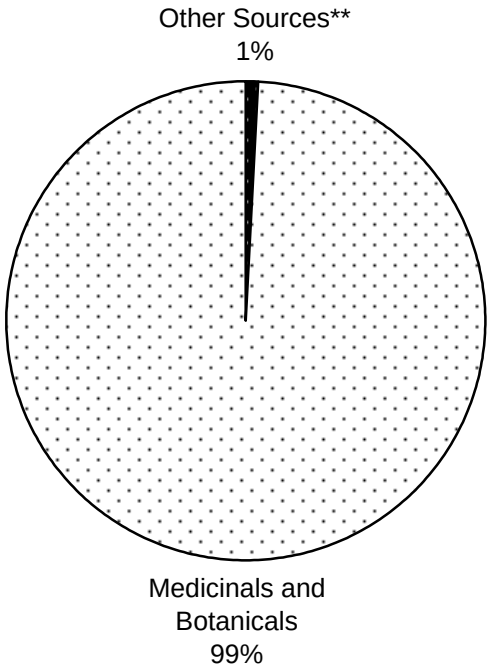
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
3296	Mineral Wool	231,013.32		x	x				x	x	
3357	Nonferrous Wire Drawing/Insulating	259,540.00	x	x					x		
2899	Chemical Preparations, n.e.c.	377,718.86	x	x	x						
3312	Blast Furnaces and Steel Mills	547,783.20		x					x	x	
-------	Other Sources**	1,042,161.13	x	x	x	x		x	x	x	x

Total Estimated Emissions: 2,458,216 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-59:

PHOSGENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



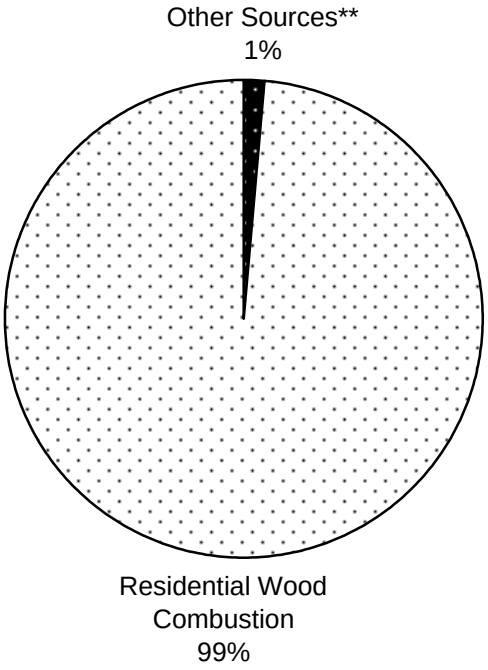
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	1.19	x	x							x
2833	Medicinals and Botanicals	160.00		x							

Total Estimated Emissions: 161.19 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-60:

PYRENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



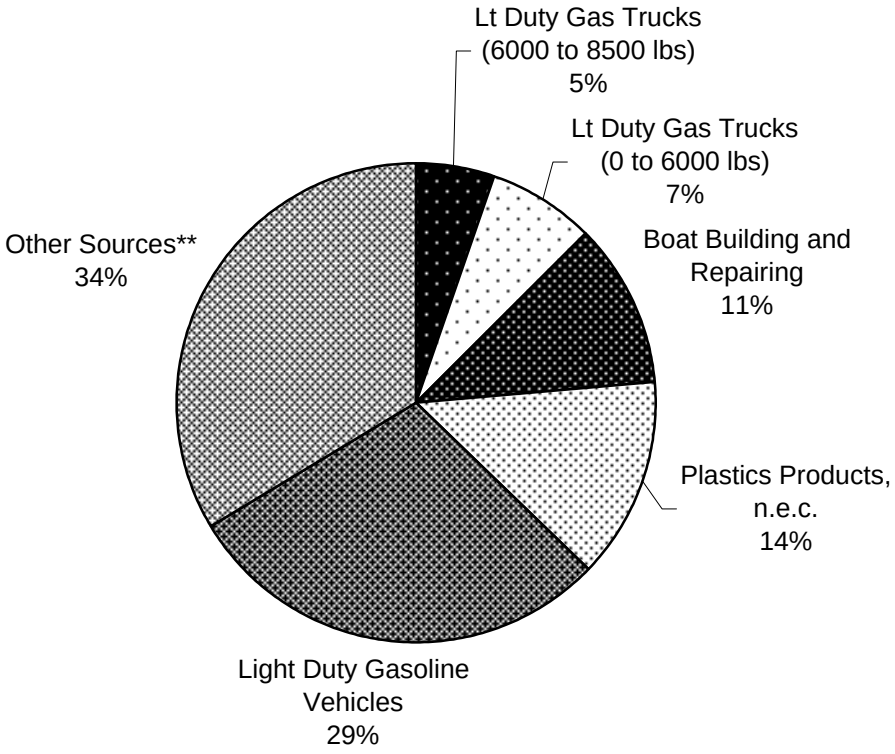
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	1,742.99	x	x	x	x		x	x	x	x
-------	Residential Wood Combustion	117,887.60	x	x	x	x		x	x		x

Total Estimated Emissions: 119,630 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-61:

STYRENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



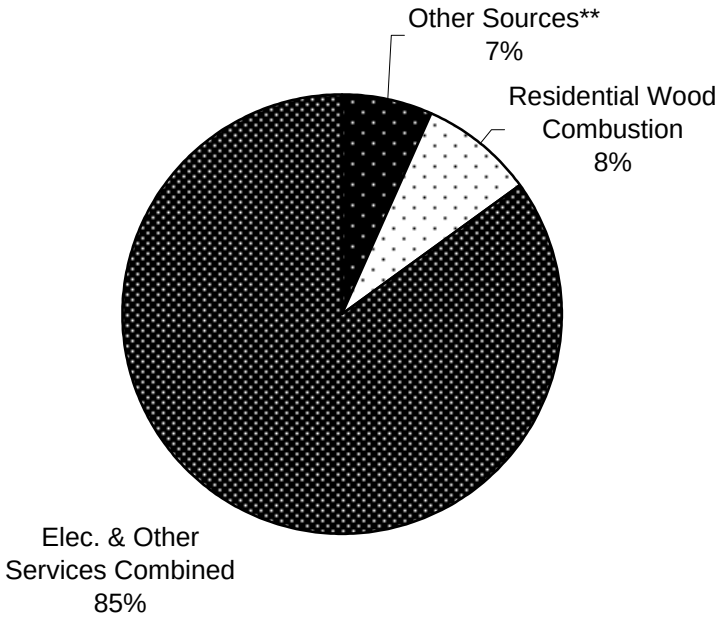
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Lt Duty Gas Trucks (6000 to 8500 lbs)	1,649,895.27	x	x	x	x		x		x	x
-------	Lt Duty Gas Trucks (0 to 6000 lbs)	2,145,150.89	x	x	x	x		x		x	x
3732	Boat Building and Repairing	3,437,102.51	x	x	x	x		x			x
3089	Plastics Products, n.e.c.	4,145,905.14	x	x	x	x		x	x	x	x
-------	Light Duty Gasoline Vehicles	8,915,445.15	x	x	x	x		x	x	x	x
-------	Other Sources**	10,293,499.29	x	x	x	x		x	x	x	x

Total Estimated Emissions: 30,586,998 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-62:

2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN (TCDD,2378) 1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



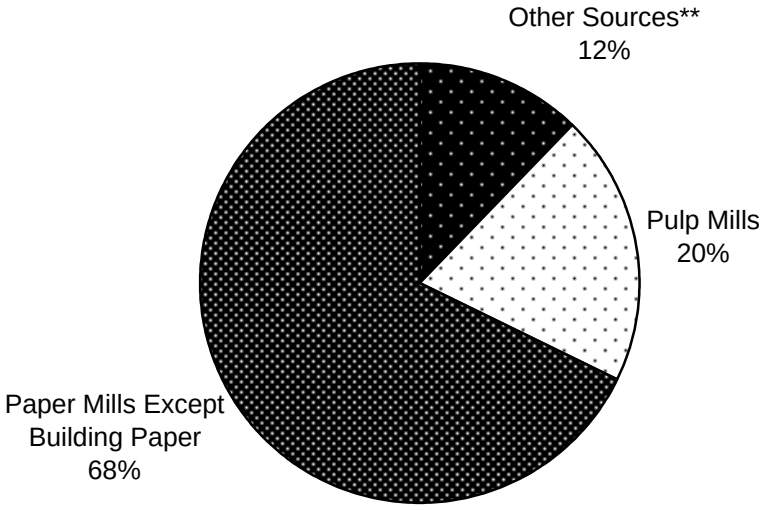
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	0.01	x	x	x	x			x		x
-------	Residential Wood Combustion	0.01				x					
4931	Elec. & Other Services Combined	0.10			x	x					x

Total Estimated Emissions: 0.12 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-63:

2,3,7,8-TETRACHLORODIBENZO-FURAN (TCDF,2378) 1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



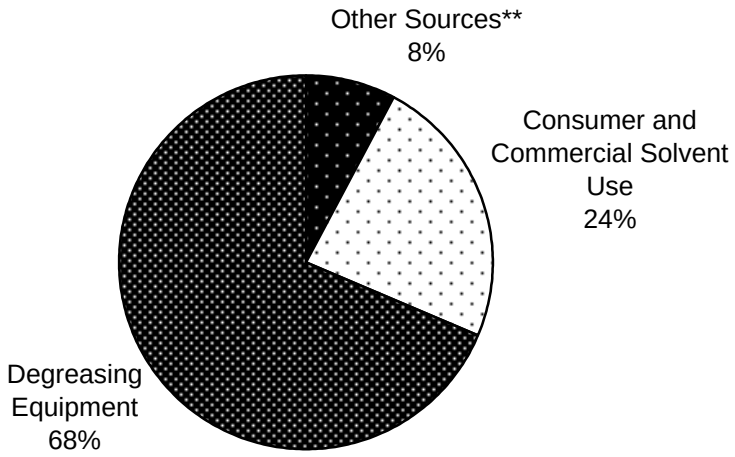
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	12.61	x	x	x	x			x		x
2611	Pulp Mills	20.73			x				x		
2621	Paper Mills Except Building Paper	69.76			x				x		

Total Estimated Emissions: 103.10 lbs.

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

Figure 2-64:

METHYLENE CHLOROFORM (TCE,111) 1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



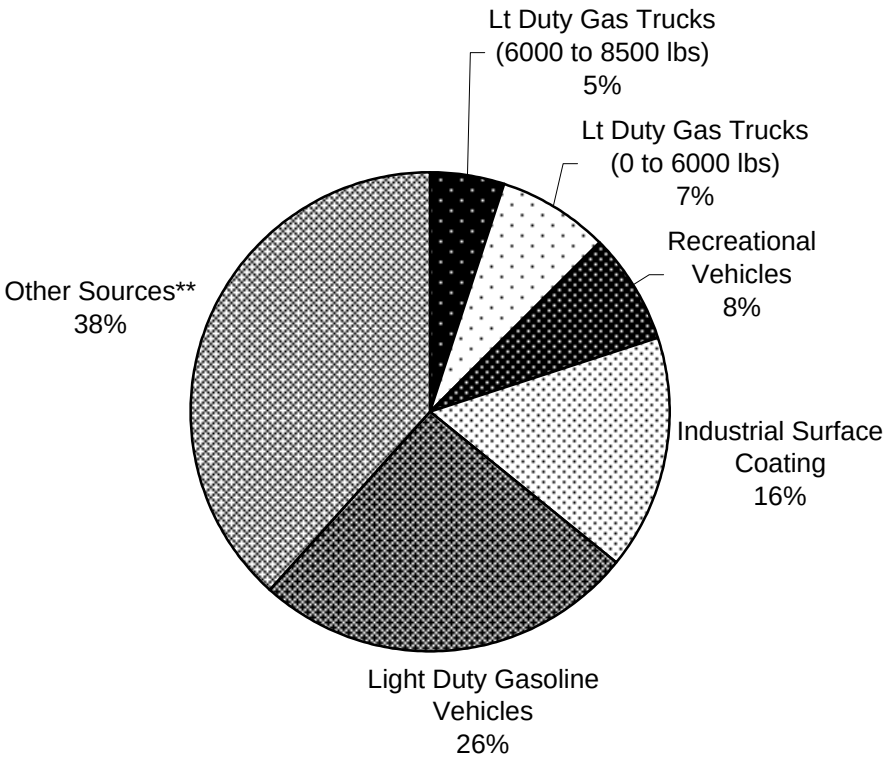
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	5,690,224.97	x	x	x	x		x	x	x	x
-------	Consumer and Commercial Solvent Use	16,973,619.96	x	x	x			x			x
-------	Degreasing Equipment	49,335,198.10	x	x	x	x		x		x	x

Total Estimated Emissions: 71,999,043 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-65:

TOLUENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



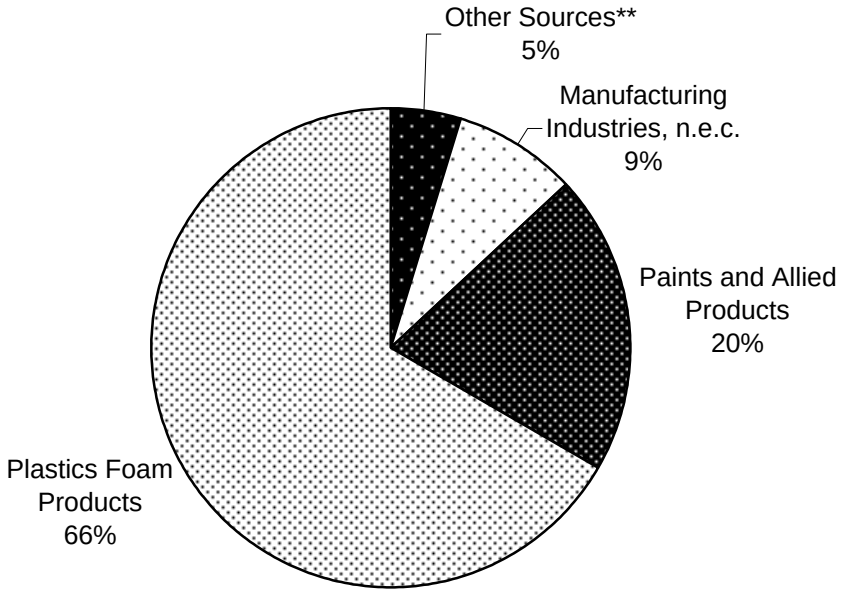
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Lt Duty Gas Trucks (6000 to 8500 lbs)	26,249,102.17	x	x	x	x		x		x	x
-------	Lt Duty Gas Trucks (0 to 6000 lbs)	37,611,204.40	x	x	x	x		x		x	x
-------	Recreational Vehicles	38,948,662.73	x	x		x		x	x	x	x
-------	Industrial Surface Coating	81,606,839.89	x	x	x	x		x	x	x	x
-------	Light Duty Gasoline Vehicles	133,906,452.30	x	x	x	x		x	x	x	x
-------	Other Sources**	198,182,302.10	x	x	x	x		x	x	x	x

Total Estimated Emissions: 516,504,563 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-66:

2,4-TOLUENE DIISOCYANATE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



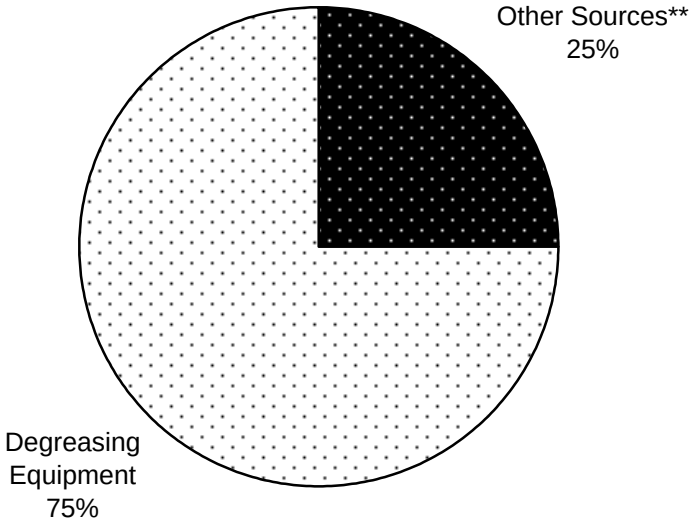
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	228.69		x		x					x
3999	Manufacturing Industries, n.e.c.	420.00		x							
2851	Paints and Allied Products	998.00	x								
3086	Plastics Foam Products	3,293.60	x	x							x

Total Estimated Emissions: 4,940 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-67:

TRICHLORETHYLENE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



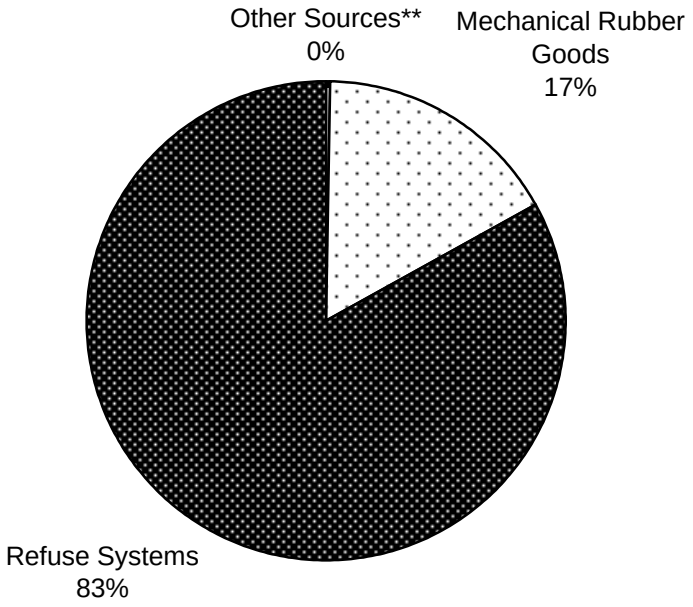
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	13,143,065.67	x	x	x	x		x	x	x	x
-------	Degreasing Equipment	39,440,205.96	x	x	x	x		x		x	x

Total Estimated Emissions: 52,583,271 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-68:

2,4,5-TRICHLOROPHENOL
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



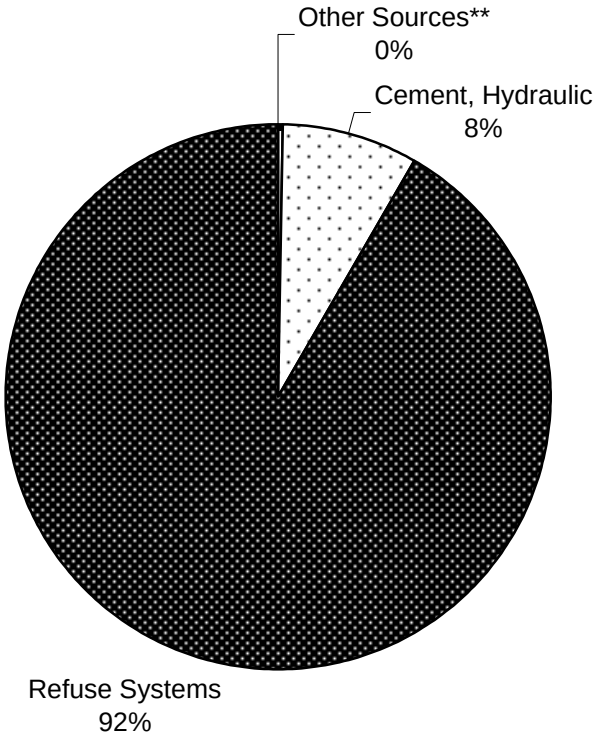
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	0.02							x		
3061	Mechanical Rubber Goods	1.00		x							
4953	Refuse Systems	5.00							x		

Total Estimated Emissions: 6.02 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-69:

2,4,6-TRICHLOROPHENOL
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



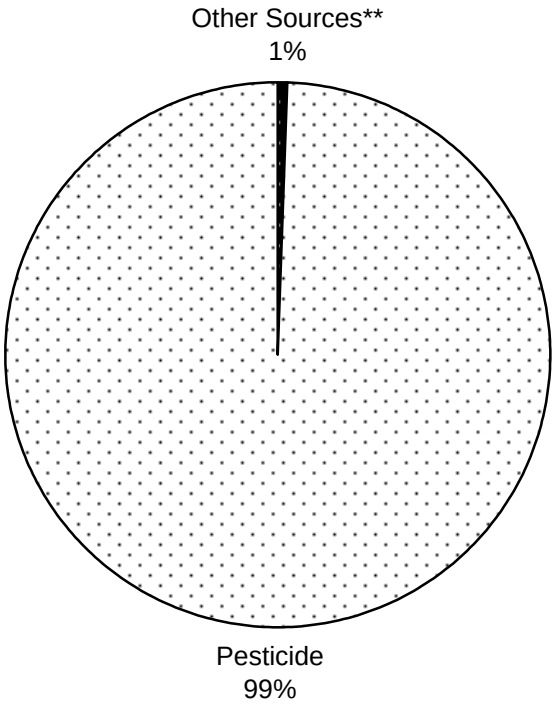
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	1.21		x					x		
3241	Cement, Hydraulic	24.00		x							
4953	Refuse Systems	276.00							x		

Total Estimated Emissions: 301.21 lbs.

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

Figure 2-70:

TRIFLURALIN
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



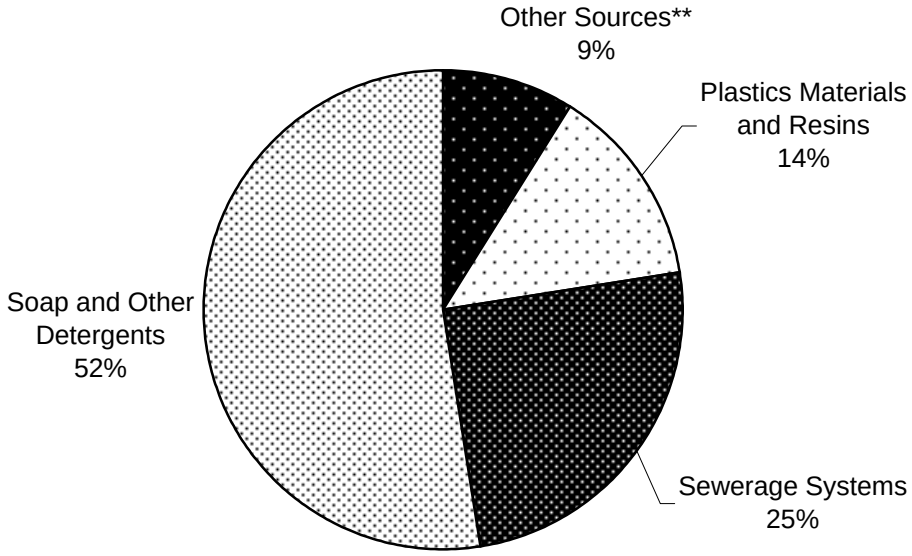
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	6,371.00		x							
-------	Pesticide	1,238,431.13	x		x	x					

Total Estimated Emissions: 1,244,802 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-71:

VINYL CHLORIDE
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



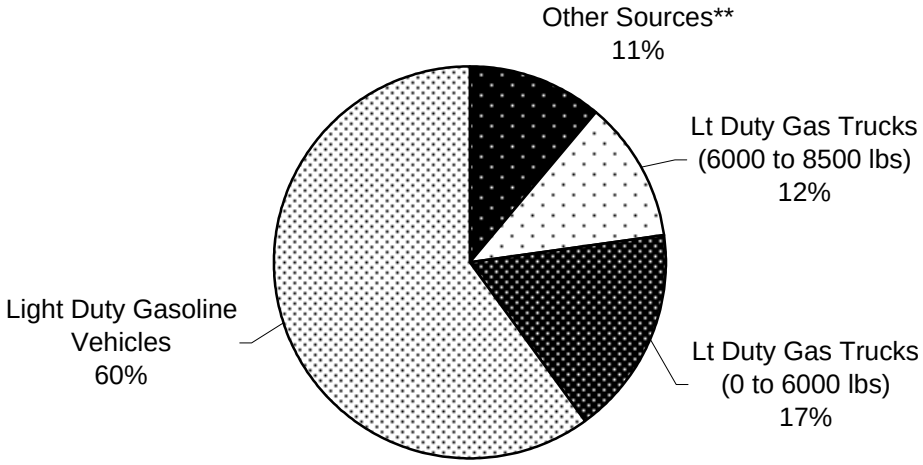
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	156,644.10	x	x	x	x		x	x	x	x
2821	Plastics Materials and Resins	238,753.09	x						x	x	
4952	Sewerage Systems	442,505.57	x	x	x	x		x	x		x
2841	Soap and Other Detergents	926,912.00	x		x						

Total Estimated Emissions: 1,764,814 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-72:

XYLENES(META)
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



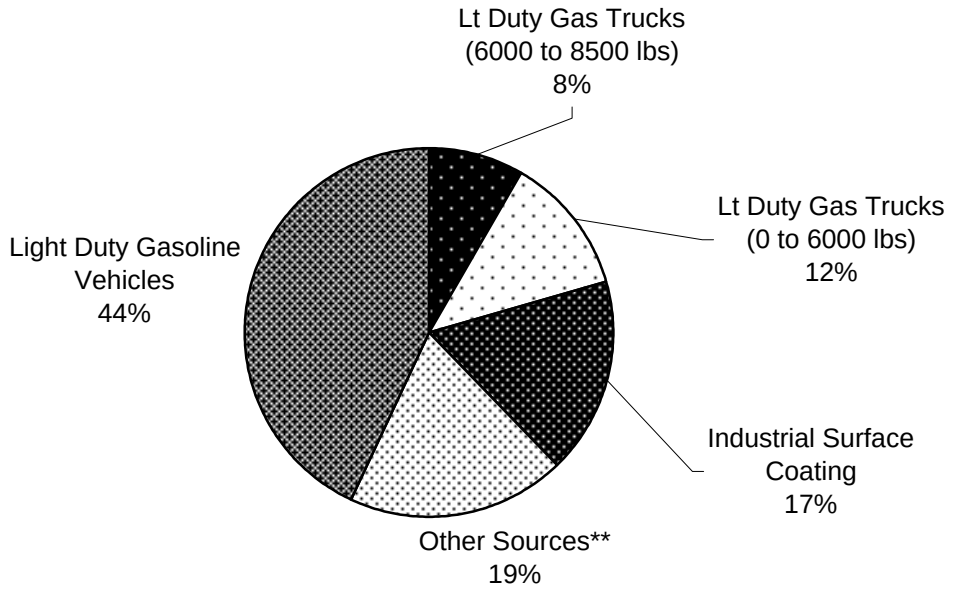
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	7,116,762.11	x	x	x	x		x	x	x	x
-------	Lt Duty Gas Trucks (6000 to 8500 lbs)	7,634,675.28	x	x	x	x		x		x	x
-------	Lt Duty Gas Trucks (0 to 6000 lbs)	11,001,378.84	x	x	x	x		x		x	x
-------	Light Duty Gasoline Vehicles	38,798,498.00	x	x	x	x		x	x	x	x

Total Estimated Emissions: 64,551,314 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-73:

XYLENES(ORTHO)
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



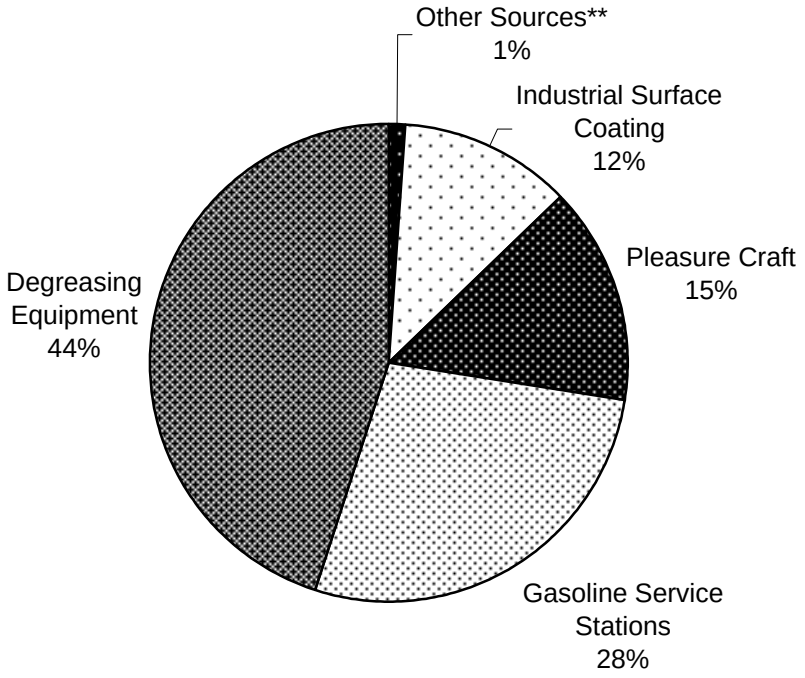
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Lt Duty Gas Trucks (6000 to 8500 lbs)	4,056,952.02	x	x	x	x		x		x	x
-------	Lt Duty Gas Trucks (0 to 6000 lbs)	5,797,143.26	x	x	x	x		x		x	x
-------	Industrial Surface Coating	8,325,503.74	x	x	x			x	x	x	x
-------	Other Sources**	9,207,353.94	x	x	x	x		x	x	x	x
-------	Light Duty Gasoline Vehicles	20,734,408.63	x	x	x	x		x	x	x	x

Total Estimated Emissions: 48,121,361 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-74:

XYLENES(PARA)
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



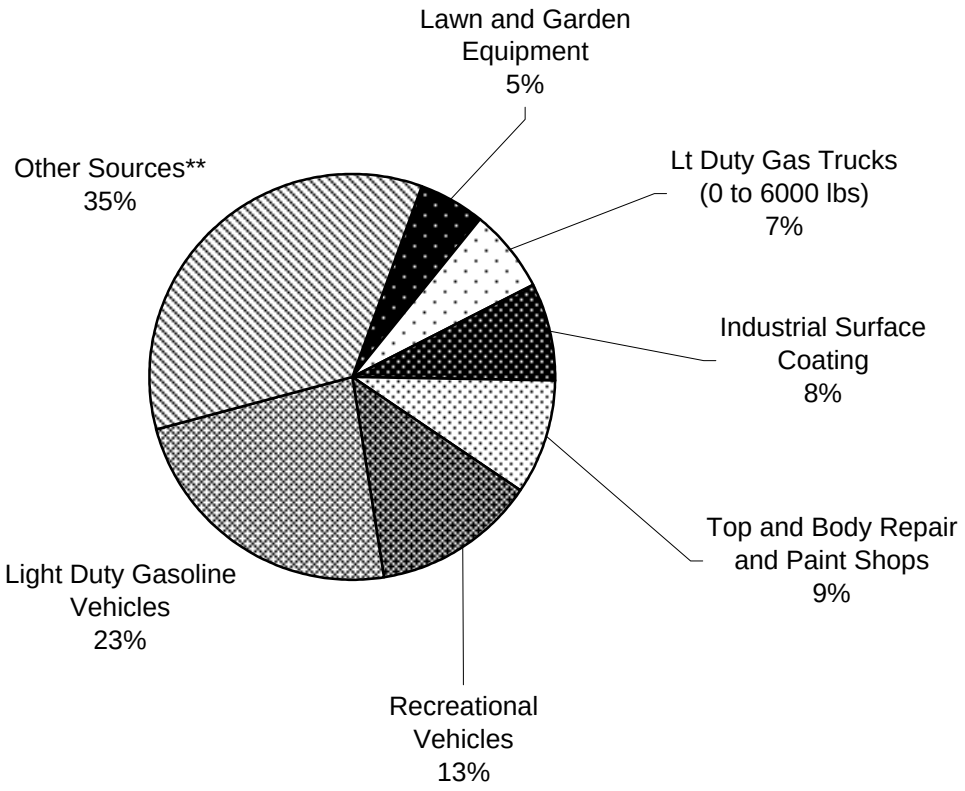
SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Other Sources**	7,914.94	x	x	x	x			x	x	x
-------	Industrial Surface Coating	84,909.04		x				x			x
-------	Pleasure Craft	109,607.91		x							
5541	Gasoline Service Stations	201,900.22				x		x	x		x
-------	Degreasing Equipment	329,450.06		x	x			x			x

Total Estimated Emissions: 733,782 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 jurisdictions that have contributed emissions data for this pollutant.

Figure 2-75:

XYLENES(ISO)
1997 Estimated Emissions* by Source Category for Point, Area, and Mobile Sources



SIC	DESCRIPTION	EMISSIONS (LB)	IL	IN	MI	MN	NY	OH	ON	PA	WI
-------	Lawn and Garden Equipment	16,992,971.98	x	x		x		x	x		x
-------	Lt Duty Gas Trucks (0 to 6000 lbs)	21,194,352.68	x	x	x	x		x		x	x
-------	Industrial Surface Coating	25,463,811.56	x	x	x	x		x	x	x	x
7532	Top and Body Repair and Paint Shops	29,512,720.14	x	x	x	x		x		x	x
-------	Recreational Vehicles	41,789,425.70	x	x		x		x	x		x
-------	Light Duty Gasoline Vehicles	75,462,152.10	x	x	x	x		x	x	x	x
-------	Other Sources**	112,376,705.68	x	x	x	x		x	x	x	x

Total Estimated Emissions: 322,792,139 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 jurisdictions that have contributed emissions data for this pollutant.

3. Conclusion

The air regulatory agencies in the eight Great Lakes states and province of Ontario agree that a collaborative effort is vital to successfully implementing an annual inventory of airborne toxic pollutant emissions for the Great Lakes region. They have been working cooperatively towards this goal since 1989.

The 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 premiers 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) under the Clean Air Act Amendments of 1990 and the assessment of atmospheric deposition to the Great Lakes under the efforts of the U.S. EPA's Great Waters Program.

The emphasis of this project was to prepare a reliable and technically accurate inventory of estimated emissions for the 82 target compounds in the Great Lakes region and not a set of individual state/provincial inventories. As a regional effort, a high level of coordination was necessary to ensure consistency. The project team established Quality Assurance/Quality Control (QA/QC) criteria to provide an accurate and useful summary of toxic air emissions at the regional level. The QA/QC plan outlines procedures to maximize the quality and accuracy of the regional inventory's data and estimates. Once a quality controlled and quality assured emissions inventory has been established, regional scientists and researchers can begin to 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.

The overall benefit of maintaining an annual inventory of air toxic emission sources ultimately belongs to organizations that are able to use the data. The 1997 inventory data, as well as the 1993 and 1996 inventories, will be made available to researchers and interested parties from the U.S. EPA's GLNPO server.

Finally, the next phase of project development will include online access to the compiled inventory of toxic emissions from point, area and mobile sources via the Great Lakes Information Network and enhanced data access from RAPIDS. While in GLIN, one will be able to use an Internet Geographic Information System to cartographically view the toxic air emissions for the Great Lakes region. Enhancements to RAPIDS will enable raw emissions data to be exported in formats compatible to a variety of analytical programs. Using established 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.

Appendices

Appendix A: Illinois Toxic Emissions Inventory

BACKGROUND

The State of Illinois compiled its statewide air toxic emission inventory for the Great Lakes Air Toxic Emission Inventory Project for calendar year 1997 for point, area, on-road and off-road sources. Illinois did not perform the emission calculations in RAPIDS. Rather, Illinois used the data from the Factor Information Retrieval System (FIRE) and the reference tables of RAPIDS to calculate emissions outside of RAPIDS. The emission estimates calculated were then imported into RAPIDS.

DATA SOURCES

Illinois maintains a criteria pollutant emission inventory known as ISSIS (Illinois Stationary Source Inventory System) which contains data from the previous inventory system, EIS (Emission Inventory System). The stationary source inventory includes points sources which require a permit. In Illinois, permitting exemptions are based upon physical characteristics of a device (e.g., boilers with less than one million BTU per hour heat input) or throughput (e.g., less than 5,000 gallons of coating/solvent use per year). There are no exemptions for permitting for de minimis emission rates so the point source inventory has a large number of sources as compared to other states.

CALCULATION METHODS

Point Source Emissions

Point source emissions were calculated using the emission factors found in FIRE and RAPIDS using operating rate data from ISSIS. Since no control efficiencies existed in ISSIS for the pollutants of interest, Illinois applied the ISSIS removal efficiency value for particulate matter to particulate toxic pollutants and the VOC value to organic toxic pollutants.

Illinois also extended the use of emission factors. In performing its calculations external to RAPIDS, Illinois discovered that SCC codes that were similar didn't necessarily have the same number of pollutants/emission factors associated with them. For example, the SCC (10100601) for electric generating natural gas fired boilers over 100 million BTU/hr had an emission factor for mercury emissions while the SCC (10200601) for industrial natural gas fired boilers over 100 million BTU/hr did not. In cases such as this, the emission factor was applied to all similar SCCs. The majority of these substitutions occurred for fuel combustion and incinerating devices.

Previous inventories identified shortcomings in the emission rates for some organic materials (e.g., methylene chloride, dibutyl phthalate, etc.). To address this shortcoming, Illinois supplemented its emission data with TRI reported data for 1997. Emission sources obtained through TRI had to be match by address to match emission sources from ISSIS. Sources that couldn't be matched were not included in the inventory. Where matches were established, a further analysis was done to associate the emissions with a specific device at the source.

Two source categories typically identified as area sources were inventoried as point sources. One of these sources was chrome plating. Due to time constraints, emissions were calculated from permitted allowable amp-hours and standard emission factors.

The second area source inventoried as a point source were landfills. Data was obtained from the Illinois EPA's "Nonhazardous Solid Waste Management and Landfill Capacity in Illinois" report dated December 1998. Emissions were then calculated using the EIIP/AP-42 methodology. For sources with flaring and gas-to-energy systems, a capture percent of 75% and a destruction efficiency of 90% was assumed.

Area Source Emissions

Area sources were primarily calculated using EIIP methods and speciation profiles contained in RAPIDS. A description of the calculation methods, assumptions and data sources for each area source inventoried follows.

Architectural Coating

The EIIP methodology was followed. Nationwide production estimates were obtained from the Census Bureau report "MA28F – Paint and Allied Products", August 1998 (www.census.gov/cir/www/ma28f.html). These values were then apportioned to county level using population. Emissions were then calculated by using per capita factors.

Autobody Refinishing

Employment data was obtained from the Census Bureau report "1997 County Business Patterns", September 1999 (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 "1997 County Business Patterns", September 1999 (www.census.gov/prod/www/abs/cbptotal.html). The EIIP emission factors were then used to calculate perchloroethylene emissions.

Ethylene Oxide Sterilizers

Inventoried as a point source.

Gasoline Marketing

The amount of gasoline and gasohol sold in Illinois was obtained from *Monthly Gasoline Reported by States 1997* (Federal Highway Administration Highway Statistics, Table MF-33GA, September 1998) . 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.

Underground Tank Breathing – Used EIIP calculation methodology in combination with speciation profile 1190.

Gasoline Trucks in Transit – Used EIIP calculation methodology in combination with speciation profile 1190.

Graphic Arts

Inventoried as a point source.

Incineration/Crematories

Inventoried as a point source.

Industrial Surface Coating

Employment data was obtained from the Census Bureau report "1997 County Business Patterns", September 1999 (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 1997 Field Crops Summary* (National Agricultural Statistics Service (www.agr.state.il.us/agstats/ctyest/1997Main.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 1997* (Department of Energy, Energy Information Administration, DOE/EIA-2014(97), September 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 1997* (Department of Energy, Energy Information Administration, DOE/EIA-2014(97), September 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

Employment data was obtained from the Census Bureau report "1997 County Business Patterns", September 1999 (www.census.gov/prod/www/abs/cbptotal.html) for the SIC categories of 25, 33, 34, 35, 36, 37, 38, 39 and 55. The per employee EIIP emission factors were then used to calculate TOG emissions. Emissions were speciated by using profile 1195.

The calculated emissions were then converted to controlled emissions by assuming 90% control efficiency, 80% 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.

Structure Fires

The number of fires in Illinois was obtained from the National Fire Data Center (NFIRS Fire Profile www.usfa.fema.gov/nfirs/nfirs_query.cfm). The state-wide number of structure and residential fires was apportioned to the county level by the number of houses in a county (1990 census). The EIIP methodology was then used to calculate emissions.

Traffic Lane Markings

Coating specifications and use were obtained from the Illinois Department of Transportation. Coating use was available by district so coating use was apportioned at the county level by the percentage of miles of roads in the county compared to the total miles of roads in the district. This data was obtained for the previous 1993 inventory. Since the source category did not comprise a significant portion of the 1993 inventory, it was assumed that coating use was the same for 1997 as it was in 1993. Emissions were speciated using profile 2438.

Mobile Source Emissions

Emissions for mobile sources were calculated for the categories of aircraft, off-road and on-road sources. A description of the calculation methods, assumptions and data sources for each source inventoried follows.

Aircraft

The number of operations (landings and takeoffs) for each airport were obtained from Illinois' 1996 ozone inventory. For O'Hare and Midway airports, data had been previously obtained from Landrum & Brown via the Chicago Department of Aviation (March 1998) on the design day flights from those airports. This data included operations for specific aircraft types and engine types.

For O'Hare and Midway, emissions were calculated by using emission factors from the FAA Engine Emission Database (FAEED) version 2.1 specific to the engine type being inventoried. Default time-in-modes (TIM) were used. Since the daily count of flights was given, this value was multiplied by 366 to obtain the annual number of flights. For airports other than O'Hare and Midway, emissions were calculated by using "average" emission factors from AP-42. Once VOC emissions were calculated, they were converted to TOG and speciated to obtain the pollutants of interest.

Emissions for 1996 were grown to 1997 values by using data from the FAA (www.apo.data.faa.gov/faaatadsall.htm). Airports not included in this report were assumed to have the same activity as 1996.

Off-road Mobile Sources

Off-road mobile sources were calculated using USEPA's NONROAD model with the default parameters. Output from the model was for the pollutant TOG which was then speciated to obtain the pollutants of interest. A review of the data showed snowmobile emissions to be higher in urban areas than rural areas. This implied an improper surrogate was being used to calculate activity. Snowmobile emissions were removed from the inventory.

On-road Mobile Sources

Annual VMT by road type for each county was obtained from the Illinois Department of Transportation. Using conversion factors, these values were converted to monthly VMT values and then apportioned to vehicle types.

Next, USEPA's MOBILE 5b model was run for each county for each month of 1997 to obtain emission factors of TOG. The inputs into the model included average speed for the road type, monthly maximum and average temperatures from the National Weather Service, fleet mix and appropriate inspection and maintenance values (if appropriate). If a county did not have a National Weather Service site which recorded temperature, the nearest site to that county was used. Emission factors output from the MOBILE model were then multiplied by VMT to obtain TOG emissions. These emissions were then speciated to obtain the pollutants of interest.

Particulate matter emissions from on-road mobile sources were calculated using USEPA's PART5 model. The inputs into the model included average speed for the road type, fleet mix, particle size, average vehicle weight, number of wheels and number of precipitation days. The number of precipitation days was obtained from the National Weather Service. Emission factors output from the PART5 model were then multiplied by VMT to obtain particulate emissions. These emissions were then speciated to obtain the pollutants of interest. No roadway dust emissions were included.

INFORMATION

For more information about Illinois' air toxics inventory, please contact:

Buzz Asselmeier
Bureau of Air
IL Environmental Protection Agency
P.O. Box 19276
Springfield, IL 62794-9276

(P) 217-782-5811
(F) 217-782-6348
(E) buzz.asselmeier@epa.state.il.us

Table A-1: Illinois - Statewide Summary of Emissions (lbs./yr.)

	Point Sources	Area Sources	Mobile Sources	Nonroad Sources	Total
ACENAPHTHEN	12.01	14,477.12			14,489.13
ACENAPHTHYL	20.59	46,324.83			46,345.42
ACETALDEHYDE	25,224.91	9,321.75	1,772,973.20	3,245,591.23	5,053,111.09
ACROLEIN	16,539.03	154,131.12	251,640.87	157,108.69	579,419.71
ACRYLAMIDE	1.00				1.00
ACRYLONITRIL	414,029.43				414,029.43
ANTHRACENE	5.42	13,029.80		23.25	13,058.47
ANTIMONY	3,153.09				3,153.09
ARSENIC	15,904.97	119.60	17.20		16,041.77
ATRAZINE		1,415,680.00			1,415,680.00
BENZ(A)ANTHR	10,530.72	2,086.08		314.68	12,931.47
BENZ(GHI)PE	1.61	28,953.06		616.95	29,571.62
BENZENE	827,477.29	1,253,489.65	10,246,177.31	4,489,965.90	16,817,110.15
BENZO(A)PYRE	23,364.97	8,686.38		185.56	32,236.91
BENZO(B)FLUO	2.09	5,791.39		160.77	5,954.25
BENZO(K)FLUO	1.14	1,448.52		172.66	1,622.32
BERYLLIUM	4,043.67	21.12			4,064.79
BUTADIENE,13	108,396.84	147.69	1,309,741.39	685,629.51	2,103,915.41
CADMIUM	20,893.42	590.81			21,484.23
CARBON TETRA	2,466.25	6,552.00			9,018.25
CHLOROFORM	31,261.29	50,243.21			81,504.50
CHROMIUM	78,285.23	712.40	266.81	2,017.70	81,282.14
CHROMIUM VI	16,025.86				16,025.86
CHRYSENE	16,696.38	14,477.17		237.02	31,410.57
COBALT	4,500.65	41.75			4,542.40
COKE OVEN GS	1,151,548.62				1,151,548.62
COPPER	67,212.87	1,325.02	64,661.95		133,199.84
DIBENZAHAN	1.59	5,791.09		25.20	5,817.88
DIBROMOET,12	62.70				62.70
DIBUTYL PHTH	1,198.63	3,166.30			4,364.94
DICHLORETH12	23,808.06	54.98			23,863.04
DIEYLHEX PHT	2,874.93				2,874.93
ETHYLBENZENE	992,614.15	563,675.59	4,223,536.01	2,026,802.04	7,806,627.80
ETHYLENE OXI	158,008.60	178,522.32			336,530.91
FLUORANTHENE	15,772.39	11,582.59		210.43	27,565.41
FLUORENE	35.49	20,268.11			20,303.60
FORMALDEHYDE	7,709,952.06	87,088.39	4,690,010.75	7,098,509.48	19,585,560.68
GLYCOL ETHRS	3,691,154.63	6,174,970.22			9,866,124.86
HEXCLBENZENE		0.7361			0.7361
HYDRAZINE	4.00				4.00
INDN(123CDPY	1.82	28,953.35		25.50	28,980.67
LEAD	151,559.71	293.96	15,369.55		167,223.22
MANGANESE	257,019.37	421.83	459.55	2,131.46	260,032.21
MERCURY	9,719.94	144.37	343.17	572.42	10,779.90
METHENE(B)4-	34.60				34.60
METHYLENE CL	2,051,563.06	2,664,728.36			4,716,291.42
NAPHTHALENE	206,777.92	1,225,308.66	637,797.45	28,205.15	2,098,089.19
NICKEL	52,868.03	1,087.81	344.86	948.69	55,249.39
PCBS	1.17				1.17
PCDD	4.0599				4.0599
PCDF	1.6737				1.6737
PERC	1,607,572.46	5,597,190.40			7,204,762.87
PHENANTHRENE	131.51	170,827.96		100.01	171,059.48
PHENOL	641,622.58	1,447.62		11,966.06	655,036.27
PHOSGENE	<0.0001				<0.0001
PYRENE	9.68	11,583.47		136.46	11,729.62
STYRENE	2,200,308.02	16,035.29	1,996,417.17	122,675.07	4,335,435.53
TCDD,2378	0.0010	0.0005			0.0015
TCDF,2378	0.0584	0.0130			0.0714
TCE,111	316,414.98	11,215,737.08			11,532,152.06
TOLUENE	13,500,382.46	41,320,881.82	29,097,006.11	7,983,590.69	91,901,861.07
TOLUENE24DII	1,672.60				1,672.60
TRICHLORETHY	3,054,128.29	5,218,159.94			8,272,288.23
TRIFULURALIN		1,152,000.00			1,152,000.00
VINYL CHLOR	562,692.96	41.10			562,734.06
XYLENE,M	72,782.29		8,443,620.04		8,516,402.33
XYLENE,O	998,299.74	3,742,045.29	4,484,441.56	9,499.61	9,234,286.20
XYLENE,P	378.96				378.96
XYLENES ISO	5,345,599.53	13,777,130.79	16,466,926.03	7,759,887.69	43,349,544.04

Table A-2: Illinois Pollutant Codes

Code	Pollutant	CAS Number
ACENAPHTHEN	Acenaphthene	83-32-9
ACENAPHTHYL	Acenaphthylene	208-96-8
ACETALDEHYDE	Acetaldehyde	75-07-0
ACROLEIN	Acrolein	107-02-8
ACRYLAMIDE	Acrylamide	79-06-1
ACRYLONITRIL	Acrylonitrile	107-13-1
ANTHRACENE	Anthracene	120-12-7
ANTIMONY	Antimony	7440-36-0
ARSENIC	Arsenic	7440-38-2
ATRAZINE	Atrazine	1912-24-9
BENZ(A)ANTHR	Benz(a)anthracene	56-55-3
BENZ(GHI)PE	Benzo(g,h,i)perylene	191-24-2
BENZENE	Benzene	71-43-2
BENZO(A)PYRE	Benzo(a)pyrene	50-32-8
BENZO(B)FLUO	Benzo(b)fluoranthene	205-99-2
BENZO(K)FLUO	Benzo(k)fluoranthene	207-08-9
BERYLLIUM	Beryllium	7440-41-7
BUTADIENE,13	1,3-Butadiene	106-99-0
CADMIUM	Cadmium	7440-43-9
CARBON TETRA	Carbon Tetrachloride	56-23-5
CHLOROFORM	Chloroform	67-66-3
CHROMIUM	Chromium	7440-47-3
CHROMIUM VI	Chromium VI	18540-29-9
CHRYSENE	Chrysene	218-01-9
COBALT	Cobalt	7440-48-4
COKE OVEN GS	Coke Oven gas	
COPPER	Copper	7440-50-8
DIBENZAHAN	Dibenzo(a,h)anthracene	53-70-3
DIBROMOET,12	1,2-Dibromoethane	106-93-4
DIBUTYL PHTH	Dibutyl Phthalate	84-74-2
DICHLORETH12	1,2-Dichloroethane	107-06-2
DIEYLHEX PHT	Diethylhexyl Phthalate	117-81-7
ETHYLBENZENE	Ethylbenzene	100-41-4
ETHYLENE OXI	Ethylene Oxide	75-21-8
FLUORANTHENE	Fluoranthene	206-44-0
FLUORENE	Fluorene	86-73-7
FORMALDEHYDE	Formaldehyde	50-00-0
GLYCOL ETHRS	Glycol Ethers	52286-19-8
HEXCLBENZENE	Hexachlorobenzene	118-74-1
HYDRAZINE	Hydrazine	302-01-2
INDN(123CDPY	Indeno(1,2,3-c,d)pyrene	193-39-5
LEAD	Lead	7439-92-1
MANGANESE	Manganese	7439-96-5
MERCURY	Mercury	7439-97-6
METHENE(B)4-	Methylene(b)4-phenylisocyanate	101-68-8
METHYLENE CL	Methylene Chloride	75-09-2
NAPHTHALENE	Naphthalene	91-20-3
NICKEL	Nickel	7440-02-0
PCBS	PCBs	1336-36-3
PCDD	Polychlorinated dibenzodioxins	
PCDF	Polychlorinated dibenzofurans	
PERC	Perchloroethylene	127-18-4
PHENANTHRENE	Phenanthrene	85-01-8
PHENOL	Phenol	108-95-2
PHOSGENE	Phosgene	75-44-5
PYRENE	Pyrene	129-00-0
STYRENE	Styrene	100-42-5
TCDD,2378	2,3,7,8-Tetrachlorodibenzodioxin	1746-01-6
TCDF,2378	2,3,7,8-Tetrachlorodibenzofuran	51207-31-9
TCE,111	1,1,1-Trichloroethane	71-55-6
TOLUENE	Toluene	108-88-3
TOLUENE24DII	2,4-Toluene diisocyanate	584-84-9
TRICHLORETHY	Trichloroethylene	79-01-6
TRIFULURALIN	Trifluralin	1582-09-8
VINYL CHLOR	Vinyl Chloride	75-01-4
XYLENE,M	m-Xylene	108-38-3
XYLENE,O	o-Xylene	95-47-6
XYLENE,P	p-Xylene	106-42-3
XYLENES ISO	Xylene Isomers	1330-20-7

Appendix B: Indiana Toxic Emissions Inventory

CALCULATION METHODS

Point Sources

The 1997 point source inventory was compiled the same way as in 1996. Data contained in the point source inventory include estimates made by the state using information provided by point sources and emission factors from FIRE 6.01, voluntarily reported toxics emissions data, and data from the U.S.EPA's Community Right to Know Toxic Release Inventory (TRI). Please refer to the 1996 documentation for further details.

Area Sources

The 1997 area source emission estimates were projected from the 1996 Great Lakes Air Toxics Emission Inventory estimates. Readers are encouraged to review the 1996 documentation for more details on how those estimates were made. In general, most of the 1996 area source emission estimates were based on either employment or population data, and were projected to 1997 accordingly. No new area source categories were inventoried for 1997. The following explains how categories were changed from the 1996 inventory.

Architectural Surface Coating and Consumer and Commercial Solvent Use

Statewide population estimates were obtained from the U.S. Department of Census for 1997 and were used to project the 1996 estimates to 1997.

Auto Body Refinishing

The statewide increase in employment in SIC Code 7532 between 1996 and 1997 from County Business Patterns was used to estimate 1997. For Clark, Floyd, Lake and Porter counties a 70% control efficiency and an 80% rule effectiveness was applied beginning in 1997, due to a new rule promulgated as part of IDEM's ozone control plans for these counties.

Traffic Markings

Estimates for 1997 were projected from 1996 estimates based on the amount of money used on road maintenance during those years. This information was obtained from the U.S. Census Bureau and Federal Highway Administration.

Agricultural Pesticide Use

The 1997 emission estimates for atrazine use were recalculated using data on the acres of corn planted and Atrazine usage obtained from the Purdue Agricultural Statistics web page and an emission factor of 360 pounds of atrazine/ton applied. Also for 1997 the pollutant hexachlorobenzene was added. The emissions of this pollutant are based on the amount of atrazine used. The emission factor used is 8.4e-8 lb. hexachlorobenzene/lb. of atrazine. No data were available on the usage of trifluralin.

Commercial/Industrial Dry Cleaning Operations

Employment data from County Business Patterns for 7212 were checked to see if any significant change had occurred for this area source from 1996 estimates. The Perchloroethylene Dry Cleaning NESHAP was effective late 1996. For the 1997 inventory a 44% control efficiency and an 80% rule effectiveness was applied.

Industrial Surface Coatings

Industrial surface coating activities in the 1996 inventory were made using employment data and population data and were adjusted accordingly for the 1997 estimates.

Gasoline Dispensing

New estimates were made for gasoline service stations. Activity data and county VOC totals were estimated the same as in 1996. Gas sales information for 1997 was obtained from U.S. DOT. Average speciation profiles from EPA's Bulk Gasoline MACT Background Information Document were used and are shown below:

HAP	Weight % VOC
Benzene	0.9
Ethylbenzene	0.10
Toluene	1.3
Xylenes iso	0.5

Graphic Arts

County Business Patterns data for SIC 2752 were used to project 1996 estimates for 1997.

Solvent Metal Cleaning

1996 estimates were projected to 1997 using County Business Patterns for each SIC involved in this source.

Residential Fossil Fuel Combustion

This source category uses data from the Energy Information Administration for residential fossil fuel use. Changes in fossil fuel use from 1995 (used for the 1996 inventory) to 1997 were used to estimate emissions.

Municipal Solid Waste Landfills and Public Owned Treatment Works

These source categories were not changed.

Mobile Source Emissions

New mobile source estimates were made for 1997 due to the availability of new toxic speciation profiles and HAP emission factors since the 1996 inventory effort.

Onroad Sources

Onroad toxic emissions were calculated either directly using HAP emission factors, or using speciation profiles applied to evaporative and exhaust hydrocarbon (HC) and particulate matter (PM) emissions estimates. HC and PM estimates were made using EPA's Mobile 5b and Part 5 models, and VMT from the Indiana Department of Transportation. Please refer the 1996 documentation for further details on the methodology. New toxic speciation profiles from Rapids that were used for 1997 are shown below:

VEHICLE TYPE	SPECIATED MATERIAL	SPECIATION CODE
ALL VEHICLES	BW10	G031
GAS	EVHC	G008
GAS	EXHC	G001
GAS	EXPM	G004
HD DIESEL	EXHC	G003
HD DIESEL	EXPM	G006
LD DIESEL	EXHC	G002
LD DIESEL	EXPM	G005

GAS includes all gasoline vehicles (Light Duty Gas Vehicles, Trucks, Motorcycles and Heavy Duty Gas Vehicles)
LD DIESEL includes Light Duty Diesel Vehicles and Light Duty Diesel Trucks
HD DIESEL includes Heavy Duty Diesel Vehicles

For benzene, 1,3-butadiene, acetaldehyde, and formaldehyde estimates, emission factors from EPA 1996 National Toxics Inventory were used to estimate emissions from gasoline vehicles. For the PAH constituent estimates, emission factors from Rapids were used. For all other HAP estimates the speciation profiles listed above were used.

No estimates were made for tire wear or road dust for the 1997 inventory.

Nonroad Sources

In general, the same methodology that was used for the 1996 inventory was followed for nonroad estimates. One change made was that estimates from EPA's nonroad model were compiled so that separate evaporative and exhaust emissions were available. Evaporative emission estimates include evaporative losses from the crankcase, hot soak and diurnal losses, and evaporative running and resting losses. Another change from the 1996 inventory involved records with SCC codes rejected by Rapids. In 1996 those estimates were not included. For 1997 these estimates have been included with a blank SCC code, with the SCC code from the nonroad model included in the process comment text field. New speciation profiles from Rapids used are shown below:

ENGINE TYPE	SPECIATED MATERIAL	SPECIATION CODE
2S GAS	EVHC	G018
2S GAS	EXHC	G011
2S GAS	EXPM	G014
4S GAS	EVHC	G019
4S GAS	EXHC	G012
4S GAS	EXPM	G015
DIESEL	EXHC	G013
DIESEL	EXPM	G016
DIESEL	EXPM	32202 *
GAS	EXPM	31102 *
DIESEL	TOG	1201 *
GAS	TOG	1101 *

* Speciation profiles used for recreational boats.
2S GAS includes 2 Stroke gasoline engines
4S GAS includes 4 Stroke gasoline engines

Aircraft

New aircraft estimates were made for 1997 due to an error discovered in the 1996 aircraft activity table. The error involved LTO data for the general aviation itinerant category which were incorrectly included in the commercial aircraft category. For the 1997 inventory airports have been entered as individual sources, unlike in 1996, where all airports in a county were added up and entered as a single source. The same criteria pollutant emission factors were used. Speciation profiles from Rapids used were G021 for Military Aircraft, G022 for Commercial Aircraft, G023 for General Aviation Aircraft and G024 for Air Taxis.

Railroads

1997 railroad emissions were projected from 1996 estimates using data from the U.S. Census Bureau, Statistical Abstracts of the United States, 1999, Table 1017, total ton – miles of rail shipments. The same criteria pollutant emission factors were used. Speciation profile codes G003 (EXHC) and G006 (EXPM) were used.

Commercial Marine Vessels

No estimates were made for commercial marine vessels for the 1997 inventory.

REFERENCES

1. Gasoline Sales Data
http://www.fhwa.dot.gov/ohim/hs97/mf33ga.pdf
http://www.fhwa.dot.gov/ohim/hs97/mf21.pdf
http://www.fhwa.dot.gov/ohim/hs98/tables/mf21.pdf

2. Pesticide Data
http://www.aes.purdue.edu/agstat/annbul/9899/pg51.html

3. Household Energy Data
http://www.eia.doe.gov/emeu/recs/contents.html
http://www.eia.doe.gov/emeu/sep/in/frame.html

4. Highway Expenditures
http://www.fhwa.dot.gov/ohim/hs97/sf1.pdf
http://www.fhwa.dot.gov/ohim/hs98/tables/sf1.pdf
http://www.census.gov/ftp/pub/industry/1/ma28f97.pdf

5. Population
http://www.census.gov/population/estimates/county/co-99-3/99C3_18.txt
http://www.census.gov/population/estimates/state/st-99-3.txt

6. County Business Patterns
http://www.census.gov/epcd/cbp/map/97data/18/999.txt

RESULTS

The pollutant totals for the 1997 inventory may differ from totals in the 1996 inventory due to many reasons. A few of these possible reasons are discussed below.

For area sources, the change in the methodology for 1997 for gasoline service stations provides more complete estimates for this category. The FIRE emissions factors used in 1996 were found to be incomplete. Other changes include a correction to the emission factor used to estimate atrazine emissions, and the application of control efficiencies and rule effectiveness to the perchloroethylene dry cleaning, and auto refinishing categories.

For both on and off road mobile sources, the use of new emission factors and speciation profiles resulted in significant changes to this inventory. For aircraft an error was discovered in the 1996 activity data which was corrected for the 1997 inventory. Commercial marine vessel estimates were not included in the 1997 inventory.

The attached tables provide summaries of Indiana's emission totals by source type and by county.

INFORMATION

For more information about Indiana's air toxics inventory, please contact:

Jon Bates
Office of Air Mgmt.
IN Dept. of Environmental Management
P.O. Box 6015
101 N. Senate Ave.-Room 1001
Indianapolis, IN 46206

(P) 317-233-4226
(F) 317-233-5697
(E) jbate@opn.dem.state.in.us

Table B-1: Indiana - Statewide Summary of Emissions (lbs./yr.)

	Point Sources	Area Sources	Mobile Sources	Nonroad Sources	Total
ACENAPHTHEN	29.25	2,732.33			2,761.58
ACENAPHTHYL	59.16	30,963.21			31,022.37
ACETALDEHYDE	198,240.37		1,621,278.04	2,007,714.91	3,827,233.31
ACROLEIN	16,928.59		241,240.49	77,313.06	335,482.14
ACRYLONITRIL	3,356.50	8,612.94			11,969.44
ANTHRACENE	1,586.29	3,643.09	11.35	13.01	5,253.73
ANTIMONY	4,695.96				4,695.96
ARSENIC	28,012.09	74.76	10.65	1.21	28,098.71
ATRAZINE		1,226,914.35			1,226,914.35
BENZ(A)ANTHR	12,637.56	10,928.45	97.68	176.53	23,840.22
BENZ(GHI)PE	1.78	910.85	204.31	345.13	1,462.06
BENZENE	329,164.88	1,748,120.08	5,698,653.30	2,458,218.32	10,234,156.58
BENZO(A)PYRE	10,860.67	1,821.57	78.82	104.26	12,865.32
BENZO(B)FLUO	0.35	1,821.67	110.94	91.35	2,024.31
BENZO(K)FLUO	0.12	910.95	84.56	97.79	1,093.43
BERYLLIUM	2,482.41	284.61			2,767.02
BUTADIENE,13	1,648.61		1,134,901.11	426,598.56	1,563,148.29
CADMIUM	9,779.34	310.61			10,089.95
CARBON TETRA	474.49	285.03			759.52
CHLOROFORM	4,954.89	5,884.29			10,839.18
CHROMIUM	101,264.31	1,764.08	206.89	1,252.43	104,487.71
CHROMIUM VI	4,814.45				4,814.45
CHRYSENE	17,123.04	4,553.72	905.82	133.53	22,716.11
COBALT	15,857.81	14.04			15,871.84
COKE OVEN GS	430,034.00				430,034.00
COPPER	131,514.24	142.47	42,118.41	161.80	173,936.92
DIBENZAHAN	0.46	910.85	13.70	14.47	939.48
DIBROMOET,12	63.68				63.68
DIBUTYL PHTH	10,288.67	1,989.26			12,277.93
DICHLORETH12	54,880.86	1,076.29			55,957.15
DIEYLHEX PHT	13,622.41				13,622.41
DIOCTYL PHTH	1,462.00				1,462.00
ETHYLBENZENE	798,459.78	844,493.05	3,771,706.50	1,146,120.85	6,560,780.18
ETHYLENE OXI	7,549.21	88,544.60			96,093.81
FLUORANTHENE	45,448.62	5,464.55	114.70	117.14	51,145.02
FLUORENE	64.84	6,375.14			6,439.99
FORMALDEHYDE	395,659.38	24,248.20	5,085,867.35	4,383,409.77	9,889,184.70
GLYCOL ETHRS	2,272,321.90	572,013.14			2,844,335.04
HEXCHLORETH	416.00				416.00
HEXCL-13-BUT	15.00				15.00
HEXCLBENZENE	1.0000	0.5700			1.5700
INDN(123CDPY	3.42	1,821.67	17.55	14.59	1,857.23
LEAD	144,163.20	168.11	12,867.23	2,467.53	159,666.07
MANGANESE	369,028.01	7,985.29	346.93	1,315.31	378,675.55
MERCURY	10,598.55	129.55	307.47	412.45	11,448.03
METHENE(B)4-	99,302.14				99,302.14
METHYLENE CL	5,438,184.40	1,813,622.36			7,251,806.76
NAPHTHALENE	435,958.47	650,453.88	572,170.39	9,766.36	1,668,349.11
NICKEL	89,943.09	5,093.89	274.80	600.66	95,912.44
PCBS	0.12				0.12
PCDD	0.3195				0.3195
PCDF	0.9931				0.9931
PCP	4.00				4.00
PERC	254,825.62	3,626,983.79			3,881,809.41
PHENANTHRENE	1,625.55	222,662.92	65.95	48.73	224,403.15
PHENOL	1,047,469.63			4,168.59	1,051,638.21
PHOSGENE	161.00				161.00
PYRENE	22.81	4,554.19	147.90	76.08	4,800.98
STYRENE	5,228,255.23	8,375.26	868,200.10	77,027.10	6,181,857.69
TCDD,2378	0.0008				0.0008
TCDF,2378	0.4070				0.4070
TCE,111	295,912.45	8,202,716.78			8,498,629.22
TOLUENE	7,517,869.39	11,410,376.54	26,008,541.61	4,638,607.30	49,575,394.84
TOLUENE24DII	2,531.00				2,531.00

Table B-1: Indiana - Statewide Summary of Emissions (lbs./yr.) (continued)

	Point Sources	Area Sources	Mobile Sources	Nonroad Sources	Total
TRICHLORETHY	2,107,174.42	5,632,386.27			7,739,560.69
TRICLPHN,246	25.00				25.00
TRIFLURALIN	6,371.00				6,371.00
VINYL CHLOR	10,561.48	11,764.33			22,325.81
XYLENE,M	6,685.32	84,004.31	7,588,044.13		7,678,733.76
XYLENE,O	5,245.38	435,839.64	3,994,815.94	70,084.38	4,505,985.34
XYLENE,P	384.66	75,207.95		109,607.91	185,200.52
XYLENES ISO	6,765,285.56	8,683,918.53	14,731,168.50	4,283,272.84	34,463,645.44

Table B-2: Indiana Pollutant Codes

Code	Pollutant	
ACENAPHTHEN	Acenaphthene	83-32-9
ACENAPHTHYL	Acenaphthylene	208-96-8
ACETALDEHYDE	Acetaldehyde	75-07-0
ACROLEIN	Acrolein	107-02-8
ACRYLONITRIL	Acrylonitrile	107-13-1
ANTHRACENE	Anthracene	120-12-7
ANTIMONY	Antimony	7440-36-0
ARSENIC	Arsenic	7440-38-2
ATRAZINE	Atrazine	1912-24-9
BENZ(A)ANTHR	Benz(a)anthracene	56-55-3
BENZ(GHI)PE	Benzo(g,h,i)perylene	191-24-2
BENZENE	Benzene	71-43-2
BENZO(A)PYRE	Benzo(a)pyrene	50-32-8
BENZO(B)FLUO	Benzo(b)fluoranthene	205-99-2
BENZO(K)FLUO	Benzo(k)fluoranthene	207-08-9
BERYLLIUM	Beryllium	7440-41-7
BUTADIENE,13	1,3-Butadiene	106-99-0
CADMIUM	Cadmium	7440-43-9
CARBON TETRA	Carbon Tetrachloride	56-23-5
CHLOROFORM	Chloroform	67-66-3
CHROMIUM	Chromium	7440-47-3
CHROMIUM VI	Chromium VI	18540-29-9
CHRYSENE	Chrysene	218-01-9
COBALT	Cobalt	7440-48-4
COKE OVEN GS	Coke Oven gas	
COPPER	Copper	7440-50-8
DIBENZAHAN	Dibenzo(a,h)anthracene	53-70-3
DIBROMOET,12	1,2-Dibromoethane	106-93-4
DIBUTYL PHTH	Dibutyl Phthalate	84-74-2
DICHLORETH12	1,2-Dichloroethane	107-06-2
DIEYLHEX PHT	Diethylhexyl Phthalate	117-81-7
DIOCTYL PHTH	Di-n-octyl Phthalate	117-84-0
ETHYLBENZENE	Ethylbenzene	100-41-4
ETHYLENE OXI	Ethylene Oxide	75-21-8
FLUORANTHENE	Fluoranthene	206-44-0
FLUORENE	Fluorene	86-73-7
FORMALDEHYDE	Formaldehyde	50-00-0
GLYCOL ETHRS	Glycol Ethers	52286-19-8
HEXCHLORETH	Hexachloroethane	67-72-1
HEXCL-13-BUT	Hexachlorobutadiene	87-68-3
HEXCLBENZENE	Hexachlorobenzene	118-74-1
INDN(123CDPY	Indeno(1,2,3-c,d)pyrene	193-39-5
LEAD	Lead	7439-92-1
MANGANESE	Manganese	7439-96-5
MERCURY	Mercury	7439-97-6
METHENE(B)4-	Methylene(b)4-phenylisocyanate	101-68-8
METHYLENE CL	Methylene Chloride	75-09-2
NAPHTHALENE	Naphthalene	91-20-3
NICKEL	Nickel	7440-02-0
PCBS	PCBs	1336-36-3
PCDD	Polychlorinated dibenzodioxins	
PCDF	Polychlorinated dibenzofurans	
PCP	Pentachlorophenol	87-86-5
PERC	Perchloroethylene	127-18-4
PHENANTHRENE	Phenanthrene	85-01-8
PHENOL	Phenol	108-95-2
PHOSGENE	Phosgene	75-44-5
PYRENE	Pyrene	129-00-0
STYRENE	Styrene	100-42-5
TCDD,2378	2,3,7,8-Tetrachlorodibenzodioxin	1746-01-6
TCDF,2378	2,3,7,8-Tetrachlorodibenzofuran	51207-31-9
TCE,111	1,1,1-Trichloroethane	71-55-6
TOLUENE	Toluene	108-88-3
TOLUENE24DII	2,4-Toluene diisocyanate	584-84-9

Table B-2: Indiana Pollutant Codes

TRICHLORETHY	Trichloroethylene	79-01-6
TRICLPHN,246	2,4,6-Trichlorophenol	88-06-2
TRIFULURALIN	Trifluralin	1582-09-8
VINYL CHLOR	Vinyl Chloride	75-01-4
XYLENE,M	m-Xylene	108-38-3
XYLENE,O	o-Xylene	95-47-6
XYLENE,P	p-Xylene	106-42-3
XYLENE,ISO	Xylenes Isomers	1330-20-7

Appendix C: Michigan Toxic Emissions Inventory

INTRODUCTION

The State of Michigan conducted its 1997 portion of the Great Lakes Region air toxic emissions inventory by updating the calendar year 1996 data. With a 1990 population of 9,295,297, Michigan represents 10.7 percent of the total population of the Great Lakes Region.

The 1996 inventory included all point sources from the Michigan 1996 criteria pollutant Emission Inventory System (EIS) and ten area source categories. Namely, residential wood burning, architectural surface coating, dry cleaning, consumer and commercial solvent use, solvent cleaning/cleanup, graphic arts, industrial surface coating, pesticides-agricultural and non-agricultural, gasoline marketing (stage I and II), and auto body refinishing. Landfills were included in the point source inventory.

The 1997 update includes re-estimated emissions for forty-two of Michigan's eighty-three counties. Re-estimated area source emissions for architectural surface coating, auto-body refinishing, and consumer and commercial solvent use, and new area source emissions estimates for hospital sterilizers and human cremation were added. Additionally, on-road and off-road mobile source emissions have been added with the inventory update.

Michigan followed the *Air Toxic Emissions Inventory Protocol for the Great Lakes Commission* in developing its contribution to the regional inventory. The Factor Information Retrieval System (FIRE) and the Reference Tables in the Regional Air Pollutant Inventory Development System (RAPIDS) were used as a source of emission factors and constants. The RAPIDS software was used to estimate emissions.

Data Sources

The data for the point source emissions in the Michigan inventory were collected by the Michigan Department of Environmental Quality (DEQ), Air Quality Division (AQD) as part of its annual air emissions inventory process. The emission inventory report is required by the administrative rules of the Michigan Department of Environmental Quality under authority of Act 348, P.A. 1965 and by Section 182 (a) (3) (B) of the Clean Air Act. Data was collected from 2102 facilities under these reporting requirements. This data is deemed to be of high accuracy as it was quality assured and used for criteria pollutant fee billings. A shortcoming is that it contains very little reported toxic emission information.

The Michigan EIS database was used to calculate toxic emissions for the processes within each facility. When using this technique one of the first problems encountered relates to volatile organic compounds (VOC). Specifically, few SCC codes with VOC factors contain the related toxic pollutant emission factors. Therefore the toxic components for the majority

of point source criteria pollutant VOC were estimated as area source emissions. Factors from the EPA speciate tables are acceptable for area and mobile source emission calculations but they are suspect when applied to individual process information and should be used only when no other acceptable measurement is available. Speciation was not used to estimate any of the point source toxic emissions. Another concern is the lack of control efficiency information relating to the toxic emissions. There is a potential to end up with uncontrolled particulate toxic emissions larger than the total particulate material emitted from a process with emissions control equipment.

The EIS data include a process description, SIC codes to identify industry type, SCC codes to identify process type, fuel and material throughputs for each process within a facility. SCC codes from all sources were matched against available emission factors from FIRE Version 6.0. Source specific emission factors were used preferentially when available. Sources with no FIRE or source specific emission factors were assumed to be included in the area source emission calculations.

CALCULATION METHODS

Point Source Emissions

The 1996 Michigan EIS point source data was converted into a format that could be imported into the RAPIDS software. After quality checks were applied to the import files the data was loaded into RAPIDS. RAPIDS then made an emissions estimate for the 82 toxic pollutants of interest for every SCC code which had a source specific or generic toxic emission factor and a proper corresponding throughput material and amount. The calculated results were then exported to spreadsheets for analysis. It was found that toxic pollutant control factors had not been applied uniformly by the RAPIDS software. These control factor corrections were applied in the spreadsheets for point source emissions of 10,000 pounds or greater per year of toxic particulate matter, VOC, and lead emissions of 1000 pounds per year or greater. Toxic point emissions less than the above *thresholds* may be in error to the high side and therefore over-reported. Mercury emissions are reported uncontrolled.

1997 Point Source Emissions Update

The 1997 point source emissions update was to do a thorough qa/qc and correction of the 1996 estimated emissions for one half of the counties of the state. The other half of the counties will be updated in the 1998 point source emissions inventory. The counties to be qa/qc analyzed were selected alphabetically starting with A through K (42 of 83 counties) being picked for the review. The sources in those counties account for 39% of the total point sources in the state inventory. The 1996 emissions were not re-calculated, but rather, were given a process by process analysis to certify the values for accuracy. This analysis included; (1) Correct control efficiencies were applied to all toxic emissions. (2) Questionable SCC code/toxic pollutant assignments were refereed against the more recently released FIRE 6.22 database. (3) Unsubstantiated emissions resulting from calculations for “Other Not Classified” SCC code-process descriptions were deleted. (4) Emissions from obviously

incorrect emission factors were deleted. (5) Calculation protocols were challenged for any, suspected out of range, emissions estimates. The list of corrected SCC codes includes:

1-02-004-01 – all toxic metals except Copper were deleted, not in FIRE 6.22.

2-02-002-02 – all toxic emissions except Mercury were deleted, not in FIRE 6.22.

2-02-002-52 – Formaldehyde was recalculated, bad emission factor.

3-01-999-99 – deleted all toxic emissions, unsubstantiated.

3-04-999-99 – deleted Mercury emissions, unsubstantiated.

3-05-002-01 – deleted Lead emissions, bad emission factor.

3-99-999-94 – deleted Mercury emissions, unsubstantiated.

Area Source Emissions

Residential Wood Burning

Michigan followed the methodology in the Regional Protocol using state energy data reports. However, to convert wood use from cords to tons, Michigan used the method proposed in the Emission Inventory Improvement Program (EIIP) guidance.

Architectural Surface Coating

This category was estimated consistent with the Regional Protocol.

Dry Cleaning

Michigan followed the Regional Protocol recommended EIIP guidance, alternative method two. Employment data for dry cleaning was only available for 13 counties. An emission factor was derived from the average per capita emissions of those 13 counties. This Michigan specific per capita emission factor was then applied to the remaining 70 counties.

Consumer and Commercial Solvent Use

Michigan used the preferred method from the EIIP guidance.

Solvent Cleaning/Cleanup

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

In accordance with the Regional Protocol, Michigan used alternative method one of the EIIP guidance.

Pesticides – Agricultural and Non-agricultural

The Regional Protocol was followed. State specific emission factors for ATRAZINE and TRIFLURALIN were obtained from Michigan State University.

Gasoline Marketing (Stage I and II)

The Regional Protocol recommendation to utilize the EIIP guidance was followed. All gasoline marketing (stage I and stage II) emissions are included in this inventory except for emissions from vehicle refueling, which were not estimated.

Auto Body Refinishing

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 a point source in Michigan's inventory.

Traffic Markings

Michigan will follow the Regional Protocol. This utilizes the EIIP recommendations. Michigan will use alternate method one. Michigan is waiting for MSDS data. Traffic marking emissions will be added to the inventory when available.

1997 Update Area Source Emissions

Architectural Surface Coating

This category was estimated consistent with the Regional Protocol.

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.

Consumer and Commercial Solvent Use

Michigan used the preferred method from the EIIP guidance.

1997 Update New Area Source Categories

Hospital Sterilizers

Michigan followed the methodology in the Regional Protocol. The first method, assuming the operation of each hospital sterilizer at given conditions, was used.

Human Cremation

Michigan followed the recommendations of the Regional Protocol. The human cremations per county for 1997 were obtained from the Michigan Department of Community Health. Emission factors from the NTI were then applied.

1997 Update Mobile Source Emissions

Michigan was unable to estimate mobile source emissions for the 1996 Inventory. These emissions have been completed. The mobile source emissions for the year 1996 are included with the emissions reported in this 1997 Update.

On-Road Mobile Emissions

On-road mobile source air toxic emissions were speciated from on-road mobile source emissions estimates for EXHC-exhaust hc, EVHC-evaporative hc, EXPM-exhaust PM10, BW10-brake wear PM10, and TW10-tire wear PM10, supplied by the EPA Final 1996 NET Ver. 3, emissions inventory for Michigan posted on the EPA ftp server in January, 2000. The latest draft version of the EPA mobile source model was used by EPA to develop the emission factors used for the above emissions estimates. RAPIDS import files were generated containing the on-road mobile source estimates and were imported into RAPIDS. The toxic emissions were then calculated using the RAPIDS on-road toxic speciation profiles. The final estimated toxic emissions were then submitted to the Rapids QA/QC committee for quality assurance.

Off-Road Mobile Emissions

The off-road mobile source air toxic emissions were estimated using the off-road mobile source emissions for TOG, and PM10 generated for each off-road process using the June, 2000 draft EPA off-road emission inventory model.

RVP and temperature values for the annual emissions runs were added. The maximum and minimum temperature values selected were consistent with the values used for the Southeast Michigan Council of Governments' (SEMCOG) ozone season and winter inventories. An annual average temperature was also added. 1996 annual average temperatures were developed for the Southern Lower Peninsula, Northern Lower Peninsula, and Upper Peninsula, based on temperature data provided by the Modeling & Meteorology Unit of the Michigan Department of Environmental Quality (DEQ), Air Quality Division (AQD).

Michigan has different Reid Vapor Pressure (RVP) values for summer (May through September) and winter (October through April). While monthly runs could accurately show the RVP values at each time of year, 12 monthly runs per county would require about 1000 modeling runs. Therefore annual runs were chosen, and an average RVP for each county was created.

Aircraft

1996 aircraft emission estimates for TOG were calculated by using the EPA, FAA, Aircraft Engine Emission Database (FAAED) and Michigan airport LTO's. The LTO's for commercial, public and, private airports were obtained from the Michigan Department of Transportation (MDOT) Bureau of Aeronautics.

RAPIDS import files were generated containing the off-road and aircraft, mobile source emissions and were imported into RAPIDS. The toxic emissions were then calculated using the RAPIDS off-road and aircraft toxic speciation profiles. The final speciated toxic emissions were then submitted to the RAPIDS QA/QC committee for quality assurance.

RESULTS

The toxic emissions for Michigan are listed in the table following R*eferences.* The values are expressed in total pounds per year of pollutant by inventory type. As indicated in the text, point source emissions were calculated at the source level, but, have been aggregated to and are only reported at the state level. Point source emissions at the site level were not certified by the sources. An electronic database of toxic emissions, for the state of Michigan, is available at the county level upon request. For additional information, contact the Michigan Department of Environmental Quality, Air Quality Division, Emissions Reporting and Assessment Unit, Hollister Building, Fourth Floor, P.O. Box 30260, Lansing, Michigan, 48909, (517)-373-7023.

Michigan was only able to estimate emissions for 64 of the 82 toxic air pollutants of concern. This was due to lack of emission factors, throughput data, production or handling data, related products no longer manufactured, products no longer used, or a lack of resources. For example Michigan was not able to produce area source emissions for *Traffic Markings* as we are still trying to obtain MSDS data from the paint supplier. *References* and a toxic emissions summary table follow.

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CONTACT

For more information on Michigan's air toxics inventory, please contact:

Mr. Gary Baker
Michigan Department of Environmental Quality
Air Quality Division
Hollister Building, 4th Floor
P.O. Box 30270
106 W. Allegan
Lansing, MI 48909

(P) 517.373.7058
(F) 517.919.1265
(E) gbaker@great-lakes.net

Table C-1: Michigan - Statewide Summary of Emissions (lbs./yr.)

	Point Sources	Area Sources	Mobile Sources	Nonroad Sources	Total
ACENAPHTHEN	14.64	7,148.51			7,163.15
ACENAPHTHYL	164.23	80,995.00			81,159.23
ACETALDEHYDE	11,271.51		1,883,479.58	680,241.99	2,574,993.09
ACROLEIN	14.90		275,083.41	182.85	275,281.16
ACRYLONITRIL	2,279.88				2,279.88
ANTHRACENE	141.89	9,530.80		0.00	9,672.70
ANTIMONY	246.65				246.65
ARSENIC	3,738.65	0.64	14.29		3,753.58
ATRAZINE		1,858,748.76			1,858,748.76
BENZ(A)ANTHR	932.72	28,592.41		0.01	29,525.14
BENZ(GHI)PE	2.88	2,382.69		0.01	2,385.58
BENZENE	247,264.72	3,610,953.79	12,681,043.35	575,865.87	17,115,127.74
BENZO(A)PYRE	8,223.70	4,765.40		0.01	12,989.10
BENZO(B)FLUO	0.18	4,765.40		0.00	4,765.58
BENZO(K)FLUO		2,382.69		0.00	2,382.69
BERYLLIUM	289.86	0.03			289.89
BUTADIENE,13	0.17		1,639,157.93	185.14	1,639,343.23
CADMIUM	7,239.28	55.06			7,294.34
CARBON TETRA	1.50	0.00			1.50
CHLOROFORM	3.50	9,691.95			9,695.45
CHROMIUM	8,181.19	1.79	288.87		8,471.86
CHROMIUM VI	34.11				34.11
CHRYSENE	711.46	11,916.00		0.00	12,627.46
COBALT	385.11				385.11
COKE OVEN GS	343,173.85				343,173.85
COPPER	5,149.66		58,784.97		63,934.63
DIBENZAHAN	0.08	2,382.69		0.00	2,382.77
DIBROMOET,12	0.21	306.49			306.71
DIBUTYL PHTH	14.70	232,429.70			232,444.40
DICHLORETH12	16.93	3,200.23			3,217.16
DIEYLHEX PHT	293.76				293.76
DIOCTYL PHTH	74.46				74.46
ETHYLBENZENE	10,911.38	951,538.28	5,388,275.29	220,417.91	6,571,142.86
ETHYLENE OXI	27,767.50	147,762.08			175,529.58
FLUORANTHENE	403.32	14,296.20		0.02	14,699.54
FLUORENE	36.03	16,678.93			16,714.96
FORMALDEHYDE	656,478.04	12,399.50	4,877,195.28	2,012,972.53	7,559,045.36
GLYCOL ETHRS		395,944.68			395,944.68
INDN(123CDPY	1.37	4,765.40		0.00	4,766.77
LEAD	63,811.57		14,200.74		78,012.30
MANGANESE	54,540.57	262.11	523.97		55,326.65
MERCURY	16,545.02	69.84	261.51		16,876.37
METHYLENE CL	506,507.16	2,839,828.09			3,346,335.25
NAPHTHALENE	12,505.15	980,440.02	804,617.64	9.55	1,797,572.36
NICKEL	8,976.60	3.40	359.56		9,339.55
PCBS	2.86				2.86
PCDD	0.8531				0.8531
PCDF	0.7427				0.7427
PERC	492,030.29	10,286,237.70			10,778,267.99
PHENANTHRENE	314.20	582,570.73		0.07	582,885.00
PHENOL	7,256.14			26.53	7,282.67
PYRENE	62.57	11,913.48		0.02	11,976.07
STYRENE	172,141.08		2,972,171.21	38.18	3,144,350.47
TCDD,2378	0.0025				0.0025
TCDF,2378	97.1618				97.1618
TCE,111	170,915.89	13,115,379.71			13,286,295.60
TOLUENE	8,036,082.97	22,609,843.36	37,019,594.57	980,422.65	68,645,943.54
TRICHLORETHY	1,608,830.54	8,829,438.90			10,438,269.44
TRIFLURALIN		35,374.21			35,374.21
VINYL CHLOR	574,542.14				574,542.14
XYLENE,M	38.73	96,238.86	10,609,339.06	611,789.13	11,317,405.78
XYLENE,O	49.94	1,397,511.18	5,748,407.29	299,337.25	7,445,305.66
XYLENE,P	3.59	96,238.86			96,242.45
XYLENES ISO	2,134,060.24	9,563,473.58	20,917,805.74	152.64	32,615,492.20

Table C-2: Michigan Pollutant Codes

Code	Pollutant	CAS Number
ACENAPHTHEN	Acenaphthene	83-32-9
ACENAPHTHYL	Acenaphthylene	208-96-8
ACETALDEHYDE	Acetaldehyde	75-07-0
ACROLEIN	Acrolein	107-02-8
ACRYLONITRIL	Acrylonitrile	107-13-1
ANTHRACENE	Anthracene	120-12-7
ANTIMONY	Antimony	7440-36-0
ARSENIC	Arsenic	7440-38-2
ATRAZINE	Atrazine	1912-24-9
BENZ(A)ANTHR	Benz(a)anthracene	56-55-3
BENZ(GHI)PE	Benzo(g,h,i)perylene	191-24-2
BENZENE	Benzene	71-43-2
BENZO(A)PYRE	Benzo(a)pyrene	50-32-8
BENZO(B)FLUO	Benzo(b)fluoranthene	205-99-2
BENZO(K)FLUO	Benzo(k)fluoranthene	207-08-9
BERYLLIUM	Beryllium	7440-41-7
BUTADIENE,13	1,3-Butadiene	106-99-0
CADMIUM	Cadmium	7440-43-9
CARBON TETRA	Carbon Tetrachloride	56-23-5
CHLOROFORM	Chloroform	67-66-3
CHROMIUM	Chromium	7440-47-3
CHROMIUM VI	Chromium VI	18540-29-9
CHRYSENE	Chrysene	218-01-9
COBALT	Cobalt	7440-48-4
COKE OVEN GS	Coke Oven gas	
COPPER	Copper	7440-50-8
DIBENZAHAN	Dibenzo(a,h)anthracene	53-70-3
DIBROMOET,12	1,2-Dibromoethane	106-93-4
DIBUTYL PHTH	Dibutyl Phthalate	84-74-2
DICHLORETH12	1,2-Dichloroethane	107-06-2
DIEYLHEX PHT	Diethylhexyl Phthalate	117-81-7
DIOCTYL PHTH	Di-n-octyl Phthalate	117-84-0
ETHYLBENZENE	Ethylbenzene	100-41-4
ETHYLENE OXI	Ethylene Oxide	75-21-8
FLUORANTHENE	Fluoranthene	206-44-0
FLUORENE	Fluorene	86-73-7
FORMALDEHYDE	Formaldehyde	50-00-0
GLYCOL ETHRS	Glycol Ethers	52286-19-8
INDN(123CDPY	Indeno(1,2,3-c,d)pyrene	193-39-5
LEAD	Lead	7439-92-1
MANGANESE	Manganese	7439-96-5
MERCURY	Mercury	7439-97-6
METHYLENE CL	Methylene Chloride	75-09-2
NAPHTHALENE	Naphthalene	91-20-3
NICKEL	Nickel	7440-02-0
PCBS	PCBs	1336-36-3
PCDD	Polychlorinated dibenzodioxins	
PCDF	Polychlorinated dibenzofurans	
PCP	Pentachlorophenol	87-86-5
PERC	Perchloroethylene	127-18-4
PHENANTHRENE	Phenanthrene	85-01-8
PHENOL	Phenol	108-95-2
PYRENE	Pyrene	129-00-0
STYRENE	Styrene	100-42-5
TCDD,2378	2,3,7,8-Tetrachlorodibenzodioxin	1746-01-6
TCDF,2378	2,3,7,8-Tetrachlorodibenzofuran	51207-31-9
TCE,111	1,1,1-Trichloroethane	71-55-6
TOLUENE	Toluene	108-88-3
TRICHLORETHY	Trichloroethylene	79-01-6
TRICLPHN,246	2,4,6-Trichlorophenol	88-06-2
TRIFULURALIN	Trifluralin	1582-09-8
VINYL CHLOR	Vinyl Chloride	75-01-4
XYLENE,M	m-Xylene	108-38-3
XYLENE,O	o-Xylene	95-47-6
XYLENE,P	p-Xylene	106-42-3
XYLENE,ISO	Xylenes Isomers	1330-20-7

Appendix D: Minnesota Toxic Emissions Inventory

INTRODUCTION

Generally, the development of the Minnesota portion of the regional air toxics emission inventory follows the instructions illustrated in the protocol document and uses the Regional Air Pollution Inventory Development System (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, 1018 point sources were estimated to have emissions for one or more pollutants listed in the 1997 Great Lakes regional air toxics emission inventory. Also, various area sources were examined and emissions were estimated for 19 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 1997 Minnesota portion of the air toxic emission inventory includes three principal source categories: point, area, and mobile sources. The following sections give separate discussions on emission data acquisition for each source category.

Point Source Emissions

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 2787 point sources in Minnesota in calendar year 1997.

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 were converted to RAPIDS format and imported to RAPIDS.

Area Source Emissions

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 19 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, Hospital Sterilizers, Human Cremation, Industrial Surface Coating, Marine Vessel Loading, Municipal Solid Waste Landfills, Public-Owned Treatment Works, Residential Fuel Combustion, Residential Wood Burning, Solvent Cleaners, Structure Fires, and Traffic Marking. Table D - 1 lists all these categories along with activity data and information sources.

Mobile Source Emissions

Mobile sources are non-stationary sources including four subcategories: on-road sources, non-road sources, aircraft, and locomotives. Although an emission factor method is preferred to estimate air toxics emissions, the information was only available for some air toxics emitted from on-road sources. In most cases, the air toxics emissions were estimated by using a speciation method which speciates total organic gases (TOG), particulate matter (PM), and/or particulate matter smaller than 10 microns (PM10) to individual air toxics. The TOG, PM, and/or PM10 emission factors were obtained from respective information sources for the four mobile source subcategories. The emission factors and speciation profiles for air toxics were directly from the 1996 National Toxics Inventory (NTI) with a supplement of speciation factors from EPA SPECIATE 1.5 for the pollutants not included in the NTI[8]. The detailed data collection and emission estimation for each subcategory is discussed in the Emission Estimation Section.

Emission Estimation

Point Sources

RAPIDS was used to compile Minnesota's air toxics inventory for point sources. The approach was to first separately identify each device/process at each facility, and then estimate emissions for each device/process that was identified. The following describes the available emission estimation methods and their prioritization for use in the emission inventory.

1. Direct reporting values

   Because Minnesota does not have a rule to mandate point sources to report air toxics emissions, in May 1999, MPCA sent a letter to the top 182 emitters based on the sum of PM and VOC emissions to request that they voluntarily provide emission information. Some facilities responded, including refineries and other manufacturing facilities. This reported information was examined and appropriate emissions were used.

   Also, lead (Pb) emissions were available in the emission inventory for criteria pollutants and reviewed by facilities. These values were adapted to the air toxics emission inventory in order to maintain the consistency in these two MPCA inventories.

2. Emission factors

   An emission factor is defined as "a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant."[1] Emission factors can be either source-specific or generic. In the current version of RAPIDS, the emission factors from the EPA Factor Information Retrieval (FIRE) Data System, version 6.22, are used as generic emission factors.[2] In most cases, these emission factors are derived from actual measurements of the emissions from representative sources/processes, and are assumed to be the long-term averages for all facilities in the source category. The source-specific emission factors are derived from source-specific emission testing, mass balance, or chemical analysis. Therefore, they are preferred for estimating emissions from a source. Some source-specific emission factors were developed based on the information in facility permit applications.

   The MPCA has focused on developing source-specific emission factors. Some source-specific emission factors were developed based on the information in facility permit applications and stack testing reports. Metal Mining/Iron Ores Process and Electric Services/Coal Burning facilities were selected for this special effort. These two industrial sectors are not covered by the TRI report but contributed almost 50% of PM emissions from point sources in 1997. A detailed discussion on the development of emission factors and the emission inventory for these two industrial sectors was presented in two papers.[3,4]

   In addition, we also developed source-specific emission factors for municipal solid waste incinerators, chromium electroplating facilities, some paper mills, and some facilities manufacturing wood products.

   We have noticed that a number of measurements from stack tests or chemical analyses are lower than detection limits. In these situations, the detection limits were used in place of the measurements.

3. TRI data

   The TRI report is prepared by the Minnesota Department of Public Safety for manufacturing point sources with certain reporting thresholds. The emission data are facility-based and of unknown accuracy. For many facilities reporting to the TRI, the emission estimates appear to be incomplete in terms of the number of pollutants included. However, when the source-specific or generic emission factors were not available, TRI emissions were used for some facilities.

Area Source Emissions

For area sources, the activity data were pre-treated to a county-level by using spreadsheets. Also, source-specific emission factors and speciation profiles were developed for each area source category. Then, the county-level activity data were imported to RAPIDS and emission estimates were calculated by using the emission factor method and speciation method. In the speciation method, emissions of particulate matter (PM) or total organic gases (TOG) were speciated to individual air toxic compounds using speciation profiles.

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 6.22 and SPECIATE version 3.0 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] These emission factors and speciation profiles were compiled from a review of available literature. EPA publications or studies, such as Emission Inventory Improvement Program (EIIP) documents, were given first preference.[6] Information from the California Air Resource Board and other resources were also incorporated. If information was not available for a source category, emission factors for similar processes or sources were used as surrogates such as the use of emission factors for commercial/institution combustion to estimate emissions from residential fuel combustion.

The resulting approaches and methodologies have been documented in the emission estimation protocols for Minnesota area sources.[7]

Mobile Source Emissions

On-Road Mobile sources

U.S. EPA's Mobile5b[9] and Part5[10] models produced total organic gases (TOG) and particulate matter (PM10) emission factors for 87 counties in Minnesota. The TOG factors included exhaust (tailpipe) and engine evaporative factors. Refueling losses from vehicles were covered in a separate area source category. Exhaust PM10 emission factors were obtained along with PM10 factors for brake and tire wear.

The on-road fleet in each county was broken down into eight vehicle types:

Light Duty Gasoline Vehicles (LDGV)

Light Duty Gasoline Trucks; gross vehicle weight rating 0-6000 lbs. (LDGT1)

Light Duty Gasoline Trucks; gross vehicle weight rating 6001-8500 lbs. (LDGT2)

Heavy Duty Gasoline Vehicles (HDGV)

Light Duty Diesel Vehicles (LDDV)

Light Duty Diesel Trucks (LDDT)

Heavy Duty Diesel Vehicles (HDDV)

Motorcycles (MC)

Each of the emission factors were combined with the appropriate activity factor, vehicle miles traveled (VMT), to obtain TOG and PM10 emissions.

Mobile5b Emission Factors for TOG. U.S. EPA's Mobile5b model uses many factors to create TOG emission factors for on-road vehicles, including ambient temperature, gasoline type, and inspection/maintenance program effects. To account for some of these factors, the MPCA calculated TOG emission factors for four different areas of the state:

1. Twin Cities Metropolitan Area: Anoka, Carver, Dakota, Hennepin, Ramsey, Scott and Washington counties. Some vehicles in the metro area were required to participate in an inspection/maintenance (I/M) program in 1997.
2. Northeast Minnesota
3. Northwest Minnesota
4. Central Minnesota

The latter three areas did not have an I/M program, but TOG emission factors were calculated separately to account for variations in ambient temperature. In addition, separate emission factors were calculated for each season to account for seasonal temperature changes on emissions.

MPCA calculated TOG emission factors for seven speed classes that represent 12 roadway functional classes. The factors were specific to vehicle type, season, geographic area, and roadway type. The emission factors were combined with county and functional class-specific VMT activity data to obtain TOG estimates for all 87 counties in Minnesota.

PART5 Emission Factors for PM10. U.S. EPA's Part5 model produces VMT-based PM10 emission factors but with fewer inputs than the Mobile5b model for TOG. For example, PM10 emissions are not as sensitive to temperature as TOG. MPCA calculated PM10, brake wear, and tire wear emission factors for each county in Minnesota.

Vehicle Miles Traveled Activity Data. The Minnesota Department of Transportation (Mn/DOT) provided VMT data from its Traffic Information System. Mn/DOT provided the VMT data broken down by functional class for each county in Minnesota. MPCA estimated VMT for each vehicle type using the Mobile5b model's default fleet breakdown.

The Minnesota Department of Transportation (Mn/DOT) provided VMT data from its Traffic Information System. Mn/DOT provided the VMT data broken down by functional class for each county in Minnesota. MPCA estimated VMT for each vehicle type using the Mobile5b model's default fleet breakdown.

Toxics Emission Estimation. MPCA used RAPIDS to speciate toxic air pollutants from TOG and PM10 emissions. To improve accuracy, TOG emissions were separated into exhaust emissions (EXHC) and evaporative emissions (EVHC). As previously stated, the evaporative emissions did not include evaporative emissions from refueling. Similarly, PM10 emissions were broken down into exhaust particulate (EXPM), brake wear (BW10), and tire wear (TW10) emissions.

For some pollutants and vehicle types, VMT-based emission factors for air toxics were available. For example, benzene, 1,3-butadiene, formaldehyde, and acetaldyhyde emissions were calculated using emission factors rather than TOG speciation for all vehicle types. Chromium, manganese, and nickel emission factors were also available, but only for three vehicle types: LDGV, LDGT1, and LDGT2. Toxics emissions were speciated for other vehicle types.

Non-Road Mobile Sources

MPCA estimated air toxics emissions from off road sources using EPA's NONROAD model. The NONROAD model used EPA's default equipment population data and emission factors to calculate EXHC, EVHC, and PM10 emissions. The model provided emission estimates at a county level by equipment AMS code. Air toxics emissions were then speciated from those emission estimates using the RAPIDS emission estimator. "Equipment population" refers to the quantity of equipment in operation in a certain county. Snowmobiles, lawn mowers, and construction equipment are examples of specific types of equipment.

There was one exception to the methodology. MPCA calculated emissions from aircraft auxiliary power units using specific information. State specific information of aircraft APU operations from 1990 was used to estimate 1997 operations using aircraft LTOs as a growth factor. Hydrocarbon (HC) and PM10 emission factors based on the amount of fuel used were used. HC emissions were converted to TOG using appropriate conversion factors. Air toxics were speciated from those emissions.

Aircraft

MPCA estimated air toxics emissions from three types of aircraft: commercial, air taxis, and general aviation. Insufficient information was available to estimate emissions for military aircraft. TOG emissions were estimated using emission factors based on default

time-in-mode (TIM) and state-specific landing and takeoff operations (LTO) data. The U.S. Department of Transportation provided detailed LTO information[11]. Air toxics emissions were speciated from the TOG emissions.

Locomotives

Locomotive emissions were calculated using fuel use-based emission factors for volatile organic compounds (VOC) and PM10[12]. Individual railway companies with operations in Minnesota provided information on fuel use for their line and yard haul operations. Fuel use was apportioned to the counties in which the railways operated. The VOC and PM10 emissions were speciated to obtain air toxics emissions from locomotives.

QUALITY ASSURANCE AND QUALITY CONTROL

To develop a reasonable and comprehensive air toxic emission inventory, procedures have been developed to provide quality assurance/quality control (QA/QC) of the data throughout the entire process of the emission inventory development. Quality assurance is a planned set of external activities that are conducted by personnel not directly involved in the development of the inventory to evaluate data quality. On the other hand, quality control is a planned set of internal activities conducted by inventory development personnel to ensure data accuracy and completeness.

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 their emissions are included with the point source emissions.

For mobile sources, the 1997 activity data were compared with 1996 data to make sure the changes reasonable.

Emission Factors

There are many multiple generic emission factors found in FIRE 6.22. To select the appropriate emission factors, each state reviewed a section of FIRE 6.22. 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.

For area and mobile sources, the 1996 National Toxics Inventory documents were reviewed. The appropriate methodologies and emission factors were used in the 1997 emission inventory.

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 re-calculated. 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. For mobile sources, emission estimates were compared with the 1996 NTI data. Efforts were made to find the cause of the differences. Necessary corrections were taken accordingly.

Quality Assurance

The QA plan included the following activities:

- 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 66 out of the 82 air toxics. Point sources emit 62 pollutants, area source also emit 62 pollutants while mobile sources emit 31 pollutants. The summary table (Table D-2) shows the name and the emissions of these 66 pollutants totaled by principal source category.

It was estimated that 1018 out of 2787 point sources emitted one or more pollutants listed in the summary table. Point source emissions are from 214 distinct standard industrial classification (SIC) codes and 219 distinct source classification codes (SCC). Emissions from area sources were calculated for the 19 categories mentioned in the previous section and 32 distinct SCCs. Emissions of mobile sources were from four subcategories and 262 SCCs.

Table D-2 lumps emissions from non-road sources, aircraft, and locomotives to a nonroad category to distinguish emissions from onroad vehicles.

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 incorrect 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 834 facilities in this source category in 1997. Although some facilities were reported to the TRI, most of these small point sources had to be treated as area sources. Since chemical species used vary from one facility to the other, the best solution is to collect material usage and composition data from these facilities. There is a plan for the future.

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.

Detection Limits

A number of source-specific emission factors as well as generic emission factors were developed by using detection limits when the measurements were lower than detection limits. This approach provides conservative results but tends over-estimating emissions. A discussion between MPCA staff and the Minnesota Chamber of Commerce is going to obtain a consensus on more representative values in the near future.

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INFORMATION

For more information about Minnesota's air toxics inventory, please contact:

Ms. Chun Yi Wu
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155

(P) 651-282-5855
(F) 651-297-7709
(E) chun.yi.wu@pca.state.mn.us

Mr. Christopher Nelson
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155

(P) 651-296-7750
(F) 651-297-7709
(E) christopher.nelson@pca.state.mn.us

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

Source Categories	Sub-Source Category	Emission Estimation Method	Activity Data Information Source
Agricultural Pesticide Application		Use vapor pressure of the active ingredients to determine per acre emission factors. Consider pesticide application and formulation type.	MD of Agricultural U.S. Department of Agricultural
Architectural Surface Coatings		Apply speciation profiles to VOC. VOC emissions are obtained from population-based estimation method	Census data
Auto Body Refinishing		Use per capita emission factor for VOC and apply speciation profiles to VOC emissions.	Census data
Chromium Electroplating		Use both source-specific and generic emission factors. Activity data are source-specific.	NESHAP submittals Phone survey Stack testing reports
Consumer and Commercial Solvent Use		Use national per capita emission factors	Census data
Dry Cleaning	Coin-Op	Survey	No facilities in Minnesota
	Commercial	Use emission factor based on solvent usage and machine type.	NESHAP submittals and survey letters
	Industrial	Use emission factor based on solvent usage and machine type.	NESHAP submittals and survey letters
Gasoline Marketing	Gasoline Trucks in Transit	Use EPA emission factor for VOC. County activity data are allocated from state fuel consumption based on population. Apply speciation profiles to VOC emissions for air toxics.	MD of Revenue
	Stage I (Delivery to Outlets and Storage Tank Breathing)	Use EPA emission factor for VOC and some air toxics. County activity data are allocated from state fuel consumption based on population. Applied speciation profiles to VOC emissions for air toxics without emission factors.	MD of Revenue
	Stage II (Refueling)	Use EPA emission factor for VOC and some air toxics. County activity data are allocated from state fuel consumption based on population. Applied speciation profiles to VOC emissions for air toxics without emission factors.	MD of Revenue
Graphic Arts		Apply speciation profiles to VOC. VOC emissions are obtained from population-based estimation method.	Census data
Hospital Sterilizers		Use the 1996 EPA NTI emission factors based on the number of beds in a hospital.	American Hospital Association
Human Cremation		Emission factors from the EPA 1996 NTI based on tons cremated. Assume 150 LB per body.	MD of Health

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 consumption. Treat big facilities based on actual processes. Assume a typical plant then use emission factors for small facilities.	MPCA Water Quality Division, WWTIR
Residential Fuel Combustion		Use population-based fuel consumption and both state -specific and generic emission factors.	MD of Public Service, MN energy data book Census data
Residential Wood Combustion		Use population-based fuel consumption and emission factors.	MD of Public Service, MN energy data book Census data
Solvent Cleaning	Cold and Vapor /In-Line Cleaning Equipment: Non-halogenated Solvents	Use employee-based emission factors for VOC and apply sepciation profiles to VOC emissions.	Census data
	Halogenated Solvent Cleaning Equipment	Use emission factors and facility-specific data on type of degreasing and solvent consumption.	NESHAP submittals Phone Survey
	Solvent Used for Cleanup: Non-halogenated Solvents	Use employee-based emission factors for VOC and apply sepciation profiles to VOC emissions.	Census data
Structure Fires		Use emission factors recommended by the EIIP document based on tons of material burned. Assume the average total material burned in each fire is 1.15 ton.	MD of Public Safety
Traffic Markings		Use line-mile factor for pain usage. Apply Minnesota specific information from the MSDS for estimating VOC and air toxics.	MD of Transportation

DC = Department of Climatology, University of Minnesota. It provided heating degree days for adjusting the wood consumption.
DNR = Minnesota Department of Natural Resources
MD = Minnesota Department
NESHAP = National Emission Standards for Hazardous Air Pollutants
WWTIR = Wastewater Treatment Facilities Inventory Report

Table D-2: Minnesota - Statewide Summary of Emissions (lbs./yr.)

	Point Sources	Area Sources	Mobile Sources	Nonroad Sources	Total
ACENAPHTHEN	16.81	14,466.35			14,483.16
ACENAPHTHYL	133.10	289,658.61			289,791.71
ACETALDEHYDE	201,261.56	637.35	1,739,657.83	1,997,499.01	3,939,055.76
ACROLEIN	92,851.74	0.93	155,690.17	91,506.14	340,048.98
ACRYLONITRIL		8,129.83			8,129.83
ANTHRACENE	51.91	19,819.82	8.06	19.38	19,899.16
ANTIMONY	2,585.90	680.98			3,266.89
ARSENIC	21,483.92	109.80	3.59	0.40	21,597.71
ATRAZINE		497,070.00			497,070.00
BENZ(A)ANTHR	18.57	27,768.65	82.65	263.72	28,133.59
BENZ(GHI)PE	0.56	7,103.72	181.17	517.25	7,802.70
BENZENE	161,328.75	3,486,251.76	8,620,467.98	3,346,669.96	15,614,718.44
BENZO(A)PYRE	2,663.90	6,005.69	68.66	155.51	8,893.76
BENZO(B)FLUO	14.54	8,525.28	95.86	134.79	8,770.47
BENZO(K)FLUO	1.61	2,836.58	72.10	144.76	3,055.05
BERYLLIUM	491.11	47.21			538.32
BUTADIENE,13	15,423.08		938,567.14	430,061.53	1,384,051.76
CADMIUM	1,370.28	282.07			1,652.35
CARBON TETRA	1,622.24	8,181.82			9,804.07
CHLOROFORM	43,622.25	14,944.54			58,566.79
CHROMIUM	21,698.85	363.63	554.72	1,168.51	23,785.70
CHROMIUM VI	1,017.42	91.42			1,108.84
CHRYSENE	9.95	17,284.29	805.24	198.70	18,298.18
COBALT	1,601.91	795.96			2,397.87
COPPER	22,330.00	744.44	34,014.76		57,089.20
DIBENZAHAN	0.45	5,772.34	11.70	23.50	5,808.00
DIBROMOET,12	19.28	884.43			903.71
DIBUTYL PHTH	669.27	1,137.86			1,807.14
DICHLORETH12	669.85	1,357.03			2,026.88
DIEYLHEX PHT	1,712.72				1,712.72
DIOCTYL PHTH	15,003.72	0.23			15,003.95
ETHYLBENZENE	237,367.20	495,460.13	2,539,847.89	1,972,524.01	5,245,199.23
ETHYLENE OXI	147.40	102,450.49			102,597.89
FLUORANTHENE	48.62	27,930.21	88.14	176.04	28,243.00
FLUORENE	41.96	33,867.63			33,909.60
FORMALDEHYDE	820,812.23	30,045.77	3,726,513.42	4,200,313.26	8,777,684.68
GLYCOL ETHRS	827,182.00	1,570,329.99			2,397,511.99
HEXCLBENZENE		0.1326			0.1326
INDN(123CDPY	0.46	28,658.71	15.17	23.79	28,698.13
LEAD	156,171.70	253.68	6,599.25		163,024.64
MANGANESE	232,703.87	425.38	232.67	1,291.43	234,653.36
MERCURY	2,980.26	130.19	115.70	318.02	3,544.17
METHENE(B)4-	283.00				283.00
METHYLENE CL	337,604.33	583,045.53			920,649.86
NAPHTHALENE	34,663.94	1,028,058.93	374,371.22	711.16	1,437,805.25
NICKEL	31,976.15	447.55	433.35	598.27	33,455.32
PCBS	0.98	0.09			1.07
PCDD	0.0390	3.8692			3.9082
PCDF	0.0643	21.3585			21.4227
PERC	146,299.14	639,291.09			785,590.23
PHENANTHRENE	196.49	130,993.50	45.69	82.04	131,317.73
PHENOL	147,547.96	1,426.24		6,655.24	155,629.44
PYRENE	12.88	33,234.45	108.14	114.06	33,469.54
STYRENE	2,996,628.67	989.29	1,558,139.36	118,095.21	4,673,852.53
TCDD,2378	0.0021	0.0100			0.0121
TCDF,2378	0.0061	0.5939			0.6000
TCE,111	99,521.38	1,830,033.96			1,929,555.34
TOLUENE	2,540,891.81	13,652,951.47	17,354,780.44	8,023,807.27	41,572,430.99
TOLUENE24DII	1.00				1.00
TRICHLORETHY	482,621.32	83,674.17			566,295.50
TRIFLURALIN		51,056.93			51,056.93
VINYL CHLOR	287.55	14,535.75			14,823.30
XYLENE,M	387.97	132,656.86	4,920,876.31		5,053,921.14
XYLENE,O	125,920.63	393,492.47	2,707,432.34	5,307.50	3,232,152.94
XYLENE,P	0.05	48,901.28			48,901.33
XYLENES ISO	2,153,557.13	8,488,881.77	9,810,670.26	8,136,899.36	28,590,008.52

Table D-3: Minnesota Pollutant Codes

Code	Pollutant	CAS Number
ACENAPHTHEN	Acenaphthene	83-32-9
ACENAPHTHYL	Acenaphthylene	208-96-8
ACETALDEHYDE	Acetaldehyde	75-07-0
ACROLEIN	Acrolein	107-02-8
ACRYLONITRIL	Acrylonitrile	107-13-1
ANTHRACENE	Anthracene	120-12-7
ANTIMONY	Antimony	7440-36-0
ARSENIC	Arsenic	7440-38-2
ATRAZINE	Atrazine	1912-24-9
BENZ(A)ANTHR	Benz(a)anthracene	56-55-3
BENZ(GHI)PE	Benzo(g,h,i)perylene	191-24-2
BENZENE	Benzene	71-43-2
BENZO(A)PYRE	Benzo(a)pyrene	50-32-8
BENZO(B)FLUO	Benzo(b)fluoranthene	205-99-2
BENZO(K)FLUO	Benzo(k)fluoranthene	207-08-9
BERYLLIUM	Beryllium	7440-41-7
BUTADIENE,13	1,3-Butadiene	106-99-0
CADMIUM	Cadmium	7440-43-9
CARBON TETRA	Carbon Tetrachloride	56-23-5
CHLOROFORM	Chloroform	67-66-3
CHROMIUM	Chromium	7440-47-3
CHROMIUM VI	Chromium VI	18540-29-9
CHRYSENE	Chrysene	218-01-9
COBALT	Cobalt	7440-48-4
COPPER	Copper	7440-50-8
DIBENZAHAN	Dibenzo(a,h)anthracene	53-70-3
DIBROMOET,12	1,2-Dibromoethane	106-93-4
DIBUTYL PHTH	Dibutyl Phthalate	84-74-2
DICHLORETH12	1,2-Dichloroethane	107-06-2
DIEYLHEX PHT	Diethylhexyl Phthalate	117-81-7
DIOCTYL PHTH	Di-n-octyl Phthalate	117-84-0
ETHYLBENZENE	Ethylbenzene	100-41-4
ETHYLENE OXI	Ethylene Oxide	75-21-8
FLUORANTHENE	Fluoranthene	206-44-0
FLUORENE	Fluorene	86-73-7
FORMALDEHYDE	Formaldehyde	50-00-0
HEXCLBENZENE	Hexachlorobenzene	118-74-1
INDN(123CDPY	Indeno(1,2,3-c,d)pyrene	193-39-5
LEAD	Lead	7439-92-1
MANGANESE	Manganese	7439-96-5
MERCURY	Mercury	7439-97-6
METHENE(B)4-	Methylene(b)4-phenylisocyanate	101-68-8
METHYLENE CL	Methylene Chloride	75-09-2
NAPHTHALENE	Naphthalene	91-20-3
NICKEL	Nickel	7440-02-0
PCBS	PCBs	1336-36-3
PCDD	Polychlorinated dibenzodioxins	
PCDF	Polychlorinated dibenzofurans	
PCP	Pentachlorophenol	87-86-5
PERC	Perchloroethylene	127-18-4
PHENANTHRENE	Phenanthrene	85-01-8
PHENOL	Phenol	108-95-2
PYRENE	Pyrene	129-00-0
STYRENE	Styrene	100-42-5
TCDD,2378	2,3,7,8-Tetrachlorodibenzodioxin	1746-01-6
TCDF,2378	2,3,7,8-Tetrachlorodibenzofuran	51207-31-9
TCE,111	1,1,1-Trichloroethane	71-55-6
TOLUENE	Toluene	108-88-3
TOLUENE24DII	2,4-Toluene diisocyanate	584-84-9
TRIFULURALIN	Trifluralin	1582-09-8
VINYL CHLOR	Vinyl Chloride	75-01-4
XYLENE,M	m-Xylene	108-38-3
XYLENE,O	o-Xylene	95-47-6
XYLENE,P	p-Xylene	106-42-3
XYLENE,ISO	Xylenes Isomers	1330-20-7

Appendix E: New York Toxic Emissions Inventory

INFORMATION

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

The State of Ohio developed a comprehensive toxic emission inventory for the Great Lakes Air Toxic Emission Inventory Project for calendar year 1997. The inventory is a major improvement to the 1996 inventory by including additional area and mobile source inventories. Future inventories will continue to build on existing inventories and receive additional enhancements in order to produce a better estimate of the State's Toxic Profile. In most cases, Ohio followed the Air Toxic Emissions Inventory Protocol for the Great Lakes Commission in developing its contribution to the regional inventory. Collection of activity data presented a major challenge to Ohio and in some cases assumptions were made to produce realistic estimates. The point and area source calculations were performed outside of RAPIDS and the emission estimates were then imported in RAPIDS. Mobile source activity data were imported in RAPIDS and the emission estimate was performed in RAPIDS.

CALCULATION METHODS

Point Sources

Ohio is in the process of converting criteria pollutant information from the state's Emission Inventory System (EIS) into RAPIDS and apply Fire emission factors in estimating toxic at the process level. The application being developed, OSTRICH, is not yet completed. Ohio decided to follow a similar approach to the one used for the 1996 inventory year and utilized the Toxic Release Inventory (TRI) data to fulfil the point source inventory requirement. This data is considered of high confidence and it has been quality assured. There are 1600 TRI facilities in the state and around 1200 facilities have air releases. The TRI pollutant name was converted to the RAPIDS material code and inserted in RAPIDS.

Area sources

A large number of area source inventories were included in the 1997 inventory that were not in the 1996 inventory. A description of the calculation methods, assumptions and data sources for area source inventories is described below.

Architectural Coating

County population, VOC emission factors for both water and solvent based paints, and the annual paint usage factors were employed to estimate the VOC emissions at the county level. The approach is consistent with the recommended methodology.

Autobody Refinishing

County employment and the EIIP recommended factor of 3519 lbs. VOC/employee were used to estimate VOC emissions. Toxic emissions were speciated using profile 1194.

Consumer and commercial Solvents

County population and the 7.84 lbs. VOC/person emission factor were employed to estimate VOC emissions. Toxic emissions were calculated using EIIP recommended factors.

Dry Cleaning

The two major types of dry cleaning operations are coin operated with SIC code 7215 and SIC 7216. County employment and the EIIP recommended toxic emission factors of 52 lbs. perc/employee for SIC 7215 and 1200 lbs. of perc/employee for SIC 7211 were used in the percloroethylene estimate.

Gasoline Marketing

The amount of gasoline sales in Ohio for year 1997 was provided from the National Energy Information. Use of gasoline sales was apportioned to county by VMT (Vehicles Miles Traveled). In the emission calculation of Stage I operations, Ohio assumed that 95% of the loadings are submerged and 5% are splashed in the underground tank. In the emission calculation of Stage II operations, 16 counties are subjected to a stage II vapor control system. For spillage and tank breathing, Ohio used EIIP calculation methodology. Rapids speciation profile 1190 was used in the estimation of Toxic pollutants.

Graphic Arts

County population and the 70.1 lbs. VOC/person emission factor provided by Wisconsin DNR were employed to estimate VOC emissions. Toxic emissions were calculated using EIIP recommended factors and RAPID profiles 1191 and 1086.

Industrial Surface Coatings

Employment data for available SIC codes were obtained from the A1996 County Business Patterns A publication. For SICs with minimum information, a program was written that allocated calculated employment values. The per employee EIIP emission factors were used to estimate VOC emissions and the regional protocol speciation profiles were applied to estimate toxic emissions.

Landfills

Activity data were provided by the Ohio EPA=s Division of Solid Waste. Assumption had to be made to complete missing information on waste received per year and years landfills are in operation. Assumptions and toxic emission factors are consistent with the EIIP guidance Volume III: Chapter 14.

Pesticide Use

From the U.S. Dept of Agriculture chemical application rates and acres treated for corn, soybeans, wheat, oat field crops were obtained. Pesticide apportionment was accomplished by multiplying the state pesticide usage by the ratio of county to the state harvested acres. Emissions were calculated by using emission factors published in: *Air and Waste Management Association. M. Trevor Scholtz, Carol F. Slama, Eva C. Voldner. Pesticide Emission Factor from Agricultural Soils. June 13-18, 1993.*

Publicly Owned Treatment Works

Activity data were provided by our Division of Surface Water. RAPIDS protocol was used to estimate waste flow and toxic pollutants.

Residential Fuel Combustion

This source category covers only the residential air emissions from the combustion of coal, natural gas, distillate fuel oil, liquefied petroleum gas, natural gas and wood. The county fuel use was multiplied with the toxic emission factors for commercial units since there is a limited number of factors for residential units.

Solvent Cleaning

Ohio opted to utilize the per capita methodology and toxic speciation profile number 1195 in RAPIDS which is consistent with the regional protocol.

Traffic Marking

Ohio has utilized the third alternative method recommended in the regional protocol. This method employs the county population and the per capita emission factor for paint usage. The emission factors of the regional protocol were used in the toxic estimate.

Mobile Sources

On-Road Mobile Sources

The Ohio Department of Transportation has provided us with VMT data for each vehicle type and arterial classification. The Mobile Section has prepared the input files and run Mobile 5 and Part 5 models. The output files were imported in RAPIDS and the emission estimator was applied once to estimate the primary pollutants and once more to calculate toxic pollutants based on the speciation profile of the source classification code.

Off-Road Mobile Sources

Ohio run the NONROAD model using the default parameters and produced reports of Emission Totals by SCC for all pollutants and for each county in the state. The reports were converted into a format acceptable to RAPIDS. Emissions were calculated within RAPIDS.

Aircraft

Air traffic activity from Ohio's 11 major airports was received from Office of Airline Information Bureau of Transportation Statistics. The aircraft landings and take offs were grouped for each aircraft and engine type and imported in RAPIDS. Emissions were estimated within RAPIDS.

Locomotives

Gross Ton Miles (GTM) of the two major transportation companies in Ohio (Norfolk and CSX) were provided directly from the companies. Hydrocarbon emissions were calculated using the actual gross ton miles and dividing by an efficiency factor to determine the fuel utilized on an individualized line segment. The efficiency factor is based on 1997 data and is calculated to be 702.9 gross ton miles/gal of diesel fuel. The factor is assumed to include the emissions from yard units, line of road units and pushers. Toxic emissions were calculated outside of RAPIDS using the speciation profiles of diesel fuel.

RESULTS

Ohio's Great Lakes Toxic Inventory included toxic estimates of 67 substances out of the 82 Great Lakes Air Toxics. The summary table provides you with the county and the emissions of these 65 pollutants from point, area, on-road and non-road sources.

INFORMATION

For more information about Ohio's air toxics inventory, please contact:

Tom Velalis - EIS Supervisor
Ohio Environmental Protection Agency
Lazarus Government Center
122 South Front Street
Columbus, OH 43215

(P) 614-644-4837
(F) 614-644-3681
(E) tom.velalis@epa.state.oh.us

Table F-1: Ohio - Statewide Summary of Emissions (lb./yr.)

	Point Sources	Area Sources	Mobile Sources	Nonroad Sources	Total
ACENAPHTHEN		1			1
ACENAPHTHYL		1			1
ACETALDEHYDE	239,219	100,590	1,315,643	2,850,420	4,505,872
ACROLEIN		22	187,448	200,816	388,286
ACRYLAMIDE	685				685
ANTHRACENE	8,377	16		1	8,394
ANTIMONY	939				939
ARSENIC		13,650			13,650
BENZ(A)ANTHR		72		169	241
BENZ(GHI)PE		36		420	456
BENZENE	46,931	831,634	7,756,463	4,908,365	13,543,393
BENZO(A)PYRE				76	76
BENZO(B)FLUO				61	61
BENZO(K)FLUO				69	69
BERYLLIUM	721	9,288			10,009
BUTADIENE,13	58,203	1,007,576	1,002,562	804,657	2,872,998
CADMIUM		9,086			9,086
CARBON TETRA	418	2,003			2,421
CHLOROFORM		3			3
CHROMIUM	17,095	9,766	91	1,353	28,305
CHRYSENE		39		115	154
COBALT	273	26			299
COPPER	33,552	299	864		34,715
DIBENZAHAN		682		2	684
DIBROMOET,12	644	39,566			40,210
DIBUTYL PHTH	497	2,868			3,365
DICHLORETH12		1,437			1,437
DIEYLHEX PHT	6,059	3			6,062
ETHYLBENZENE	90,658	1,134,042	3,440,757	2,476,083	7,141,540
ETHYLENE OXI		438,840			438,840
FLUORANTHENE		90		99	189
FLUORENE		85			85
FORMALDEHYDE	105,689	742,665	3,467,304	6,251,136	10,566,794
GLYCOL ETHRS		136,890			136,890
INDN(123CDPY		32		2	34
LEAD	1194	27,665	10,869		39,728
MANGANESE	17,928	18,063	230	1,489	37,710
MERCURY		9,276	136	272	9,684
METHYLENE CL	1,923,387	1,104,798			3,028,185
NAPHTHALENE	82	669,737	498,728	2,087	1,170,634
NICKEL	2,539	12,578	137	581	15,835
PERC	209,473	1			209,474
PHENANTHRENE		229		66	295
PHENOL	28,735			14,326	43,061
PYRENE		80		44	124
STYRENE	1,042,134	38,131	2,361,569	156,276	3,598,110
TCE,111	130,291				130,291
TOLUENE	342,447	15,601,829	23,347,051	9,717,444	49,008,771
TRICHLORETHY	341,837				341,837
VINYL CHLOR	1,179				1,179
XYLENE,M		231,471	6,534,391		6,765,862
XYLENE,O		994,683	3,661,647	11,331	4,667,661
XYLENE,P		111,708			111,708
XYLENES ISO	329,927	18,275,779	13,208,899	9,804,896	41,619,501

Table F-2: Ohio Pollutant Codes

Code	Pollutant	CAS Number
ACENAPHTHEN	Acenaphthene	83-32-9
ACENAPHTHYL	Acenaphthylene	208-96-8
ACETALDEHYDE	Acetaldehyde	75-07-0
ACROLEIN	Acrolein	107-02-8
ANTHRACENE	Anthracene	120-12-7
ANTIMONY	Antimony	7440-36-0
ARSENIC	Arsenic	7440-38-2
BENZ(A)ANTHR	Benz(a)anthracene	56-55-3
BENZ(GHI)PE	Benzo(g,h,i)perylene	191-24-2
BENZENE	Benzene	71-43-2
BENZO(A)PYRE	Benzo(a)pyrene	50-32-8
BENZO(B)FLUO	Benzo(b)fluoranthene	205-99-2
BENZO(K)FLUO	Benzo(k)fluoranthene	207-08-9
BERYLLIUM	Beryllium	7440-41-7
BUTADIENE,13	1,3-Butadiene	106-99-0
CADMIUM	Cadmium	7440-43-9
CARBON TETRA	Carbon Tetrachloride	56-23-5
CHLOROFORM	Chloroform	67-66-3
CHROMIUM	Chromium	7440-47-3
CHRYSENE	Chrysene	218-01-9
COBALT	Cobalt	7440-48-4
COPPER	Copper	7440-50-8
DIBENZAHAN	Dibenzo(a,h)anthracene	53-70-3
DIBROMOET,12	1,2-Dibromoethane	106-93-4
DIBUTYL PHTH	Dibutyl Phthalate	84-74-2
DICHLORETH12	1,2-Dichloroethane	107-06-2
DIEYLHEX PHT	Diethylhexyl Phthalate	117-81-7
ETHYLBENZENE	Ethylbenzene	100-41-4
ETHYLENE OXI	Ethylene Oxide	75-21-8
FLUORANTHENE	Fluoranthene	206-44-0
FLUORENE	Fluorene	86-73-7
FORMALDEHYDE	Formaldehyde	50-00-0
GLYCOL ETHRS	Glycol Ethers	52286-19-8
INDN(123CDPY	Indeno(1,2,3-c,d)pyrene	193-39-5
LEAD	Lead	7439-92-1
MANGANESE	Manganese	7439-96-5
MERCURY	Mercury	7439-97-6
METHYLENE CL	Methylene Chloride	75-09-2
NAPHTHALENE	Naphthalene	91-20-3
NICKEL	Nickel	7440-02-0
PERC	Perchloroethylene	127-18-4
PHENANTHRENE	Phenanthrene	85-01-8
PHENOL	Phenol	108-95-2
PYRENE	Pyrene	129-00-0
STYRENE	Styrene	100-42-5
TCE,111	1,1,1-Trichloroethane	71-55-6
TOLUENE	Toluene	108-88-3
TRICHLORETHY	Trichloroethylene	79-01-6
TRICLPHN,246	2,4,6-Trichlorophenol	88-06-2
VINYL CHLOR	Vinyl Chloride	75-01-4
XYLENE,M	m-Xylene	108-38-3
XYLENE,O	o-Xylene	95-47-6
XYLENE,P	p-Xylene	106-42-3
XYLENE,ISO	Xylenes Isomers	1330-20-7

Appendix G: Ontario Toxic Emissions Inventory

BACKGROUND

The province of Ontario, Canada, has prepared an air toxic emissions inventory on the target compounds for the Great Lakes Regional Air Toxic Emissions Inventory Project for the 1997 calendar year. This 1997 emissions inventory includes point, area and mobile sources. Ontario followed the Air Toxic Emissions Inventory Protocol and the emission source methodologies agreed upon by the project's Technical Steering Committee in developing the regional inventory where applicable. Emissions related information was collected from domestic regulatory and voluntary inventories for point sources, statistical organizations (i.e., Statistics Canada) for area sources, and the Ontario Ministry of Transportation for mobile sources. These sources of information were deposited into Ontario's Regional Air Pollution Inventory Development System (RAPIDS Version 2.0) and emissions were compiled using its reference tables and the air toxic emission factors from the Factor Information Retrieval System (FIRE) and source specific profiles.

DATA SOURCES

Point Sources:
The point source emissions inventory contains industrial process and release information provided by regulatory and voluntary reporting programs, which include the National Pollutant Release Inventory (NPRI), the Strategic Option Processes (SOP), the National Emissions Reduction Master Plan (NERM) of the Canadian Chemical Producers Association, and the Accelerated Reduction and Elimination of Toxics (ARET). The 1997 Ontario point source emissions inventory includes 632 sources. The point source sector profile includes emissions data for 66 of the 82 targeted toxics on the GLC substance list.

Area Sources:
The area source emissions inventory represents smaller emission sources. These include wide-spread sources and certain industrial sources that cannot be included in the point source inventory because of a lack of facility and process specific information. The area source emissions are based on available statistical information, including energy demand statistics, census data, housing data, industrial production statistics, employment information, etc. The 1997 Ontario area source inventory includes 9 source sectors. The area source sector profile includes emissions data for 49 out of the 82 targeted toxics on the GLC substance list.

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 speciated into specific targeted air toxics.

Dry Cleaning

A tetrachloroethylene (perchloroethylene) emission factor of 0.362 lb/person/year was developed using provincial emissions from a provincial solvent usage survey. The provincial total was 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 Losses (Gasoline Retail Operations - Balanced Submerged Filling), and Stage II Losses (Filling Vehicle Gas Tanks - Vapour Loss and Liquid Spill Loss w/o Control).

Graphic Arts

Emissions for graphic arts were estimated using employee based emission factors. The SIC specific employee data were taken from Statistics Canada's 1997 "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 apportioned to the county level using population statistics.

Industrial Surface Coating

The Canadian SIC codes used for this category are 2521, 254X, 256X, 26XX, 3042, 305X, 31XX, 32XX, 331X, 332X. The total VOC emissions from these SIC codes were calculated using employee based emission factors. VOC numbers for the Other Product Coatings, High Performance Coatings, and Other Special Purpose Coatings source categories were calculated using population based emission factors. Both categories of VOC emissions were speciated into the GLC targeted air toxics.

Publicly Owned Treatment Works (POTW)

POTW emissions were estimated using effluent flow information from 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.

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 taken from an Ontario Ministry of Natural Resources 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 use 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 toxic volume percent of the paint used, and the air toxic density. The total amount of traffic paint used was estimated by applying a paint use factor to the road length statistics provided by the Ontario Ministry of Transportation. Road length was apportioned to the county level using population statistics.

Mobile Sources:

The mobile source inventory included 2 major categories, on-road sources and non-road sources. The 1997 Ontario mobile source inventory included 13 source sectors (7 in the on-road and 6 in the non-road categories). The mobile source sector profile includes emissions data for 39 of the 82 targeted toxics on the GLC substance list.

On-road Mobile Sources

The on-road mobile sources include the vehicle categories as defined by the U.S. transportation model MOBILE 5. These are light-duty gasoline vehicles (LDGV), light-duty gasoline trucks (LDGT), heavy-duty gasoline vehicles (HDGV), light-duty diesel vehicles (LDDV), light-duty diesel trucks (LDDT), heavy-duty diesel vehicles (HDDV), and motorcycles (MC).

The Canadian version of the MOBILE model (MOBILE 5C) was used to estimate the evaporative and exhaust related VOC emissions of on-road vehicles. The PART5 model was used to estimate the particulate matter (PM) emissions. Toxic substance speciation profiles were applied to VOC and PM emissions to obtain the toxic emission values.

Non-road Mobile Sources

Non-road mobile sources include the following categories: i) off-road gasoline engines/vehicles; ii) off-road diesel engines/vehicles; iii) off-road equipment; and iv) locomotives, marine engines, and aviation. The following sections give details on the emission estimation methodologies associated with non-road mobile sources.

Off-road Gasoline Engines/Vehicles

The fuel consumption of off-road gasoline engines/vehicles was obtained from provincial statistics and used to estimate VOC and PM emissions. Corresponding toxic substance speciation profiles were applied to the VOC and PM emissions to obtain the toxic emission values.

Off-road Diesel Engines/Vehicles

The fuel consumption of off-road diesel engines/vehicles was obtained from provincial statistics and used to estimate VOC and PM emissions. Corresponding toxic substance speciation profiles were applied to the VOC and PM emissions to obtain the toxic emission values.

Off-road Equipment
The estimated number of off-road equipment (e.g., lawnmowers) was obtained from a federal Environment Canada field survey and used to estimate VOC and PM emissions. Corresponding toxic substance speciation profiles were applied to the VOC and PM emissions to obtain the toxic emission values.

Locomotives
The fuel consumption of locomotives was obtained from provincial statistics and used to estimate VOC and PM emissions. Corresponding toxic substance speciation profiles were applied to the VOC and PM emissions to obtain the toxic emission values.

Marine Engines
The fuel consumption and the operating statistics (i.e., movement) of marine engines (i.e., vessels) was obtained from provincial statistics, whereas the number of pleasure crafts was estimated via the federal Census. This information was used to estimate VOC and PM emissions. Corresponding toxic substance speciation profiles were applied to the VOC and PM emissions to obtain the toxic emission values.

Aviation
The aircraft movement statistics for each airport were obtained from the Ontario Ministry of Transportation to derive the landing-takeoff (LTO) cycles. Corresponding toxic substance speciation profiles were applied to the estimated VOC and PM emissions to obtain the toxic emission values.

QUALITY CHECK ACTIVITIES

During the development of this air toxics inventory, quality check activities, such as technical reviews and accuracy checks, were performed to ensure that the most appropriate emission profiles were used for each source.

UNCERTAINTIES

The emission estimates in this air toxic emissions inventory were based on the best available source information and source emission profiles. The use of NPRI data in the point source sector profile is limited to larger sources. Additional point sources from major industrial sectors were included (from SOP, NERM, and ARET inventories) in this inventory's point source sector profile.

Uncertainties exist when using 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 1997 Great Lakes Regional Air Toxic Emissions Inventory included estimates for 67 of the 82 targeted toxics on the GLC substance list. There are 9,567 estimates for 632 different point sources, 9,032 estimates for 9 area source sectors and 33,745 estimates for 13 mobile source sectors. There are 185 SCC codes and 205 SIC codes included in this Ontario inventory. The point, area, and mobile source emissions for each county in Ontario are provided in Ontario's County Emissions table.

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

Table G-1: Ontario Statewide Summary of Emissions (lbs./yr.)

Pollutant	CAS Number	Point	Area	Onroad	Nonroad	Total
1,3-Butadiene	106-99-0	197,248.69		1,259,822.24	511,336.42	1,968,407.36
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	0.00070798	0.00011443			0.00082241
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9	4.67	0.00010830			4.67
2,4,5-trichlorophenol	95-95-4	4.99				4.99
2,4,6-trichlorophenol	88-06-2	276.59				276.59
Acenaphthene	83-32-9	17.10	8,127.16		1.51	8,145.77
Acenaphthylene	208-96-8	122.32	163,207.94		0.02	163,330.28
Acetaldehyde	75-07-0	186,885.47		1,810,110.99	1,780,757.66	3,777,754.13
Acrolein	107-02-8	147.13		254,464.70	178,130.77	432,742.60
Acrylamide	79-06-1	500.54				500.54
Acrylonitrile	107-13-1	12,140.84				12,140.84
Anthracene	120-12-7	6,882.31	11,170.18		0.09	18,052.58
Antimony	7440-36-0	1,907.97			374.50	2,282.47
Arsenic	7440-38-2	196,797.69	206.88	19.30	95.57	197,119.44
Benz(a)anthracene	56-55-3	71.15	15,945.62		0.43	16,017.20
Benzene	71-43-2	2,529,591.69	2,004,023.04	9,746,828.87	3,180,943.15	17,461,386.75
Benzo(a)pyrene	50-32-8	21,385.60	3,385.42		0.27	24,771.30
Benzo(b)fluoranthene	205-99-2	72.87	4,813.34			4,886.20
Benzo(g,h,i)perylene	191-24-2	46.33	3,856.18		0.16	3,902.67
Benzo(k)fluoranthene	207-08-9	7.42	1,615.65			1,623.07
Beryllium	7440-41-7	343.62	90.53		1.98	436.13
Cadmium	7440-43-9	2,439.12	736.32		28.39	3,203.84
Carbon tetrachloride	56-23-5	1,152.27	6,099.52			7,251.79
Chloroform	67-66-3	149,386.36	24,431.64			173,818.00
Chromium	7440-47-3	87,845.76	2,755.57	439.42	1,359.40	92,400.16
Chromium (6)	18540-29-9	75.18			17.69	92.87
Chrysene	218-01-9	1,050.04	9,774.79		0.85	10,825.68
Cobalt	7440-48-4	28,625.35	25.59		429.43	29,080.37
Copper	7440-50-8	569,728.00	272.11	51,694.60	322.75	622,017.46
Dibenz(a,h)anthracene	53-70-3	4.08	226.45		0.12	230.65
Dibutyl phthalate	84-74-2	754.55	338.36			1,092.91
Diethylhexyl phthalate	117-81-7	7,094.57				7,094.57
Dioctyl phthalate	117-84-0	444.08				444.08
Ethylbenzene	100-41-4	1,172,645.70	1,442,497.10	4,016,012.35	1,936,357.60	8,567,512.74
Ethylene dibromide (1,2-Dibromoethane)	106-93-4	10.70	12.43			23.13
Ethylene dichloride (1,2-Dichloroethane)	107-06-2	30.48	731.38			761.86
Ethylene oxide	75-21-8	21,037.08				21,037.08
Fluoranthene	206-44-0	1,213.86	15,790.45		8.56	17,012.86
Fluorene	86-73-7	84.50	19,103.35		0.32	19,188.18
Formaldehyde	50-00-0	676,078.26	50,725.12	4,822,245.40	4,072,317.12	9,621,365.90
Glycol ethers			796,085.41			796,085.41
Hexachlorobenzene	118-74-1	8.06				8.06
Hydrazine	302-01-2	452.03				452.03
Indeno(1,2,3-c,d)pyrene	193-39-5	60.08	917.28		0.15	977.51
Lead	7439-92-1	489,990.08	152.32	20,936.72	2,276.96	513,356.08
Manganese	7439-96-5	115,423.17	743.46	805.09	1,773.71	118,745.43
Mercury	7439-97-6	5,390.10	183.46	366.48	422.84	6,362.87
Methyl chloroform (1,1,1-Trichloroethane)	71-55-6	1,195,343.30	23,690.56		16.83	1,219,050.69
Methylene chloride (Dichloromethane)	75-09-2	3,864,482.21	977,392.85			4,841,875.06
Methylene(b)4-phenylisocyanate	101-68-8	205.07				205.07
Naphthalene	91-20-3	86,481.51	461,881.45	610,743.85	1,298.33	1,160,405.14
Nickel	7440-02-0	624,480.50	6,558.64	543.89	6,800.71	638,383.74
Phenanthrene	85-01-8	827.59	80,690.82		0.75	81,519.16
Phenol	108-95-2	248,703.88	18,456.76		525.53	267,686.18
Polychlorinated biphenyls (PCBs)	1336-36-3	0.48				0.48
Polychlorinated dibenzodioxins, total		0.74				0.74
Polychlorinated dibenzofurans, total		5.40				5.40
Pyrene	129-00-0	377.97	18,729.28		0.30	19,107.55
Styrene	100-42-5	496,551.88	10,524.53	1,714,598.37	134,330.32	2,356,005.10
Tetrachloroethylene (Perchloroethylene)	127-18-4	271,846.48	4,109,984.89			4,381,831.37
Toluene	108-88-3	11,100,336.72	22,792,545.86	27,724,886.23	7,717,655.30	69,335,424.11
Trichloroethylene	79-01-6	1,622,790.28	37,979.85			1,660,770.14
Vinyl chloride	75-01-4	56,710.78	103,632.41			160,343.18
Xylene,m	108-38-3	28,950.61	170,732.90	8,103,805.09		8,303,488.60
Xylene,o	95-47-6	24,485.57	2,310,028.54	4,255,237.28	435.22	6,590,186.61
Xylene,p	106-42-3	221.58	66,096.94			66,318.52
Xylenes (includes o, m and p isomers)	1330-20-7	11,009,731.19	3,226,966.92	15,700,588.99	8,071,426.11	38,008,713.21

Appendix H: Pennsylvania Toxic Emissions Inventory

METHODOLOGY

Point Source Methodology

PA Department of Environmental Protection's Bureau of Air Quality, as part of its annual air emissions inventory process, collected point source emissions information included in the Pennsylvania inventory. Every January, PA DEP mails preprinted forms to every active facility in the emission inventory. Facilities are required to submit activity data for the previous year. This data includes operating schedules, throughputs, fuel usage, and emission estimates. The reports are to be completed and notarized and sent to Pa DEP by March 1st. Regional inspectors then verify and enter the data into the emission inventory database. The data is then quality assured and completed by September. Where directly reported toxics data existed for 1997, that data was broken down into its component scc-level emissions and entered into Rapids. Since a there were still a number of facilities that did not report their actual toxic emissions for 1997, It was sometimes necessary to use emission factors from the Factor Information Retrieval System (FIRE) and apply them to the annual throughputs for each Source Classification Code (SCC) and generate an emission estimate. In future years, the reporting of toxic emissions over certain thresholds is required and should generate more actual estimates supplemented with estimates from emission factors.

Area Source, Nonroad Engine and Highway Vehicle Methodologies

All of the Non-point emissions of air toxics were speciated from criteria pollutant inventories using speciation factors from the EPA's Speciate database. Since Pennsylvania develops these inventories on a three-year cycle, the data used for the 1997 inventory was projected from 1996 data. (Refer to the 1996 GLC Air Toxics inventory report for details on the methodology.) The growth projections used were based on population, economic, and vehicle use data as appropriate for the given category. Once the data were projected to 1997, they were loaded into the Rapids database and speciated.

The Speciation process made use of the profiles listed in the following table.

Table H-1: Profile Codes Applied by SCC and Material

SCC	Profile	Material	SCC	Profile	Material
2103004000	0002	TOG	2230060110	G005	EXPM
2103007000	0003	TOG	2230060130	G002	EXHC
2201001110	G008	EVHC	2230060130	G005	EXPM
2201001110	G001	EXHC	2230060170	G002	EXHC
2201001110	G004	EXPM	2230060170	G005	EXPM
2201001130	G008	EVHC	2230060230	G002	EXHC
2201001130	G001	EXHC	2230060230	G005	EXPM
2201001130	G004	EXPM	2230060270	G002	EXHC
2201001170	G008	EVHC	2230060270	G005	EXPM
2201001170	G001	EXHC	2230060310	G002	EXHC
2201001170	G004	EXPM	2230060310	G005	EXPM
2201001230	G008	EVHC	2230070110	G003	EXHC
2201001230	G001	EXHC	2230070110	G006	EXPM
2201001230	G004	EXPM	2230070130	G003	EXHC
2201001270	G008	EVHC	2230070130	G006	EXPM
2201001270	G001	EXHC	2230070170	G003	EXHC
2201001270	G004	EXPM	2230070170	G006	EXPM
2201001310	G008	EVHC	2230070230	G003	EXHC
2201001310	G001	EXHC	2230070230	G006	EXPM
2201001310	G004	EXPM	2230070270	G003	EXHC
2201020110	G008	EVHC	2230070270	G006	EXPM
2201020110	G001	EXHC	2230070310	G003	EXHC
2201020110	G004	EXPM	2230070310	G006	EXPM
2201020130	G008	EVHC	2260001000	2521	TOG
2201020130	G001	EXHC	2260002000	1186	TOG
2201020130	G004	EXPM	2260002015	1186	TOG
2201020170	G008	EVHC	2260002048	1186	TOG
2201020170	G001	EXHC	2260002075	1186	TOG
2201020170	G004	EXPM	2260002081	1186	TOG
2201020230	G008	EVHC	2260003000	1186	TOG
2201020230	G001	EXHC	2260004000	2521	TOG
2201020230	G004	EXPM	2260005000	1186	TOG
2201020270	G008	EVHC	2260005015	1186	TOG
2201020270	G001	EXHC	2260005020	1186	TOG
2201020270	G004	EXPM	2260005025	1186	TOG
2201020310	G008	EVHC	2260005030	1186	TOG
2201020310	G001	EXHC	2265001000	2521	TOG
2201020310	G004	EXPM	2265002000	1186	TOG
2201040110	G008	EVHC	2265002015	1186	TOG
2201040110	G001	EXHC	2265002048	1186	TOG
2201040110	G004	EXPM	2265002075	1186	TOG
2201040130	G008	EVHC	2265002081	1186	TOG
2201040130	G001	EXHC	2265003000	1186	TOG
2201040130	G004	EXPM	2265004000	2521	TOG
2201040170	G008	EVHC	2265005000	1186	TOG
2201040170	G001	EXHC	2265005015	1186	TOG
2201040170	G004	EXPM	2265005020	1186	TOG
2201040230	G008	EVHC	2265005025	1186	TOG
2201040230	G001	EXHC	2265005030	1186	TOG
2201040230	G004	EXPM	2265008000	1186	TOG
2201040270	G008	EVHC	2270002000	2520	TOG
2201040270	G001	EXHC	2270002015	2520	TOG
2201040270	G004	EXPM	2270002018	2520	TOG
2201040310	G008	EVHC	2270002048	2520	TOG
2201040310	G001	EXHC	2270002051	2520	TOG
2201040310	G004	EXPM	2270002063	2520	TOG
2201070110	G008	EVHC	2270002066	2520	TOG
2201070110	G001	EXHC	2270002075	2520	TOG
2201070110	G004	EXPM	2270002081	2520	TOG
2201070130	G008	EVHC	2270003000	2520	TOG
2201070130	G001	EXHC	2270004000	2520	TOG
2201070130	G004	EXPM	2270005000	2520	TOG
2201070170	G008	EVHC	2270005015	2520	TOG
2201070170	G001	EXHC	2270005020	2520	TOG
2201070170	G004	EXPM	2270005025	2520	TOG

SCC	Profile	Material	SCC	Profile	Material
2201070230	G008	EVHC	2270005030	2520	TOG
2201070230	G001	EXHC	2275001000	G021	TOG
2201070230	G004	EXPM	2275020000	G022	TOG
2201070270	G008	EVHC	2275050000	G023	TOG
2201070270	G001	EXHC	2275060000	G024	TOG
2201070270	G004	EXPM	2282005000	2521	TOG
2201070310	G008	EVHC	2282005005	2521	TOG
2201070310	G001	EXHC	2282005010	2521	TOG
2201070310	G004	EXPM	2282020005	2520	TOG
2201080110	G008	EVHC	2401001000	2401	TOG
2201080110	G001	EXHC	2401005000	1194	TOG
2201080110	G004	EXPM	2401008000	2403	TOG
2201080130	G008	EVHC	2401015000	2405	TOG
2201080130	G001	EXHC	2401020000	2405	TOG
2201080130	G004	EXPM	2401025000	2406	TOG
2201080170	G008	EVHC	2401040000	2408	TOG
2201080170	G001	EXHC	2401050000	2401	TOG
2201080170	G004	EXPM	2401055000	2401	TOG
2201080230	G008	EVHC	2401060000	2411	TOG
2201080230	G001	EXHC	2401065000	1003	TOG
2201080230	G004	EXPM	2401075000	2414	TOG
2201080270	G008	EVHC	2401080000	2415	TOG
2201080270	G001	EXHC	2401085000	2401	TOG
2201080270	G004	EXPM	2401090000	2401	TOG
2201080310	G008	EVHC	2401100000	2418	TOG
2201080310	G001	EXHC	2401200000	2401	TOG
2201080310	G004	EXPM	2415000000	2420	TOG
2230001110	G002	EXHC	2425000000	2424	TOG
2230001110	G005	EXPM	2461021000	1007	TOG
2230001130	G002	EXHC	2461022000	1007	TOG
2230001130	G005	EXPM	2461800000	0076	TOG
2230001170	G002	EXHC	2465000000	8500	TOG
2230001170	G005	EXPM	2501060050	2453	TOG
2230001230	G002	EXHC	2501060100	2453	TOG
2230001230	G005	EXPM	2501060201	2453	TOG
2230001270	G002	EXHC	2505030120	2453	TOG
2230001270	G005	EXPM	2620030000	0202	TOG
2230001310	G002	EXHC	2630020000	2542	TOG
2230001310	G005	EXPM	2630020000	9022	TOG
2230060110	G002	EXHC			

INFORMATION

For more information about Pennsylvania's air toxics inventory, please contact:

Mr. Robert Altenberg
Bureau of Air Quality
Pennsylvania Dept. of Environmental Protection
Rachel Carsen State Office Bldg.
P.O. Box 8468
Harrisburg, PA 17105-8468

(P) 717-787-4310
(F) 717-772-2303
(E) altenburg.robert@a1.dep.state.pa.us

Table H-2: Pennsylvania - Statewide Summary of Emissions (lb./yr.)

	Point Sources	Area Sources	Mobile Sources	Nonroad Sources	Total
ACETALDEHYDE		22.70	1,053.04	47.71	1,123.45
ACROLEIN		2.40	153.93	23.51	179.84
ACRYLONITRIL		0.20			0.20
ANTIMONY		1.30			1.30
ARSENIC		4.40	0.00		4.40
BENZ(GHI)PE		1.30			1.30
BENZENE	1,854.67	57.20	7,451.35	2,281.30	11,644.52
BENZO(A)PYRE		12.30			12.30
BERYLLIUM		0.30			0.30
BUTADIENE,13		0.30	918.28		918.58
CADMIUM		3.20			3.20
CARBON TETRA		2.20			2.20
CHLOROFORM	8.83	96.80			105.63
CHROMIUM		55.57	0.15		55.72
COBALT		1.50			1.50
COKE OVEN GS		126.30			126.30
COPPER		3.20	0.78		3.98
DIBUTYL PHTH	1.54	0.40			1.94
DIEYLHEX PHT		3.80			3.80
ETHYLBENZENE	82.77	76.00	2,893.95	1,137.74	4,190.46
ETHYLENE OXI	58.87	6.10			64.97
FORMALDEHYDE	17.12	251.60	2,726.01		2,994.73
GLYCOL ETHRS		167.30			167.30
HEXCHLORETH	2.9432				2.9432
LEAD		32.50	8.59		41.09
MANGANESE		81.50	0.26		81.76
MERCURY		7.20	0.18		7.38
METHYLENE CL	943.48	1,173.00			2,116.48
NAPHTHALENE	603.34	34.60	444.39	5.93	1,088.25
NICKEL		31.20	0.20		31.40
PERC	1,461.12	62.00			1,523.12
PHENOL		50.30		13.76	64.06
STYRENE	2.53	252.30	1,170.15	507.98	1,932.96
TCE,111	5,872.75	59.00			5,931.75
TOLUENE	9,755.21	1,807.60	20,101.61	4,270.57	35,934.98
TRICHLORETHY	2,529.89	858.80			3,388.69
VINYL CHLOR		50.60			50.60
XYLENE,M		3.20	5,901.72	224.48	6,129.40
XYLENE,O	110.86	2.50	3,085.03	1,446.55	4,644.94
XYLENE,P		0.20			0.20
XYLENES ISO	8,993.15	592.90	11,357.51		20,943.56

Table H-3: Pennsylvania Pollutant Codes

Code	Pollutant	CAS Number
ACETALDEHYDE	Acetaldehyde	75-07-0
ACROLEIN	Acrolein	107-02-8
ACRYLONITRIL	Acrylonitrile	107-13-1
ANTIMONY	Antimony	7440-36-0
ARSENIC	Arsenic	7440-38-2
BENZ(GHI)PE	Benzo(g,h,i)perylene	191-24-2
BENZENE	Benzene	71-43-2
BENZO(A)PYRE	Benzo(a)pyrene	50-32-8
BERYLLIUM	Beryllium	7440-41-7
BUTADIENE,13	1,3-Butadiene	106-99-0
CADMIUM	Cadmium	7440-43-9
CARBON TETRA	Carbon Tetrachloride	56-23-5
CHLOROFORM	Chloroform	67-66-3
CHROMIUM	Chromium	7440-47-3
COBALT	Cobalt	7440-48-4
COPPER	Copper	7440-50-8
DIBUTYL PHTH	Dibutyl Phthalate	84-74-2
DIEYLHEX PHT	Diethylhexyl Phthalate	117-81-7
ETHYLBENZENE	Ethylbenzene	100-41-4
ETHYLENE OXI	Ethylene Oxide	75-21-8
FORMALDEHYDE	Formaldehyde	50-00-0
GLYCOL ETHRS	Glycol Ethers	52286-19-8
HEXCLBENZENE	Hexachlorobenzene	118-74-1
LEAD	Lead	7439-92-1
MANGANESE	Manganese	7439-96-5
MERCURY	Mercury	7439-97-6
METHYLENE CL	Methylene Chloride	75-09-2
NAPHTHALENE	Naphthalene	91-20-3
NICKEL	Nickel	7440-02-0
PERC	Perchloroethylene	127-18-4
PHENOL	Phenol	108-95-2
STYRENE	Styrene	100-42-5
TCE,111	1,1,1-Trichloroethane	71-55-6
TOLUENE	Toluene	108-88-3
TRICHLORETHY	Trichloroethylene	79-01-6
VINYL CHLOR	Vinyl Chloride	75-01-4
XYLENE,M	m-Xylene	108-38-3
XYLENE,O	o-Xylene	95-47-6
XYLENE,P	p-Xylene	106-42-3
XYLENE,ISO	Xylenes Isomers	1330-20-7

Appendix I: Wisconsin Toxic Emissions Inventory

BACKGROUND

The State of Wisconsin conducted its statewide air toxic emissions inventory for the Great Lakes Air Toxic Emissions Inventory Project for calendar year 1997. With a 1997 population of 5,216,380, Wisconsin represents 5.6 percent of the total population of the overall Great Lakes region.

The sources inventoried were individual point sources, non-industrial area sources, and mobile on-road and non-road sources. The 1997 inventory update includes the addition of emissions from Human Cremation and Locomotives. Wisconsin followed the Air Toxic Emissions Inventory Protocol and the area source methodologies agreed upon by the projects Technical Steering Committee in developing its portion of the regional inventory. The Factor Information Retrieval System (FIRE 6.22) and the Reference Tables in the Regional Air Pollution Inventory Development System (RAPIDS) were also utilized in the inventory development. Emission summaries for point, area and mobile sources for the state of Wisconsin are provided following this portion of the report document.

DATA SOURCES

Point Source Emissions

Point source emissions information included in the Wisconsin inventory were collected by the Bureau of Air Management of the Wisconsin Department of Natural Resources (WDNR), as part of its annual air emissions inventory process. State regulation, ch. NR 438, Wis. Adm. Code, requires detailed annual emission reports from any source with total, actual, annual emissions above a reporting threshold. The reporting threshold varies for each of the air contaminants covered by the rule.

Table I-1: Reporting thresholds (in pounds per year) for each of the pollutants inventoried for this project.

Material Code	GLC Name	NR438 Name	THRESHOLD(LB)
ACENAPHTHEN	Acenaphthene		
ACENAPHTHYL	Acenaphthylene		
ACETALDEHYDE	Acetaldehyde	Acetaldehyde	6000
ACROLEIN	Acrolein	Acrolein	91
ACRYLAMIDE	Acrylamide	Acrylamide	105
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
CHROMIUM	Chromium	Chromium (metal)	179
CHROMIUM VI	Chromium	Chromium (VI) compounds, as Cr, water soluble	18
CHROMIUM VI	Chromium	Chromium (VI) compounds, as Cr, water insoluble	1
CHRYSENE	Chrysene	Benzo(a)phenanthrene	12
COBALT	Cobalt	Cobalt, as Co, metal, dust	18
COKE OVEN GS	Coke oven emissions	Coke oven emissions	12
COPPER	Copper	Copper, dust & mists, as Cu	368
DIBENZAHAN	Dibenz(a,h)anthracene	Dibenz(a,h)anthracene	12
DIBROMOET,12	Ethylene dibromide (Dibromoethane)	1,2-Dibromoethane (EDB)	125
DIBUTYL PHTH	Di-n-butyl phthalate	Dibutyl phthalate	1829
DICHLORETH12	Ethylene dichloride (1,2-Dichloroethane)	1,2-Dichloroethane (EDC)	12
DIEYLHEX PHT	Diethylhexyl phthalate (Bis(2-ethylhexyl)phthalate) (DEHP)	Di(2-ethylhexyl) phthalate (DEHP)	125
DIOCTYL PHTH	Di-n-octyl phthalate	n-Dioctyl phthalate	6000
ETHYLBENZENE	Ethylbenzene	Ethyl benzene	6000
ETHYLENE OXI	Ethylene oxide	Ethylene oxide	12
FLUORANTHENE	Fluoranthene	Benzo(j,k)fluorene	12
FLUORENE	Fluorene		
FORMALDEHYDE	Formaldehyde	Formaldehyde	125
GLYCOL ETHRS	Glycol ethers	Glycol ethers	6000
HEPTACHLOR	Heptachlor	Heptachlor	179
HEXCHLORETH	Hexachloroethane	Hexachloroethane	6000
HEXCL-13-BUT	Hexachlorobutadiene	Hexachlorobutadiene	46
HEXCLBENZENE	Hexachlorobenzene	Hexachlorobenzene (HCB)	12
HYDRAZINE	Hydrazine	Hydrazine and hydrazine sulfate	125
INDN(123CDPY	Indeno(1,2,3-cd)pyrene	Indeno(1,2,3-cd)pyrene	12
LEAD	Lead	Lead compounds	6000
MANGANESE	Manganese	Manganese, as Mn, dust and compounds	1114
MERCURY	Mercury, as Hg, alkyl compounds	Mercury, as Hg, alkyl compounds	3.7
MERCURY	Mercury, as Hg, aryl & inorganic compounds, all forms excpt alkyl	Mercury, as Hg, aryl & inorganic compounds, all forms excpt alkyl	37
MERCURY	Mercury, as Hg, vapor, all forms except alkyl	Mercury, as Hg, vapor, all forms except alkyl	18
METHENE(B)4-	Methylene diphenyl diisocyanate (MDI)	Methylene bisphenyl isocyanate (MDI)	44
METHOXYCHLOR	Methoxychlor	Methoxychlor	6000
METHYLENE CL	Methylene chloride (Dichloromethane)	Methylene chloride	6000
NAPHTHALENE	Naphthalene	Naphthalene	6000
NICKEL	Nickel	Nickel compounds other than nickel subsulfide, as Ni	125
NICKEL	Nickel subsulfide	Nickel subsulfide	12
PARATHION	Parathion	Parathion	37

PCBS	Total polychlorinated biphenyls (PCBs)	Polychlorinated biphenyls (PCB)	0.05
PCDD	Total polychlorinated dibenzodioxins (PCDDs)		
PCDF	Total polychlorinated dibenzofurans (PCDFs)		
PCP	Pentachlorophenol	Pentachlorophenol	179
PENTCLNITBEN	Pentachloronitrobenzene (quintobenzene)	Pentachloronitrobenzene (Quintobenzene) (PCNB)	6000
PERC	Tetrachloroethylene (Perchloroethylene)	Perchloroethylene	6000
PHENANTHRENE	Phenanthrene		
PHENOL	Phenol	Phenol	6000
PHOSGENE	Phosgene	Phosgene	147
PYRENE	Pyrene		
STYRENE	Styrene	Styrene, monomer	6000
TCDD,2378	2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)	2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.00005
TCDF,2378	2,3,7,8-tetrachlorodibenzo-furan (TCDF)		
TCE,111	Methyl chloroform (1,1,1-Trichloroethane)	Methyl chloroform (1,1,1-Trichloroethane)	6000
TOLUENE	Toluene	Toluene (Toluol)	6000
TOLUENE24DII	2,4-Toluene diisocyanate	Toluene-2,4-diisocyanate (TDI)	15
TRICHLORETHY	Trichloroethylene	Trichloroethylene	6000
TRICLPHN,245	2,4,5-Trichlorophenol	2,4,5-Trichlorophenol	6000
TRICLPHN,246	2,4,6-Trichlorophenol	2,4,6-Trichlorophenol	6000
TRIFLURALIN	Trifluralin	Trifluralin	6000
VINYL CHLOR	Vinyl chloride	Vinyl chloride	150
XYLENES ISO	Xylenes (includes o, m, and p)	Xylene, mixed isomers (Xylol)	6000

The point source data submitted by Wisconsin are for calendar year 1997 and include emission estimates as reported by all sources in the state. Toxic emission estimates are made by sources and then reported to the WDNR. Sources are required to report and certify actual, annual emissions in pounds per year, and identify the method used to make the estimate. These estimates account for any emission controls in place.

Wisconsin's annual emissions inventory is not limited to any particular type of industry or process. If the total emissions for a source exceed the reporting threshold for a given pollutant, the source is required to provide information on any process emitting any amount of that pollutant. This approach should cover most source industrial categories (SIC) and industrial process codes (SCCs). However, many SIC and SCC codes are not responsible for air emissions above any of the reporting thresholds.

For the 1997 Great Lakes Inventory, point source data have been added from the Environmental Protection Agency's Community Right to Know Toxic Release Inventory (TRI). The TRI data were added to include some pollutants not reported to the state inventory because emission levels were below the reporting threshold or to include pollutants that may have been reported in the state inventory as part of volatile organic compounds (VOC), but were reported to TRI as individual toxics.

Area Source Emissions

Emissions from fifteen area sources were inventoried for the 1997 inventory project. These area sources are: Agricultural Pesticides, Architectural Surface Coatings, Auto Body Refinishing, Consumer and Commercial Solvents, Dry Cleaning, Fuel Marketing, Graphic Arts, Human Cremation, Industrial Surface Coatings, Landfills, Publicly Owned Treatment Works (POTW), Residential Fuel Combustion, Residential Wood Combustion, Solvent Cleaning and Traffic Markings. Where appropriate, area source estimates were reconciled with the state point source inventory.

The 1997 update included the following changes from the 1996 inventory: the addition of the Human Cremation source category, the use of a revised methodology for POTW, development of state specific emission factors for Industrial Surface Coatings operations, revised emission factors for Residential Fuel Combustion, revised list of pollutants for Gasoline Marketing, and improved county activity data for Traffic Markings.

The following subsections describe the general procedures used to calculate each source type as well as any deviations from the standard methodologies set by the project's Technical Steering Committee. 1997 county population data were obtained from Bureau of Health Information of the Department of Health and Family Services (http://www.dhfs.state.wi.us/population/index.htm). SIC and county specific employment numbers were estimated using a combination of the 1997 statewide employment numbers for major SICs reported by the Wisconsin Department of Workforce Development and the 1997 Wisconsin Business Patterns published by the U.S. Department of Commerce, Bureau of the Census.

Agricultural Pesticides

The SIC code for this category is 0115 (Agricultural Production Crops, Corn). Atrazine emissions were calculated using a per acre emission factor. Atrazine is applied exclusively in corn crops. The information on state total acres of corn and the percent of corn crops to which Atrazine is applied was obtained from the USDA (http://usda.mannlib.cornell.edu/usda). The County specific corn acreage was obtained from the 1997 Census of Agriculture, which was carried out by the National Agricultural Statistics Service of USDA (http://www.nass.usda.gov/census). Hexachlorobenzene emissions were derived from atrazine emissions following the 1996 National Toxics Inventory (NTI) methodology for agricultural pesticides.

Architectural Surface Coating

Emissions were calculated by speciating each toxic from the total VOC content of all surface coatings used. The total amounts of coatings used were estimated using a per capita emission factor.

Auto Body Refinishing

The SIC for this category is 7532 (Top and Body Repair and Paint Shops). Emissions were calculated by speciating each toxic from total VOC emissions. VOC numbers for this source category were calculated using a per employee factor.

Consumer and Commercial Solvents

Emissions were calculated by multiplying the estimated 1997 county population by a per capita emission factor.

Dry Cleaning

The SICs for this category are 7211 (Power Laundries, Family, and Commercial) and 7215 (Coin-operated Laundries and Dry Cleaning). This category included commercial and coin operated dry cleaners. Perchloroethylene emissions were calculated from a per employee emission factor. The calculated emissions were reduced by 30% to account for state regulations for this source type.

Fuel Marketing

The SIC for this category is 5541 (Gasoline Service Stations). Emissions were calculated using VOC speciation and toxic specific emission factors. VOC emission factors were based on units of gasoline dispensed. County gasoline usage was derived from population, statewide gasoline consumption, and county vehicle miles traveled (VMT). Stage 1 calculations for all counties, except 20 counties in or around the ozone non-attainment area of the state, where controlled submerge filling is required, included 80% uncontrolled submerge filling and 20 % uncontrolled splash filling. Information on tank filling procedures was obtained from the state's Liquid Underground Storage Tank (LUST) Program. In addition, a 15% reduction was applied to VOC emissions from transit losses, tank breathing and spillage to account for the effect of gasoline vapor pressure regulations. A rule effectiveness of 90 % and rule penetration of 100% was assumed for Stage I. This resulted in an overall control efficiency of 96.22%. Stage 2 (vehicle gas tank filling) controls were applied to a 9 county ozone non-attainment area

of the state. This included 95% control with rule effectiveness and rule penetration of 90%. 1,3-Butadiene and 1,2-Dibromoethane were not inventoried for this category. These pollutants were erroneously included in the 1996 inventory.

Graphic Arts

The SIC for this category is 27%% (Printing, Publishing, and Allied Industries). Emissions were calculated by speciating each toxic from the total VOC emissions. A VOC emission factor of 70.1 LB/employee/year was developed using emissions information from the 1996 and 1997 Wisconsin inventory for small point sources (emissions less than 5 TPY) in SIC group 27%%.

Human Cremation

The SIC for this category is 7261 (Funeral Service and Crematories). For this category, we followed the methodology described in the 1996 National Toxics Inventory (http://www.epa.gov/ttn/chief/nti/96arerpt.pdf). Emissions were calculated using emission factors based on the weight cremated. The number of bodies cremated by county was obtained from Department of Health and Family Services, Wisconsin Bureau of Health Information. The allocation of emissions to the county level is not accurate for this source category. The numbers of bodies cremated in a particular county indicate the final disposition of the body, and not necessarily the location where the cremation took place. Crematories are not regulated in the state; therefore, the exact location of crematories is unknown.

Industrial Surface Coating

The SICs for this category are 2426-2429, 243-245, 2499, 25, 26, 341, 3479, 35, 3612, 3357, and 37. SIC specific, per employee VOC emission factors were derived using emissions information from the 1997, 1998 and 1999 WDNR air emissions inventory for industrial point sources following guidance from the EIIP documentation. Toxic emissions were calculated by speciating each toxic from the total VOC emissions. VOC numbers for all, except three AMS groups from this source category, were calculated using a per employee emission factor. VOC for the remaining three AMS groups were calculated using a per capita emission factor.

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

The SIC for this category is 4952 (Sewerage Systems). For this category, a methodology developed by the Minnesota Pollution Control Agency was used. The methodology assumes a typical POTW configuration and related processes. Emissions are calculated using generic emission factors and effluent wastewater flow data. Wastewater data were obtained from the WDNR, Bureau of Integrated Science Services.

Residential Fuel Combustion

Emissions were based on units of fuel used. Four fuel types were included with this source category: coal, distillate fuel oil, liquefied petro gas, and natural gas. Fuel use data were obtained from the 1998 Wisconsin Energy Statistics published by the Wisconsin Energy Bureau, Department of Administration. Fuel was apportioned to the county level using the fraction of total households for each county.

Residential Wood Combustion

Calculated emissions were based on units of wood fuel used. Emission factors were available for three wood burning stove types including conventional, catalytic, and non-catalytic. Wisconsin chose to apportion the 1997 county specific wood fuel use data obtained from the 1998 Wisconsin Energy Statistics into the three wood burning types based on county specific percentages. These percentages were developed from data obtained in the Residential Fuelwood Consumption and Production in Wisconsin, 1994 developed by the United States Department of Agriculture, Forest Service.

Solvent Cleaning

The SICs for this category are 25, 265, 33-39, 3465, 3711, 3713, 3714, 3861, 417, 423, 551, 552, 554-556, and 753. Emissions were calculated by speciating each toxic from the total VOC emissions. VOC emissions were calculated using a per employee emission factor.

Traffic Markings

The SIC for this category is 1611 (Highway and Street Construction). Emissions were based on total traffic paint used in each county, the air toxic volume percent in the paint used, and the air toxic density. A control efficiency of 26.8% and a rule effectiveness of 75.9% were applied to nine counties in the ozone non-attainment area. These counties are Kenosha, Kewaunee, Manitowoc, Milwaukee, Ozaukee, Racine, Sheboygan, Waukesha and Washington. Total traffic paint used in each county was calculated by apportioning the gallons of paint used in each traffic district, to the mileage percentage of paved roads in each county within the traffic district.

The availability of paint use data at the traffic district level resulted in better emissions allocation than that for the 1996 inventory. Information on the amount of paint applied was obtained from the Wisconsin Department of Transportation. The assumption was made that the reapplication rate was 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.

Mobile Source Emissions

On-Road Mobile Sources

WDNR calculated estimates of 1997 annual total organic gases (TOG) and PM10 emissions for each of Wisconsin's 72 counties. Emissions were broken down into tailpipe exhaust hydrocarbon (EXHC) and all evaporative hydrocarbon (EVHC). Emissions from vehicle refueling were calculated separately. PM10 emissions were divided into tailpipe exhaust emissions (EXPM), break-wear emissions (BW10), and tire-wear emissions (TW10). Fugitive dust emissions were not included. Within each of these counties, the emission estimates included individual emission estimates for each of the eight types of highway vehicles. These types are:

Light-Duty Gasoline Vehicles (passenger cars) [LDGV]
Light-Duty Gasoline Trucks 0-6000 lbs. gross vehicle weight rating [LDGT1]
Light-Duty Gasoline Trucks 6001-8500 lbs. gross vehicle weight rating [LDGT2]
Heavy-Duty Gasoline Vehicles [HDGV]
Light-Duty Diesel Vehicles [LDDV]
Light-Duty Diesel Trucks [LDDT]
Heavy-Duty Diesel Vehicles [HDDV]
Motorcycles [MC]

In general, the emission estimates were obtained by multiplying an activity factor by an emission factor. The activity factor was VMT. The TOG emission factors were obtained from the U.S. EPA's MOBILE5a model, 26-Mar-93. PM10 emission factors were obtained from U.S. EPA's PART5 model, revised 02-24-95.

A more detailed description of the VMT activity factor and the MOBILE5a and PART5 emission factor modeling follows.

VMT Activity Factor

The Southeastern Wisconsin Regional Planning Commission (SEWRPC) provided estimated 1996 VMTs for each of the seven counties in their planning region: Kenosha, Milwaukee, Ozaukee, Racine, Walworth, Washington, and Waukesha Counties. These estimates were based on traffic counts conducted throughout SEWRPC's travel network as well as SEWRPC's estimates of off-network VMT (about 10% of the total VMT). The Wisconsin Department of Transportation (WDOT) provided estimated 1997 VMTs for the remaining 65 counties of Wisconsin. These estimates were obtained from the Highway Performance Monitoring System (HPMS), a nationwide system for compiling transportation data. The WDNR allocated the VMT to the eight vehicle types based on:

(1) Vehicle type distributions compiled by SEWRPC.
(2) Vehicle type distributions compiled by WDOT (for HPMS).
(3) Statistical summaries of the number of LDGVs, LDGT1s, and LDGT2s tested in Wisconsin's motor vehicle inspection and maintenance (I/M) program.

Table I-2: Summary of the Wisconsin 1997 Statewide VMT Estimates

Vehicle Type	Average Daily VMT	Annual VMT	VMT Distribution
LDGV	91,658,733	33,455,437,456	62.3%
LDGT1	31,996,420	11,678,693,231	21.7%
LDGT2	10,166,412	3,710,740,291	6.9%
HDDV	8,146,862	2,973,604,532	5.5%
HDGV	3,130,771	1,142,731,326	2.1%
LDDV	1,059,661	386,776,285	0.7%
MC	752,930	274,819,540	0.5%
LDDT	294,412	107,460,526	0.2%
All	147,206,200	53,730,263,188	100.0%

SEWRPC and WDOT also provided monthly VMT adjustment factors, which allowed WDNR to calculate VMTs for each month of the year.

Additionally, for each of the seven SEWRPC counties, SEWRPC provided a distribution of the county total VMT into 14 speed classes (12 speed classes for travel on freeways, the same 12 speed classes for travel on standard arterials, and 2 additional speed classes for travel on the off-network roadways). And, for each of the 65 non-SEWRPC counties, WDOT provided VMT estimates for each of the 12 HPMS functional classes.

MOBILE5a Emission Factors for TOG

The WDNR calculated sets of MOBILE5a TOG emission factors for the following four regions of the state:

(1) Six Severe Nonattainment Counties for Ozone: Kenosha, Milwaukee, Ozaukee, Racine, Washington, and Waukesha Counties. (These six counties, all in the SEWRPC planning region, are subject to both a vehicle inspection and maintenance (I/M) program and to federal reformulated gasoline (RFG).)
(2) Walworth County. (This is the only county in the SEWRPC planning region that is not subject to I/M and not subject to RFG.)
(3) Sheboygan County. (This is the only county outside of the SEWRPC planning region that is subject to I/M. It is not subject to RFG.)
(4) Remaining 64 Counties of Wisconsin. (These counties, all outside of the SEWRPC planning region, are not subject to I/M and are not subject to RFG.)

For regions (1) and (2), which comprise the seven SEWPPC counties, WDNR computed month-specific and vehicle-type-specific emission factors for the 14 different speed classes provided by SEWRPC. And, for regions (3) and (4), which comprise the 65 non-SEWRPC counties, WDNR computed month-specific and vehicle-type-specific emission factors for 12 different speeds provided by WDOT (one speed for each of the 12 HPMS functional classes).

For each of the eight vehicle types within each of the 72 counties, WDNR then computed final monthly emission factors for each of the 12 months by taking a VMT-weighted

average of the month-specific emission factors for each of the different speeds. These monthly emission factors were then multiplied by the monthly VMT to obtain monthly emission estimates for each of the eight vehicle types within each of the 72 counties. These monthly emission estimates were then summed to obtain annual emission estimates.

PART5 Emission Factors for PM10

The WDNR's methodology for calculating PM10 emission factors was consistent with its methodology for calculating TOG emission factors described above. Since the PART5 model required a smaller set of inputs than MOBILE5a, some of the complexities of the VOC emission factor calculation were not necessary in calculating the PM10 emission factors. For example, the calculation of monthly emission factors was not necessary since the PART5 model does not include inputs for the modeling parameters that vary significantly by month of the year (e.g., ambient temperature and fuel volatility).

Toxic Emission Estimation

Emissions were calculated by speciating the relevant GLC toxic pollutants from the TOG and PM10 emission estimations. VMT emission factors were used for four pollutants (acetaldehyde, benzene, formaldehyde, and 1,3 butadiene). These emission factors were obtained from the Wisconsin portion of the Mobile5 run for the 1996 National Toxics Inventory. For accurate toxics estimations TOG and PM10 data were broken out into the component parts. For TOG the components are tailpipe exhaust (EXHC) and all evaporative emissions (EVHC) except emission from vehicle refueling. PM10 components included tailpipe exhaust emissions (EXPM), break-wear emissions (BW10), and tire-wear emissions (TW10). Fugitive dust emissions were not included.

Off-Road Sources

EXHC and PM10 Estimation

EXHC and PM10 data were calculated from the application of an emission factor based on horsepower hour (HP-HR), for which default data was used based on equipment type, and equipment population. The evaporative component of the VOC data (EVHC) was not available. For off-road sources EXHC represents the total VOC emissions.

Equipment Population

Equipment population is defined by the total number of a certain type of equipment being use in a particular county. Some examples of equipment types are lawnmowers, outdoor grills, construction equipment, chain saws, and off-road recreational equipment. Equipment population data were obtained from the 1992 USEPA publication/database called Methodology to Calculate Non-Road Emissions Inventories at the County and Sub-County Level. The database had equipment population activity for the 6 county area (Kenosha, Milwaukee, Ozaukee, Racine, Washington, and Waukesha Counties), as well as Sheboygan County. The equipment populations were estimated from surveys on suppliers and users of non-road equipment. We then apportioned the equipment to rest of the counties using per capita estimates. Estimates of lawnmowers were corrected using housing information. Estimates of snowmobiles were adjusted according to miles of snowmobile trails per county. This state specific equipment population was incorporated

using intelligent import Method I. Intelligent import Method I allows the user to supply SCC specific activity data by season for the purposes of emission estimation.

Aircraft

Toxic pollutants were speciated from TOG data estimations for each aircraft type. A more detailed description of the components and procedures used follows.

TOG Estimation

TOG data were calculated from the application of an emission factor based on time-in-mode (TIM), the amount of time spent in each phase of the lift off and landing cycle for a particular aircraft, and the number of landings and take-offs for the same aircraft type (LTO). Default data were used for the TIM estimates. LTO data for each county were obtained from the US Department of Transportation, Bureau of Transportation Statistics; 1996 Airport Activity Statistics document. TOG estimates were incorporated using intelligent import Method II. Intelligent import Method II allows the user to supply pre-calculated TOG estimates by aircraft type for emission estimation. The 1997 estimates were calculated by applying a growth factor of six percent to the LTO data for 1996. The LTO growth factor was obtained from the Wisconsin Department of Transportation, Aeronautics Program.

Locomotives

The SIC for this category is 1611. For this category, we adopted the 1996 National Toxics Inventory methodology (http://www.epa.gov/ttn/chief/nti/nonrdrpt.pdf). Toxic emissions were calculated by speciating each toxic from VOC and PM10 emissions. The VOC/PM10 emissions for each county were calculated by multiplying the county consumption of distillate fuel oil on railroad by a VOC/PM10 emission factor per ton of distillate fuel oil consumed. The county distillate fuel oil consumption was calculated by apportioning the total state consumption based on railroad mileage in each county. The state fuel consumption data were obtained from the 1997 Wisconsin Energy Statistics published by the Wisconsin Energy Bureau, Department of Administration. The railroad mileage was obtained from the Wisconsin Department of Transportation. The VOC/PM10 emission factors were calculated by dividing the national locomotive VOC/PM10 emissions by the total national consumption of distillate on railroad given in the 1996 NTI.

INFORMATION

For more information about Wisconsin's air toxics inventory, please contact:

Mr Orlando Cabrera-Rivera
Bureau of Air Mgmt.
Wisconsin Dept. of Natural Resources
P.O. 7921, 101 S. Webster St. - 7th Floor
Madison, WI 53707

(P) 608-267-2466
(F) 608-267-0560
(E) cabreo@mail01.dnr.state.wi.us

Table I-3: Wisconsin - Statewide Summary of Emissions (lb./yr.)

	Point Sources	Area Sources	Mobile Sources	Nonroad Sources	Total
ACENAPHTHEN		17,472.34			17,472.34
ACENAPHTHYL		222,074.88			222,074.88
ACETALDEHYDE	394,184.93	234.84	955,316.20	1,185,297.87	2,535,033.84
ACROLEIN	10,817.18	3,329.78	134,177.86	106,728.48	255,053.29
ACRYLAMIDE	10.00				10.00
ACRYLONITRIL	1,255.37	3,074.02			4,329.39
ANTHRACENE		20,924.57	63.96		20,988.53
ANTIMONY	5,114.67	0.36			5,115.03
ARSENIC	4,982.87	415.58	0.18	5.26	5,403.89
ATRAZINE		349,184.80			349,184.80
BENZ(A)ANTHR	64.85	27,849.11	892.00		28,805.96
BENZ(GHI)PE		17,513.98	1,757.42		19,271.40
BENZENE	194,539.92	3,116,537.90	9,152,413.43	6,612,733.44	19,076,224.69
BENZO(A)PYRE	83.67	9,078.56	529.21		9,691.44
BENZO(B)FLUO	0.60	9,332.10	461.07		9,793.78
BENZO(K)FLUO	30.33	3,201.30	495.16		3,726.78
BERYLLIUM	657.41	62.94			720.35
BUTADIENE,13	234.00		895,591.86	836,263.03	1,732,088.89
CADMIUM	2,319.43	250.10			2,569.53
CARBON TETRA	3,412.66	6,976.30			10,388.96
CHLOROFORM	400,594.84	42,734.47			443,329.31
CHROMIUM	35,177.24	339.92	707.41	97.97	36,322.56
CHRYSENE		20,938.17	678.85		21,617.01
COBALT	1,214.79	15.42			1,230.21
COPPER	33,926.80	125.59		24,105.85	58,158.24
DIBENZAHAN		4,014.99	99.49		4,114.48
DIBROMOET,12		0.02			0.02
DIBUTYL PHTH	11,401.32	226,796.57			238,197.89
DICHLORETH12	692.32	10,697.94			11,390.26
DIEYLHEX PHT	4,980.73				4,980.73
DIOCTYL PHTH	7,180.00	1.46			7,181.46
ETHYLBENZENE	310,969.57	699,118.40	8,191,290.19	2,097,311.40	11,298,689.56
ETHYLENE OXI	10,229.59	78,359.49			88,589.08
FLUORANTHENE		26,908.07	587.61		27,495.67
FLUORENE		35,047.32			35,047.32
FORMALDEHYDE	313,332.79	52,866.24	2,116,349.00	2,594,504.38	5,077,052.41
GLYCOL ETHRS	2,735,304.08	245,083.03			2,980,387.12
HEXCLBENZENE		16.30			16.30
INDN(123CDPY	0.01	3,215.48	100.69		3,316.18
LEAD	19,473.31	411.34		4,881.06	24,765.71
MANGANESE	148,885.79	523.82	1,188.71	172.48	150,770.79
MERCURY	5,125.85	99.50	144.27	94.71	5,464.33
METHENE(B)4-	1,251.19				1,251.19
METHYLENE CL	1,113,990.20	1,783,382.81			2,897,373.01
NAPHTHALENE	90,433.50	983,182.33	4,134.74	313,513.43	1,391,264.00
NICKEL	32,951.72	728.59	661.52	121.67	34,463.50
PCBS	238.12				238.12
PERC	134,437.78	2,628,193.96			2,762,631.74
PHENANTHRENE		370,487.64	210.47		370,698.11
PHENOL	159,691.06	0.32	1,747.45		161,438.83
PHOSGENE		0.19			0.19
PYRENE		29,156.04	377.13		29,533.16
STYRENE	1,234,960.22	19,837.47	442,444.23	663,738.52	2,360,980.44
TCDD,2378	0.10				0.10
TCE,111	32,475.91	8,372,218.68			8,404,694.59
TOLUENE	3,144,835.74	11,760,032.69	33,350,749.77	14,497,055.44	62,752,673.64
TOLUENE24DII	12,434.69	676.45			13,111.14
TRICHLORETHY	550,754.53	6,014,142.75			6,564,897.27
VINYL CHLOR	127.47	116,395.50			116,522.97
XYLENE,M	24,024.79	158,024.66		4,206,597.05	4,388,646.49
XYLENE,O	9,850.37	569,170.89	1,381.63	2,238,264.50	2,818,667.39
XYLENE,P	6,525.60	106,960.29			113,485.89
XYLENES ISO	3,244,528.50	8,580,990.76	36,320,539.06	8,189,004.28	56,335,062.60

Table I-4: Wisconsin Pollutant Codes

Code	Pollutant	CAS Number
ACENAPHTHEN	Acenaphthene	83-32-9
ACENAPHTHYL	Acenaphthylene	208-96-8
ACETALDEHYDE	Acetaldehyde	75-07-0
ACROLEIN	Acrolein	107-02-8
ACRYLAMIDE	Acrylamide	79-06-1
ACRYLONITRIL	Acrylonitrile	107-13-1
ANTHRACENE	Anthracene	120-12-7
ANTIMONY	Antimony	7440-36-0
ARSENIC	Arsenic	7440-38-2
ATRAZINE	Atrazine	1912-24-9
BENZ(A)ANTHR	Benz(a)anthracene	56-55-3
BENZ(GHI)PE	Benzo(g,h,i)perylene	191-24-2
BENZENE	Benzene	71-43-2
BENZO(A)PYRE	Benzo(a)pyrene	50-32-8
BENZO(B)FLUO	Benzo(b)fluoranthene	205-99-2
BENZO(K)FLUO	Benzo(k)fluoranthene	207-08-9
BERYLLIUM	Beryllium	7440-41-7
BUTADIENE,13	1,3-Butadiene	106-99-0
CADMIUM	Cadmium	7440-43-9
CARBON TETRA	Carbon Tetrachloride	56-23-5
CHLOROFORM	Chloroform	67-66-3
CHROMIUM	Chromium	7440-47-3
CHRYSENE	Chrysene	218-01-9
COBALT	Cobalt	7440-48-4
COPPER	Copper	7440-50-8
DIBENZAHAN	Dibenzo(a,h)anthracene	53-70-3
DIBROMOET,12	1,2-Dibromoethane	106-93-4
DIBUTYL PHTH	Dibutyl Phthalate	84-74-2
DICHLORETH12	1,2-Dichloroethane	107-06-2
DIEYLHEX PHT	Diethylhexyl Phthalate	117-81-7
DIOCTYL PHTH	Di-n-octyl Phthalate	117-84-0
ETHYLBENZENE	Ethylbenzene	100-41-4
ETHYLENE OXI	Ethylene Oxide	75-21-8
FLUORANTHENE	Fluoranthene	206-44-0
FLUORENE	Fluorene	86-73-7
FORMALDEHYDE	Formaldehyde	50-00-0
GLYCOL ETHRS	Glycol Ethers	
HEXCLBENZENE	Hexachlorobenzene	118-74-1
INDN(123CDPY	Indeno(1,2,3-c,d)pyrene	193-39-5
LEAD	Lead	7439-92-1
MANGANESE	Manganese	7439-96-5
MERCURY	Mercury	7439-97-6
METHENE(B)4-	Methylene(b)4-phenylisocyanate	101-68-8
METHYLENE CL	Methylene Chloride	75-09-2
NAPHTHALENE	Naphthalene	91-20-3
NICKEL	Nickel	7440-02-0
PCBS	PCBs	1336-36-3
PERC	Perchloroethylene	127-18-4
PHENANTHRENE	Phenanthrene	85-01-8
PHENOL	Phenol	108-95-2
PHOSGENE	Phosgene	75-44-5
PYRENE	Pyrene	129-00-0
STYRENE	Styrene	100-42-5
TCDD,2378	2,3,7,8-Tetrachlorodibenzodioxin	1746-01-6
TCE,111	1,1,1-Trichloroethane	71-55-6
TOLUENE	Toluene	108-88-3
TOLUENE24DII	2,4-Toluene diisocyanate	584-84-9
TRIFULURALIN	Trifluralin	1582-09-8
VINYL CHLOR	Vinyl Chloride	75-01-4
XYLENE,M	m-Xylene	108-38-3
XYLENE,O	o-Xylene	95-47-6
XYLENE,P	p-Xylene	106-42-3
XYLENES ISO	Xylene Isomers	1330-20-7

Appendix J: Architectural Surface Coating

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.

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

Air Toxin (TOX)		Speciation (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

EMISSION FACTOR

The emission factors used in calculating the VOC emissions were acquired from the STAPPA-ALAPCO-EPA EIIP (Emission Inventory Improvement Program), Volume III, July 1997.

Since resources may be unavailable for accounting actual usage of architectural coatings in a given state, the 1996 population census can be used to determine the paint usage in each county. The paint usage is also acquired from EIIP, July 1997 and this data is based upon the U.S. Bureaus of Census MA28F - Paint and Allied Products - a compilation of national usage data.

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

Paint Type	VOC Emission Factor (lb./gal)	Usage Factors (gal/person)
Solvent-Based Paint	3.87	0.59
Water-Based Paint	0.74	1.82

VOC EMISSION ESTIMATE

The following equations provide an estimation of VOC emissions using the population data, the paint usage factors and the appropriate emission factors.

VOC_{wb} = Population * 1.82 gal/person * (0.74 lb./gal)
VOC_{sb} = Population * 0.59 gal/person * (3.87 lb./gal)

where,

VOC_{wb} = Total VOC emitted from water-based paint for a county
VOC_{sb} = Total VOC emitted from solvent-based paint for a county

Using the estimated VOC emissions calculated above for each paint type, the TOX emissions from solvent-based and water-based paints were calculated by applying the appropriate speciation profiles from Table J-1 for the two paints in the following equation.

E = VOC * TOX/VOC

where,

E = Emissions of a pollutant, lb./yr.
VOC = Total VOC for a county for each paint type, lb./yr.
TOX/VOC = Ratio of TOX/VOC for each paint type, % by weight

REFERENCES

Environmental Protection Agency (EPA). *STAPPA-ALAPCO-EPA Emission Inventory Improvement Program (EIIP).* Volume III - Area Sources Preferred and Alternative Methods. July 1997.

California Air Resources Board (CARB). 1991. *Air Resources Board Speciation Manual Identification of Volatile Organic Compound Species Profiles*. Emission Inventory Branch. Profile 783. 1991.

Environmental Protection Agency (EPA). 1991. *Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone*. Volume 1. General Guidance for Stationary Sources. Research Triangle Park, NC. May 1991. 234P.

Appendix K: Asphalt Paving

OVERVIEW

Based on available data and discussions with state and industry professionals in the field of asphalt paving, the State of Michigan has concluded that the area source category of asphalt paving is not a significant source of HAPS. Furthermore, the State of Michigan suggests that the Regional Inventory not spend any more time on this category. The basis for these conclusions is detailed below.

The Michigan Dept. of Transportation (MDOT) indicated that they used 4,595,000 gallons of emulsified asphalt in 1997. MDOT, and the county departments of transportation, only use cutback asphalt for filling potholes but the quantity is not tracked. Michigan DEQ, Air Quality Division (AQD) staff decided that they would apportion the state emulsified asphalt data to the county level via Vehicle Mile Traveled (VMT) estimates.

AQD staff contacted the Asphalt Institute, but opted not to use their data. They could provide a statewide total estimate for cutback and emulsified asphalts, but only if Michigan purchased their asphalt usage report ($1,000.00 for a one year volume). Accordingly, AQD staff considered this source of information to be unfeasible.

One possible source of information is the Department of Energy, Energy Information Administration (EIA) at www.eia.doe.gov/bookshelf/consumer.html. One of their reports, the *State Energy Data Report*, has consumption data for each state. This includes asphalt and road oils. The report listed 7,777,000 barrels of asphalt and road oil in Michigan. AQD staff contacted the EIA to determine if a breakdown of the state number was available, but the data is only available as a combined number. Additionally, the data is based on U.S. refinery production totals, allocated to the state level based on state asphalt sales data from the Asphalt Institute.

The AQD considered the asphalt usage data provided by MDOT to be preferable, as it is data specific to the state of Michigan.

For information on VOCs and HAPs from emulsified asphalt, MDOT staff recommended that the AQD contact a chemical engineer from Bituminous Products, a company which supplies emulsified asphalt to MDOT.

Mark Homer, of Bituminous Products, informed AQD staff that there are no VOCs or HAPs in emulsified asphalt. The emulsion is an aqueous solution composed of water, asphalt, and an emulsifier (soap) which keeps the solution in suspension. The asphalt has no vapor pressure when emulsified. Water itself is the only volatile component in the emulsion.

Mr. Homer indicated that the asphalt industry as a whole has made a major transition to emulsified asphalt, but cutback solvents are still used in smaller quantities for specific instances, such as priming wet rock or winter application of asphalt. Based on his recommendation, and the available data, AQD staff feels that the area source category of asphalt paving is not a significant contributor to toxics in the State of Michigan.

Below, the AQD has provided an evaluation of EIIP alternative methods deemed most feasible, for any states or provinces that wish to continue with an inventory based on asphalt paving.

Alternative Method One

This method requires the surveying of a representative set of DOTs, and was considered too time and labor intensive for this study.

Alternative Method Two

This method involves the use of existing state asphalt usage data. This data may be obtained from the Asphalt Institute (http://www.asphaltinstitute.org) or other sources. First the state level data must be apportioned to the county level as in alternative method one, through the use of highway mileage, vehicle miles traveled, or other methods.

Because state usage data from the Asphalt Institute do not distinguish among the types of cutback asphalt or emulsified asphalt used, a minimum amount of information will still be needed from representative state and local DOTs. This information can be collected by telephone, and must determine: (1) the percent of each asphalt type used; (2) their typical diluent contents; and (3) when the types are used (for ozone inventories). Table 17.5-3, an example telephone survey is reproduced below.

Table K-1: EIIP Table: 17.5-3 - Example Telephone Survey Form

Asphalt Type	Cure/Set Rate	Estimated % of Total Usage	Approximate Diluent Content	Months of the Year Used [a]
Cutback Asphalt	rapid			
	rapid			
	medium			
	medium			
	slow			
	slow			
Emulsified Asphalt	rapid			
	rapid			
	medium			
	medium			
	slow			
	slow			

[a] Only needed for ozone inventories

Once this information has been obtained, equations from Alternative Method One can be used to estimate emissions.

Alternative Method Three

This is the least preferred method. It involves the application of volume based emission factors to total asphalt usage. These emission factors are found in Table 17.5-4. The factors were prepared for EPA's document, *Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone*, Volume 1. The EIIP guidance indicates assumptions made in this method may overestimate the emissions.

Data on asphalt use must either be requested from county DOTs, or state usage data from sources such as the Asphalt Institute must be apportioned to the county level as in Alternative Method Two.

Table K-2: EIIP Table 17.5-3 - Asphalt Paving Emission Factors

Asphalt Type	Volume-based [a] (lb VOC/Barrel Asphalt)
Cutback asphalt	88
Emulsified asphalt	9.2

[a] Assuming that the density of asphalt is similar to that of water, 8.34 lbs/gal, one barrel (42 gal) of asphalt weighs 350 lbs.

Once the data have been collected, emissions are estimated as follows.

Equation 1:

$$\text{Mass Emissions} = \text{Volume Usage Emission Factor} * \text{Volume Used (Barrels of Asphalt)}$$

Hazardous Air Pollutants

The simplest way to collect the necessary composition information to determine HAP emissions is for the inventory preparer to request material safety data sheets (MSDS) or manufacturer technical data sheets (TDSs) from the DOTs receiving the survey. The weight percent of each HAP is taken from the MSDS or TDS, then is multiplied by the weight of VOC emissions estimated by any of the alternative methods, to determine the speciated emissions (see Equations 17.4-8 and 17.4-9).

Equation 2:

$$\text{Mass Emissions for Each HAP} = \text{VOC Mass Emissions} * \text{Weight Fraction of Each HAP}$$

Equation 3:

$$\text{Weight Fraction of Each HAP} = \frac{\text{Weight of Each HAP}}{\text{Weight of VOC Emitted}}$$

As an alternative, the inventory preparer may solicit HAP information from local vendors or a few representative DOTs to establish typical compositions for the asphalt types used in the inventory area. This information will then be applied to the VOC estimate to determine the speciated HAP emissions.

REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). 1996. *Compilation of Air Pollutant Emission Factors - Volume I: Stationary Point and Area Sources. Fifth Edition and Supplements, AP-42.* U.S. EPA, Office of Air Quality Planning and Standards. Research Triangle Park, NC.

Homer, Mark. Chemical Engineer, Bituminous Products. Personal communication, March 30, and April 4, 2000.

Mayes, Gary. Michigan Department of Transportation. Personal communication, March 1, 2000.

Parker, Don. Michigan Department of Transportation. Personal communication, March 30, 2000.

Environmental Protection Agency (EPA). *Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone.* Volume 1. General Guidance for Stationary Sources. Research Triangle Park, NC. May 1991.

Environmental Protection Agency (EPA). *STAPPA-ALAPCO-EPA Emission Inventory Improvement Program (EIIP).* Volume III - Area Sources Preferred and Alternative Methods. Chapter 17, Asphalt Paving. October 1998.

Appendix L: Autobody Refinishing

The following is a summary of preferred and alternative methodologies for estimating toxic emissions from the auto body refinishing area source category. All quotes and information contained within are from the source, Emission Inventory Improvement Program, Volume 3, Chapter 11, *Auto Body Refinishing*.

OVERVIEW

"Auto body refinishing is the repairing of worn or damaged automobiles, light trucks, and other vehicles, and refers to any coating applications that occur subsequent to those at original equipment manufacture (OEM) assembly plants." "This source category covers solvent emissions from the refinishing of automobiles, including paint solvents, thinning solvents, and solvents used for surface preparation and cleanup." Auto body refinishing also, can be both an area and a point source (SIC 7532). Therefore, states will need to adjust their area source estimations by removing total point source emissions.

ASC: 2401005000

VOC emissions are influenced by

1) VOC content of the product used
2) Transfer efficiency of spraying equipment
3) Cleanup/housekeeping practices
4) Regulations

METHODOLOGY

Table L-1: Descriptions of Different Methods for Calculating Emissions

Methods	Description
Preferred Method – Survey	Gather detailed information from auto body refinishing operations. This may include information on activity (number of partial/complete refinishing jobs performed, temporal resolution of activity, etc.), number of employees, product use by product category, type of equipment used, pollution control measures used, business projections, etc. These data are then reviewed and compiled to develop an accurate description of the auto body refinishing activity in the survey area. Emission factors can be developed from specific product data such as Material Data Safety Sheets or can be based on typical VOC content ranges for product types.
Alternate Method 1 - Apportion National Data	Use national data on the number of refinishing jobs performed in year, apportion to inventory area by population to estimate activity. Use estimate of typical amount of surface preparation, coating, and cleaning products and typical VOC contents to estimate emissions.
Alternate Method 2 - Per Employee Factor	Use per employee emission factor and number of employees in inventory area to estimate emissions.
Alternate Method 3 - Per Capita Factor	Use per capita emission factor and population in inventory area to estimate emissions.

Table L-2: Data Elements Needed for Each Method

Data Element	Method			
	Preferred[a]	Alt 1[b]	Alt 2[c]	Alt 3[d]
Number of refinish jobs completed	x	x		
Type and amount of product used by product type or by specific product	x	x		
VOC content of product type or of specific product	x	x		
Population (inventory area and/or U.S.)		x		x
Amount of product type used by activity (surface preparation, coating, cleaning)	x	x		
Employment in SIC 7532 in inventory area[e]			x	
Per capita emission factor				x
Per employee emission factor			x	

[a]Preferred method is the survey method.
[b]Alt 1 method is the apportion national data method.
[c]Alt 2 method is the per employee factor method.
[d]Alt 3 method is the per capita factor method.

EMISSION CALCULATIONS

1) Survey Method - (Use EIIP for examples of surveys and additional ideas on how to implement this method)

Emissions = amount of product (gal) * product VOC content (lbs./gal) ÷ 2000 lbs./ton
Sum emissions of all products

An alternative to this method is to assume that the number of jobs performed in an area is directly proportional to the area's population. Using the latest national figures on refinishing jobs performed:

# of jobs in the area of estimation is = US total jobs * (area population/US population)

The next step is to calculate emissions by:
Emissions=# of jobs in area * gal product per job * VOC content in lbs./gal ÷ 2000 lbs./ton

2) Per Employee
Emissions=area employment in SIC 7532*employee EF of lbs. VOC/yr. ÷ 2000 lbs./ton

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

3) Per Capita
Emissions = population * lbs. 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, Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone, Volume I: General Guidance for Stationary Sources.

SPECIATION

ASC: 2401005000

Profile Name Auto Body Repair
Profile Code: 1194

000071-43-2	Benzene	0.0151 lbs./lbs. VOC
000084-74-2	Dibutyl Phthalate	0.0001 lbs./lbs. VOC
000091-20-3	Naphthalene	0.0146 lbs./lbs. VOC
000108-88-3	Toluene	0.0865 lbs./lbs. VOC
001330-20-7	Xylene, (m, o, & p mixture)	0.2067 lbs./lbs. VOC

Adjusting for regulations and control

EF_A	=	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 survey method

CAE SUB A~=~(UAE SUB A)[1~-~(CE)(RP)(RE)]

Adjustments to other methods using emission factors and activity data

CAE SUB A~=~(EF SUB A)(Q)[1~-~(CE)(RP)(RE)]

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, Reduction of Volatile Organic Compound Emissions from Automobile Refinishing, 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 this is feasible. There are other alternatives such as employee and per capita based estimation 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.

Appendix M: Consumer &Commercial Solvent Use

OVERVIEW

All quotes and information contained within are from the source, Emission Inventory Improvement Program, Volume 3, Chapter 5, *Consumer and Commercial Solvent Use*. The consumer and commercial solvent source category includes a wide array of products including personal care products, household cleaning products and household pesticides. However, all VOC emitting products used by businesses, institutions and numerous industrial manufacturing operations are also included. Products included in this category are shown in Table M-1. The majority of VOC's introduced into the atmosphere from this category is a result of evaporation of the solvent contained in the product or from the propellant. There are two methods for estimating emissions for consumer and commercial solvent use recommended by the Emissions Inventory Improvement Program (EIIP). The choice as to which one is employed depends on the desired level of accuracy as well as available data and resources.

ASC: 2465000000

METHODOLOGY

The two methodologies for estimating emissions of VOC's and HAP's from this source category are outlined below.

VOC's

-Use of national average per capita emission factors adjusted for state or local emission limits.
-Surveying consumer and commercial product use or sales in the inventory area.

The former population based method is preferred for emissions estimating. Surveying may be more accurate but will be quite expensive if done correctly. The procedure for the preferred method is outlined below:

- Identify applicable state and local regulations;
- Create a database or spreadsheet with per capita emission factors for the source categories of interest;
- Obtain population data for the base year of interest and allocate it to geographic areas as needed;
- Multiply per capita emission factors by population to obtain overall emissions estimates;
- Adjust estimated emissions for applicable regulations as needed.

Example:

To estimate VOC emissions from personal care products:

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.

EMISSION FACTORS

Table M-1: Consumer and Commercial Solvent Product Categories and Emission Factors

Product Category	Per Capita Emission Factor (lb VOC/Person)
Personal Care Products	2.32
Household Products	0.79
Automotive Aftermarket Products	1.36
Adhesives and Sealants	0.57
FIFRA-Regulated Products	1.78
Coatings and Related Products	0.95
Miscellaneous Products	0.07
Total for All Consumer and Commercial Products	7.84

SPECIATION

ASC: 2465000000

Profile code: 0197 - didn't use speciation factors associated with this profile code but those provide by EIIP below.

Table M-2: Per Capita Consumer and Commercial Solvent HAP Emission Factors (lb./yr./person)

CAS code	Chemical name	Per Capita Emission Factor (lbs.. /Person)
000071-43-2	Benzene	4.72e-06
000056-23-5	Carbon tetrachloride	4.10e-10
000067-66-3	Chloroform	9.91e-04
	Dibenzofuran	8.07e-06
000107-06-2	Ethylene dichloride	4.65e-06
000100-41-4	Ethyl benzene	2.07e-03
000075-21-8	Ethylene oxide	1.51e-02
000050-00-0	Formaldehyde	1.26e-03
	Glycol ethers	4.04e-02
000075-09-2	Methylene Chloride	3.64e-02
000091-20-3	Naphthalene	4.61e-02
000127-18-4	Perchloroethylene	2.82e-02
000108-88-3	Toluene	4.29e-01
000071-55-6	1,1,1-Trichloroethane	3.87e-01
000079-01-6	Trichloroethylene	4.86e-04
001330-20-7	Xylenes, m, o, & p	2.03e-01

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

Pollutant	Personal Care Products	Household Products	Automotive Aftermarket Products	Adhesives & Sealants	FIFRA-Regulated Products[b]	Coatings & Related Products	Misc.	Overall Emission Factor (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 tetrachloride						4.10E-10		4.10E-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-Dichlorobenzene		4.79E-02			3.52E-02			8.31E-02
1,2-Dichloroethane	4.62E-06	3.52E-08						4.65E-06
1,3-Dichloropropene					1.60E-01			1.60E-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
Hydrogen fluoride		8.75E-08	1.41E-05					1.41E-05
Isophorone					9.47E-04			9.47E-04
Methanol	5.67E-07	6.66E-04	6.61E-01	6.82E-04	9.48E-04	1.60E-02	1.84E-02	6.97E-01
Methyl bromide					2.22E-01			2.22E-01
Methyl ethyl ketone	1.75E-05	4.49E-04	3.04E-03	3.91E-02	2.01E-05	7.94E-03	1.01E-05	5.06E-02
Methyl isobutyl ketone		1.08E-04	8.73E-04	1.24E-03	9.01E-05	5.26E-03		7.57E-03
Methyl-tert-butyl ether			2.36E-05					2.36E-05
Methylene chloride		2.39E-03	4.83E-03	8.78E-03	6.81E-04	1.97E-02	2.38E-05	3.64E-02
Naphthalene		5.52E-07	2.26E-06	1.07E-04	4.60E-02	5.75E-06		4.61E-02
2-Nitropropane				2.12E-06				2.12E-06
Perchloroethylene		2.96E-03	2.35E-02	6.75E-04	1.92E-04	1.48E-04	7.53E-04	2.82E-02
Toluene	3.41E-03	5.82E-04	2.49E-02	8.43E-02		3.16E-01	2.46E-06	4.29E-01
1,1,1-TCE	7.45E-04	2.85E-02	7.63E-02	2.14E-01	5.99E-02	7.69E-03	2.46E-04	3.87E-01
Trichloroethylene		4.34E-05	2.67E-04	3.88E-05		1.37E-04		4.86E-04
Triethylamine					3.13E-04	5.26E-04		8.39E-04
Vinyl acetate				4.94E-08				4.94E-08
Xylenes		3.28E-03	1.20E-02	9.76E-03	1.37E-01	4.05E-02	4.31E-04	2.03E-01

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

EF_A	=	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

CAE SUB A~=~(EF SUB A)(Q)[1~-~(CE)(RP)(RE)]

Adjustments to survey method

CAE SUB A~=~(UAE SUB A)[1~-~(CE)(RP)(RE)]

Example:

New York has a regulation in place affecting various product subcategories of the categories listed in Table M-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 M-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 speciated contaminant and VOC emission estimates with CE, RE, & RP calculated for the relevant category using the formula for the preferred method above.

Refer to Appendix A of the Emission Inventory Improvement Program, Volume 3, Chapter 5, *Consumer and Commercial Solvent Use* for additional information on product types per category and associated per capita emissions estimates.

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.

Appendix N: Chromium Electroplating

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 and chromium compounds. This section will focus on chromium emissions from chromic acid operations, hard and decorative hexavalent chromium electroplating operations. Decorative trivalent electroplating operations will not be included due to lack of information available for estimating emissions. Chromium electroplating and anodizing operations are regulated by the NESHAP for Hard and Decorative Chromium Electroplating and Chromium Anodizing Tanks, finalized on January 25, 1995.

Source Identification

Chromium electroplating operations are classified under the Standard Industrial Classification Code (SIC) 3471 - Plating and Polishing.

The following codes were found for chromium electroplating operations in the Source Classification Code (SCC) list:

3	Industrial Processes
309	Fabricated Metal Products
309010	Electroplating Operations
30901018	Hard Chromium Electroplating - Uncontrolled
30901028	Decorative Chromium Electroplating - Uncontrolled
30901038	Chromic Acid Anodizing Tank - Uncontrolled and Packed Scrubber

The following codes were found for electroplating and anodizing operations in the Area and Mobile Source Code (AMS) list:

A23	Industrial Processes
A2309	Fabricated Metals
A2309100	Coating, Engraving, and Allied Services
A2309100010	Electroplating
A2309100050	Anodizing

Pollutants

The targeted pollutant emissions of concern for chromium electroplating operations are Chromium and Chromium VI (hexavalent chromium).

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.

Table N-1: Emission Factors from FIRE 5.1B

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

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 emissions from this facility were not included in the area source inventory. The emission factor for chromic anodizing with a packed bed scrubber is shown in Table N-1 for reference.

Data was gathered using the information contained in the NESHAP Initial Notification forms, the facilities' Compliance Certification reports for the NESHAP, facility performance test results, and by calling the facilities directly and requesting any additional information needed. Table N-2 shows a summary of the data collected.

Emission Estimation

Total chromium emissions from hard and decorative chromium electroplating for each county are calculated by multiplying the total production ampere-hours per year by the appropriate emission factors in Table N-1. The following equation is an example calculation used to determine the chromium emissions at each facility.

$$E = EF \times PR$$

where:
- E = Chromium emissions (lb./yr.)
- EF = Chromium emission factor from FIRE (lb./A-hr)
- PR = total production rectifier ampere-hours per year (Amp-hr/yr.)

Emissions from chromic anodizing tanks were calculated using the operating hours of the unit and the surface area of the tank, then multiplying by the appropriate emission factor.

$$E = EF \times SA \times OP$$

where:
- E = Chromium emissions (lb./yr.)
- EF = Chromium emission factor from FIRE (lb./ft^2-hr)
- SA = Surface area of the anodizing tank (ft^2)
- OP = Operating hours of the unit (hr/yr.)

The emission factors from FIRE are specific to hexavalent chromium emissions. Therefore, all emissions calculated using the emission factors in Table N-1 are hexavalent chromium emissions. It can be assumed that 75 percent of chromium emissions are hexavalent, therefore, total chromium emissions can be back-calculated from the hexavalent chromium emissions.

After each facility's emissions were calculated, process emissions were totaled by county. Those emissions are included in Table N-3.

Table N-2: Facility-Specific Information for 1997

Facility Name	County	Tank type	1997 Activity	Units	EIS?
United Defense	Anoka	hard	1,440,000	Amp-hr	Ö
United Defense	Anoka	anodizing	28,800	ft^2-hr	Ö
Rapid Plating	Benton	dec. hex	6,240,000	Amp-hr	
North Star Plating	Crow Wing	dec. hex	10,500,000	Amp-hr	
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	Ö
Hard Chrome	Hennepin	hard	99,300,000	Amp-hr	
Hard Chrome	Hennepin	dec. hex	720,000	Amp-hr	
Hiawatha Panel & Name Plate	Hennepin	anodizing	49,275	ft^2-hr	
J&R Chrome Plating	Hennepin	dec. hex	114,000	Amp-hr	
Joyner's	Hennepin	dec. hex	3,120,000	Amp-hr	
Maxwell Aircraft Service	Hennepin	anodizing	1,500	ft^2-hr	
Minnesota Rubber Company	Hennepin	hard	3,600,000	Amp-hr	
Nico Products, Inc.	Hennepin	dec. hex	0		
Superior Plating	Hennepin	dec. hex	4.4	lbs..	Ö
Superior Plating	Hennepin	hard	2.2	lbs..	Ö
Twin City Plating	Hennepin	hard	3.99	lbs..	
VisionEase Lens	Hennepin	hard	2800	Amp-hrs	Ö
New Dimension Plating	McLeod	dec. hex	300,000	Amp-hr	
New Dimension Plating	McLeod	hard	3,400,000	Amp-hr	
Prestige Plating	McLeod	dec. hex	500	Amp-hr	
Northwest Airlines, MSP Maint.	Ramsey	hard	42,666,667	Amp-hr	Ö
St. Paul Electroplating	Ramsey	dec. hex	73,810	Amp-hr	
Wolkerstorfer Co, Inc.	Ramsey	hard	15,190	Amp-hrs	Ö
Plating Specialties, Inc.	St. Louis	dec. hex	52,000	Amp-hr	
SPX, Power Team Divsions	Steele	hard	618,076	Amp-hr	
Olson Industries	Watonwan	hard	212,052	Amp-hr	
St. James Automotive Products	Watonwan	dec. hex	3,129,619	Amp-hr	

Table N-3: Chromium Emissions (lbs.) by County

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

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

Appendix O: 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

- local per facility solvent consumption (through survey/permits)
- local per employee factors (through surveys/permits)
- national employee factors
- national per capita factors

Data Requirements

The data requirements for calculating emissions from dry cleaners depends upon the methods used. These elements are described perfectly in the EIIP document on dry cleaning (Volume III: Area Sources - Chapter 4: Dry Cleaning). The data items include:

- type of solvent used
- amount of solvent used
- number of employees
- number of employees by SIC
- machines per facility
- type of machines
- control methods
- number of facilities
- applicable emission factors (can be per facility, per machine, per employee or per capita and be a national value or a local (source specific) value)

Pollutants emitted by dry cleaners pertinent to RAPIDS

- 1,1,1-trichloroethane (second most common)
- Ethylbenzene
- Naphthalene
- Perchloroethylene (most common)
- Toluene
- 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 (www.epa.gov/ttn/chief/ap42.html)
- EIIP Document Volume III: Chapter 4 (www.epa.gov/ttn/chief/eiip/techrep.htm)

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

Table O-1: Drycleaner Emission Factors

Subcategory	Reactive VOC (lb./year/employee)	Total Organics (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 Unspecified Solvents	1,800	1,800

On a per-unit basis: 0.8 tons/facility-year (assumes that average coin-op facility has two dry cleaning units and each emits 0.4 tons of PERC per year.

From AP-42

Commercial:	1.3 lb./year/person (all nonmethane VOC)
Coin Operated:	0.4 lb./year/person (all nonmethane VOC)

Appendix P: 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) Stage I (transfer of gasoline from tank trucks to storage tanks at service stations);
c) Stage II (transfer of gasoline from storage tanks at service stations to the vehicle gasoline tank);
d) Gasoline station storage tanks; and
e) Spillage.

GASOLINE TRUCKS IN TRANSIT

Introduction

Evaporative emissions of gasoline vapor occur (1) from loaded tank trucks during the transportation of gasoline from the bulk terminals/plants to the gasoline service stations, and (2) from empty tank trucks returning from service stations to bulk terminals/plants.

Source Identification

There is no uniquely defined SIC that categorizes the emissions resulting from the transportation of gasoline between bulk terminals/plants and service stations. This type of emission occurs neither at the bulk terminals/plants nor the service stations. Since the transportation of gasoline is part of the services provided by the bulk terminals/plants to their customers (service stations), the SIC of 5171 in the Standard Industrial Classification Code 1972 for bulk terminals/plants is used to identify this type of emission source, or under 42271 (petroleum bulk stations and terminals) in the North America Industry Classification System 1997 (NAICS).

There are also Source Classification Codes (SCC) and Area Mobile Source Codes (AMS) that describe the evaporative emissions from transportation of gasoline by trucks. Table P-1 shows the SCC relating to the transportation of gasoline.

Table P-1: SCC Codes for Transportation of Gasoline

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**
A2505030	Storage and Transport Petroleum and Petroleum Product Transport Truck	
A2505030120	Gasoline	40600162 40600163

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 documents[5]. A search of the first three sources revealed some emission factors on VOCs. Reference 5 provided a HAP profile on gasoline (Table P-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 P-3 presented a summary of the available emission factors from FIRE and the HAP profile.

Table P-2: HAP Profile in Gasoline Vapor

HAP	Weight Percentage	
Benzene	0.9%	lb./lb. VOC
Ethylbenzene	0.1%	lb./lb. VOC
Naphthalene	0.5%	lb./lb. VOC
Toluene	1.3%	lb./lb. VOC
Xylenes	0.5%	lb./lb. VOC

Table P-3: Emission Factors for Gasoline Truck in Transit

Pollutant	Emission Factors		Remarks	Reference
SCC 40600162:	Petroleum and Solvent Evaporation Transportation and Marketing of Petroleum Products Tank Cars and Trucks Gasoline: Loaded with Fuel (Transit Losses)			
VOC	5.000E-3 [1]	Lb. per 1000 Gallons Transferred	UNCONTROLLED	EIIP/FIRE
Benzene	9.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Ethylb.enzene	1.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Naphthalene	5.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Toluene	1.300E-2	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Xylene, mixed isomers	5.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
SCC 40600163:	Petroleum and Solvent Evaporation Transportation and Marketing of Petroleum Products Tank Cars and Trucks Gasoline: Return with Vapor (Transit Losses)			
VOC	5.500E-2 [2]	Lb. per 1000 Gallons Transferred	UNCONTROLLED	EIIP/FIRE
Benzene	9.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Ethylbenzene	1.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Naphthalene	5.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Toluene	1.300E-2	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Xylene, mixed isomers	5.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
AMS A2505030132	Petroleum and Solvent Evaporation Transportation and Marketing of Petroleum Products Trucks Gasoline: (Transit Losses)			
VOC	6.000E-2 [3]	Lb. per 1000 Gallons Transferred	UNCONTROLLED	EIIP/FIRE
Benzene	9.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Ethylbenzene	1.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Naphthalene	5.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Toluene	1.300E-2	Lb. per lb. 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).

Facility Identification

As recommended by the Emission Inventory Improvement Program, the county-level fuel sales statistics should be obtained by survey data or from other sources (e.g. tax department, statistics agencies). If county-level statistics are not readily available, the state/province total fuel sales should be obtained from the relevant department. This state/province total fuel sales data must be apportioned to the county level based on such factors as:

a) gasoline service stations $-sales in each county;
b) previous county-level sales survey data;
c) number of gasoline vehicle registrations in each county, travelling patterns and fuel economy.

Emission Estimation

Gasoline Trucks in Transit

The emissions from gasoline trucks in transit for each county can be estimated from the following equations.

$$GTA = \frac{TGD + TGT}{TGD}$$

Where GTA = Gasoline transportation adjustment factor
TGD = Total gasoline dispensed in a county (1,000 gallons)
TGT = Amount of gasoline transported twice within a county (1,000 gallons)

and

$$TTE = \frac{(TGD \times LEF \times GTA) + (TGD \times UEF \times GTA)}{2{,}000}$$

Where TTE = Annual emission of a pollutant from tank trucks in-transits (tons)
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).

There are also Source Classification Codes (SCC) and Area Mobile Source Codes (AMS) that describe the evaporative emissions from gasoline service station operations. Table P-4 shows the SCC regarding gasoline service station operations.

Table P-4: SCC Codes for Gasoline Service Stations (Stage I and II)

FIRE SCC Code	**Description**	
406003	Petroleum and Solvent Evaporation Transportation and Marketing of Petroleum Products Gasoline Retail Operations - Stage I	
40600301	Splashing Filling	
40600302	Submerged Filling w/o Controls	
40600305	Unloading	
40600306	Balanced Submerge Filling	
40600307	Underground Tank Breathing & Emptying	
406004	Petroleum and Solvent Evaporation Transportation and Marketing of Petroleum Products Filling Vehicle Gas Tanks - Stage II	
40600401	Vapor Loss w/o Control	
40600402	Liquid Spill Loss w/o Control	
40600403	Vapor Loss w/o Control	
FIRE AMS Code	**Description**	**Equivalent SCC**
A250106005	Storage and Transport Petroleum and Petroleum Product Storage Gasoline Service Stations: Stage I	
A2501060050	Total	40600300
A2501060051	Submerged Filling	40600302
A2501060052	Splash Filling	40600301
A2501060053	Balanced Submerged Filling	40600306
A250106010	Storage and Transport Petroleum and Petroleum Product Storage Gasoline Service Stations: Stage II	
A2501060100	Total	
A2501060101	Displacement Loss/Uncontrolled	40600401

A2501060102	Displacement Loss/Controlled	40600403
A2501060103	Spillage	40600402
A250106020	Storage and Transport Petroleum and Petroleum Product Storage Gasoline Service Stations: Underground Tank	
A2501060200	Total	
A2501060201	Breathing and Emptying	40600307

Emission Factors Identification

There are four sources of information that contain 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], iv) MOBILE 5B Transportation model[4] and v) other technical documents[5]. A search of the first three sources revealed some emission factors for Benzene, 1,3-Butadiene, 1,2-Dibromoethane, 1,2-Dichloroethane, Ethylbenzene, Toluene, VOC, and Xylene. Only 1,2-Dichloroethane and Ethylbenzene are included in the GLC 49 substance list.

Since the emissions from gasoline service stations are inventoried under area sources, the AMS code will be used to identify the sources. In FIRE 6, there are no associated emission factors for the AMS code for gasoline service stations. 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 the HAPs shown in Table P-5 when there are no direct emission factors for the concerned HAPs in FIRE. The following table presented a summary of the available emission factors.

Table P-5: 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 Petroleum Products AMS A2501060052 Gasoline Retail Operations - Stage I Splashing Filling				
Benzene	6.930E-2	Lb. per 1000 Gal Gas Stored	UNCONTROLLED	FIRE
1,3-Butadiene	3.940E0	Lb. per 1000 Gal Gas Pumped	UNCONTROLLED	FIRE
1,2-Dibromoethane	1.490E-4	Lb. per 1000 Gal Material Processed	UNCONTROLLED	FIRE
1,2-Dichloroethane	1.530E-3	Lb. per 1000 Gal Material Processed	UNCONTROLLED	FIRE
Ethylbenzene	1.980E-2	Lb. per 1000 Gal Gas Pumped	UNCONTROLLED	FIRE
Toluene	1.760E-1	Lb. per 1000 Gal Gas Pumped	UNCONTROLLED	FIRE
Xylene, mixed isomers	8.800E0	mg per L Gas Stored	UNCONTROLLED	FIRE
VOC	1.150E1	Lb. per 1000 Gallons Transferred	UNCONTROLLED	FIRE

Naphthalene	5.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
SCC 40600302: Petroleum and Solvent Evaporation Transportation and Marketing of Petroleum Products AMS A2501060051 Gasoline Retail Operations - Stage I Submerged Filling w/o Controls				
Benzene	4.420E-2	Lb. per 1000 Gal Gas Stored	SUBMERGED FILLING	FIRE
1,2-Dibromoethane	9.510E-5	Lb. per 1000 Gal Material Processed	UNCONTROLLED	FIRE
1,2-Dichloroethane	9.760E-4	Lb. per 1000 Gal Material Processed	UNCONTROLLED	FIRE
Toluene	9.330E1	mg per Liter Gas Stored	UNCONTROLLED	FIRE
Xylene, mixed isomers	5.600E0	mg per L Gas Stored	UNCONTROLLED	FIRE
VOC	7.300E0	Lb. per 1000 Gallons Transferred	UNCONTROLLED	FIRE
Ethylbenzene	1.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Naphthalene	5.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
SCC 40600306: Petroleum and Solvent Evaporation Transportation and Marketing of Petroleum Products AMS A2501060053 Gasoline Retail Operations - Stage I Balanced Submerged Filling				
Benzene	1.670E-3	Lb. per 1000 Gal Gas Stored	SUBMERGED FILLING	FIRE
1,2-Dibromoethane	3.840E-6	Lb. per 1000 Gal Material Processed	UNCONTROLLED	FIRE
1,2-Dichloroethane	4.420E-5	Lb. per 1000 Gal Material Processed	UNCONTROLLED	FIRE
Toluene	4.200E0	mg per Liter Gas Stored	UNCONTROLLED	FIRE
Xylene, mixed isomers	7.500E-1	mg per L Gas Stored	UNCONTROLLED	FIRE
VOC	3.000E-1	Lb. per 1000 Gallons Throughput	UNCONTROLLED	FIRE
Ethylbenzene	1.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Naphthalene	5.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
SCC 40600307: Petroleum and Solvent Evaporation Transportation and Marketing of Petroleum Products AMS 2501060201 Gasoline Retail Operations - Stage I Underground Tank Breathing and Emptying				
Benzene	5.840E-3	Lb. per 1000 Gal Gas Stored	UNCONTROLLED	FIRE
Toluene	1.270E1	mg per Liter Gas Stored	UNCONTROLLED	FIRE
Xylene, mixed isomers	6.380E1	mg per L Gas Stored	UNCONTROLLED	FIRE
VOC	1.000E0	Lb. per 1000 Gallons Throughput	UNCONTROLLED	FIRE

Ethylbenzene	1.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Naphthalene	5.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
SCC 40600401: Petroleum and Solvent Evaporation Transportation and Marketing of Petroleum Products AMS A2501060101 Filling Vehicle Gas Tanks - Stage II Vapor Loss w/o Control				
Benzene	6.590E-2	Lb. per 1000 Gal Gas Stored	UNCONTROLLED	FIRE
Toluene	9.940E-2	Lb. per Ton Gas Stored	UNCONTROLLED	FIRE
Xylene, mixed isomers	4.050E0	mg per L Gas Stored	UNCONTROLLED	FIRE
Xylene, meta	1.710E-2	Lb. per Ton Gas Stored	UNCONTROLLED	FIRE
Xylene, ortho	6.620E-3	Lb. per Ton Gas Stored	UNCONTROLLED	FIRE
Xylene, para	6.620E-3	Lb. per Ton Gas Stored	UNCONTROLLED	FIRE
VOC	1.100E1	Lb. per 1000 Gallons Pumped	UNCONTROLLED	FIRE
Ethylbenzene	1.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Naphthalene	5.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
SCC 40600402: Petroleum and Solvent Evaporation Transportation and Marketing of Petroleum Products AMS A2501060103 Filling Vehicle Gas Tanks - Stage II Liquid Spill Loss w/o Control				
1,2-Dichloroethane	1.330E-4	Lb. per 1000 Gal Gas Transferred	UNCONTROLLED	FIRE
Toluene	8.900E0	mg per Liter Gas Stored	UNCONTROLLED	FIRE
Xylene, mixed isomers	3.000E-1	mg per L Gas Stored	UNCONTROLLED	FIRE
VOC	7.000E-1	Lb. per 1000 Gallons Pumped	UNCONTROLLED	FIRE
Benzene	9.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Ethylbenzene	1.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
Naphthalene	5.000E-3	Lb. per lb. of VOC	UNCONTROLLED	HAP SPECIATE
SCC 40600403: Petroleum and Solvent Evaporation Transportation and Marketing of Petroleum Products Filling Vehicle Gas Tanks - Stage II Vapor Loss w/o Control				
1,2-Dichloroethane	1.750E-3	Lb. per 1000 Gal Gas Transferred	MISCELLANEOUS CONTROL DEVICES	FIRE
Toluene	1.390E1	mg per L Gas Stored	MISCELLANEOUS CONTROL DEVICES	FIRE
Xylene, mixed isomers	4.500E-1	mg per L Gas Stored	MISCELLANEOUS CONTROL DEVICES	FIRE

VOC	1.100E0	Lb. per 1000 Gallons Pumped	MISCELLANEOUS CONTROL DEVICES	AP42
Benzene	9.000E-3	Lb. per lb. of VOC	MISCELLANEOUS CONTROL DEVICES	HAP SPECIATE
Ethylbenzene	1.000E-3	Lb. per lb. of VOC	MISCELLANEOUS CONTROL DEVICES	HAP SPECIATE
Naphthalene	5.000E-3	Lb. per lb. of VOC	MISCELLANEOUS CONTROL DEVICES	HAP SPECIATE

Facility Identification

As recommended by the Emission Inventory Improvement Program, the county-level fuel sales statistics should be obtained by survey data or from other sources (e.g. tax department, statistics agencies). If the county-level statistics are not readily available, the state/province total fuel sales should be obtained from the relevant department. This state/province total fuel sales data must be apportioned to the county level based on such factors as:

a) gasoline service stations $-sales in each county;
b) previous county-level sales survey data;
c) number of gasoline vehicle registrations in each county, travelling pattern and fuel economy.

The control technology applied in the operation of the stations (e.g. filling underground tanks and dispensing fuel, etc) and the amount of fuel handled by each technology should also be obtained.

Emission Estimation

Stage I: Gas Retail Operations - Gasoline Filling

The emissions from gasoline service stations include the evaporative emissions from the filling of underground gasoline storage tanks. Emissions are generated when gasoline vapors in the underground storage tanks are displaced to the atmosphere by the gasoline being loaded into the tank. Two methods are commonly used in filling the tanks, splash loading and submerged loading. With the splash loading method, the filling pipe dispensing the gasoline is lowered only part way into the tank. Significant turbulence and vapor/liquid contact occur during the splash loading operation, resulting in high levels of vapor generation and loss. In submerged loading, the fill pipe extends almost to the bottom of the storage tanks with the opening situated below the liquid surface level. Liquid turbulence is controlled significantly, resulting in much lower vapor generation than the splash loading method.

The Stage I emissions of a specific pollutant from gasoline filling operations in a county is estimated by the following formula:

$$EM_{fill} = [\ (BQ * P_{splash} * EF_{splash}) + (BQ * P_{submerged} * EF_{submerged}) + (BQ * P_{balsub} * EF_{balsub}) \ ] \ / \ 100{,}000$$

Where
- EM_{fill} = Annual emission of a pollutant in a county (lb./yr.)
- BQ = Total annual consumption of gasoline in a county (gal)
- P_{splash} = Percentage of gasoline filling using splash method (%)
- 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)
- P_{balsub} = Percentage of gasoline filling using balanced submerged method (%)
- EF_{balsub} = 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:

$$EM_{breath} = BQ * EF_{breath} \ / \ 1{,}000$$

Where
- EM_{breath} = Annual emission of a pollutant in a county (lb./yr.)
- BQ = Total annual consumption/throughput of gasoline in a county (gal)
- EF_{breath} = Emission factor of pollutant for splash filling (lb./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 temperature, gasoline RVP, and dispensing rate. The refueling emission rate (in lb./gal) can be obtained from the MOBILE model. Since variation in factors will affect the emission rate, it is preferable to obtain an individual emission rate for each county instead of a generic state/province rate.

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

$$EM_{refuel} = BQ * P_{refuel} * EF_{refuel} + BQ * P_{refuel\_con} * EF_{refuel\_con}$$

Where	EM_{refuel}	=	Annual emission of a pollutant in a county (lb./yr.)
	BQ	=	Total annual consumption/throughput of gasoline in a county (gal)
	P_{refuel}	=	Percentage of gasoline dispensed without Stage II control (%)
	EF_{refuel}	=	Emission factor of pollutant for vehicle refueling without Stage II control (lb./gal)
	P_{refuel_con}	=	Percentage of gasoline dispensed with Stage II control (%)
	EF_{refuel_con}	=	Emission factor of pollutant for vehicle refueling with Stage II control (lb./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:

$$EM_{spill} = BQ * EF_{spill} / 1{,}000$$

Where	EM_{spill}	=	Annual emission of a pollutant in a county (lb./yr.)
	BQ	=	Total annual consumption/throughput of gasoline in a county (gal)
	EF_{spill}	=	Emission factor of pollutant for spilling loss (lb./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.

Appendix Q: 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.

AMS CODES FOR THIS CATEGORY

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: 0.09999lb./lb. 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
Amount of VOC or HAPs contained in the raw materials and solvents (weigh %), and amount of material recycled
Controls used

For Ink Sales Emission Factor Method

- Ink sales for the state or data from the US Census Bureau
- Uncontrolled point source emissions from graphic arts operations
- Controls used in region (Note: controls may also include local state regulations)

Advantages of Method

- Inks are common to all printers and not used by any other sources
- VOC content of the inks is consistent
- Consistency of the printing process (same VOC content used in the same type of printing process)

Summary of Method:

- Obtain amount of ink produced in pounds, in the US (Ref. Census of Manufacturer's, Industry Series for SIC Code 289, Miscellaneous Chemical Products).

  (Note: I checked with the National Association of Printing Ink Manufacturers about the availability of ink sales data per state. That information is not available. Also, the NAPIM does not agree with this method).

- Apportion nationwide ink amount to the state level by the ration between state and national employment in printing and publishing (SIC Code 27). This information can be

obtained 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.
- Table 7.5-2, Chapter 3 EIIP, offers VOC emission factors for VOC per pound of ink used.

REFERENCES

Environmental Protection Agency (EPA). *STAPPA-ALAPCO-EPA Emission Inventory Improvement Program (EIIP).* Volume III - Area Sources Preferred and Alternative Methods. July 1997.

Personal communication, National Association of Printing Ink Manufacturer's

Appendix R: Hospital Sterilizers

SOURCE IDENTIFICATION

Hospital sterilization is covered by Area and Mobile Source (AMS) code 2850000010: Hospitals – Sterilization Procedures. Standard Industrial Classification (SIC) code 8060 – Hospitals and North American Industrial Classification System (NAICS) code 622xx: Hospitals also describe the hospital sterilization category.

POLLUTANTS

Ethylene oxide (EO) is the only pollutant identified.

AIR TOXIC EMISSION ESTIMATION

Two methods are available to estimate emissions from ethylene oxide sterilizers. The first method assumes each hospital operates a sterilizer at given conditions. The second uses an EPA emission factor based on the number of beds in a hospital to estimate ethylene oxide emissions.

Hospital data for the first method can be obtained from state Health Departments. State NESHAP databases may also contain data on facilities with ethylene oxide sterilizers.

An ethylene oxide cartridge, assumed to be adequate for one sterilization cycle, contains 3.54 ounces of EO (0.22 lb).

If the sterilizer were assumed to operate continuously over the course of a year and complete one-quarter of a cycle per hour, the annual emissions of EO would be:

0.22 lb EO/cycle * 0.25 cycle/hr = 0.055 lb EO/hr

0.055 lb EO/hr * 8769 hr/yr = 481.8 lb/yr

481.8 lb/yr * 2000 lb/ton = 0.241 ton/yr.

Each hospital would emit 0.241 tons of EO annually under the assumption of one sterilizer per hospital.

If facilities with hospital sterilizers were required to use Best Available Control Technology (BACT) with 99.9% control efficiency, the following emissions would result:

0.22 lb EO/cycle * (1-0.999) = 0.00022 lb EO/cycle

0.00022 lb EO/cycle * 0.25 cycle/hr = 0.000055 lb EO/hr

0.000055 lb/hr * 8760 hr/yr = 0.4818 lb/yr

0.4818 lb/yr * 2000 lb/ton = 0.000241 tons/yr.

The second method uses emission factors based on hospital size. EPA developed EO emission factors for hospitals depending on the number of bed in the hospital:

Nationwide Emission Factors for EO from Hospital Sterilization

Hospital Size	**# Beds**	**Emission Factors (kg EO/yr/bed)**
Large	>500	1.05
Medium	200-500	0.63
Small	<200	0.82

The number of hospitals and beds on a county basis for the Great Lakes states can be obtained from the American Hospital Association. As previously stated, hospital information may also be available from state Health Departments.

EO Emissions = Number of Beds * Emission Factor (kg EO/bed)

REFERENCES

Wisconsin Department of Natural Resources. Williams, Megan and Hanson, Jeffrey. *Analysis, Preliminary Determination and Draft Permit for the Category of Ethylene Oxide Sterilization Systems.* June 14, 2000.

United States Environmental Protection Agency (U.S. EPA). *Documentation for the 1996 Base Year National Toxics Inventory for Area Sources.* Appendix A, A-23. June 02, 2000.

Appendix S: Human Cremation

METHODOLOGY

Source Identification

Protocol Section 3.2.1-SIC codes
SIC code 7261-Funeral Service and Crematories

Protocol Section 3.2.2-SCC/AMS codes
SCC 2601020000-Waste Disposal, Treatment and Recovery-On-site Incineration

Protocol Section 3.2.3-New SCC/AMS codes
The SCC code given above is the most appropriate one that could be found. A new SCC code may need to assign to this area source.

Protocol Section 3.3-Pollutants
Pollutants identified include Arsenic, Beryllium, Cadmium, Chromium, Formaldehyde, Mercury and Nickel.

Air Toxic Emission Estimation

Emissions were calculated using emission factors based on the weight cremated. The number of bodies cremated was obtained from Department of Health and Family Services, Wisconsin Bureau of Health Information. An average weight of 150 LB per body was assumed.

Emissions = Bodies Cremated * Average Weight (LB) * Factor (LB/ton) * ton/2000LB

Nationwide Emissions Factors for Human Cremation

Pollutant	Emission Factors (LB/ton cremated)
Arsenic	4.00e-04
Beryllium	1.84e-05
Cadmium	1.48e-04
Chromium	3.99e-04
Formaldehyde	2.89e-09
Mercury	4.39e-02
Nickel	5.09e-04
POM as 7-PAH	1.03e-09
POM as 16-PAH	9.63e-04

REFERENCES

United States Environmental Protection Agency (U.S. EPA). *Documentation for the 1996 Base Year National Toxics Inventory for Area Sources.* Appendix A, A-24, A-25. March 27, 2000.

Appendix T: Industrial Surface Coatings

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.

Table T-1: Profiles in the Speciate Database

By Solvent	Profile
Naptha	0282
Butyl Acetate	0288
Butyl Alcohol	0289
Cellosolve	0290
Methyl Alcohol	0291
Dimethylformamide	0292
By Thinning Solvent	
Hexylene Glycol	1026
Ethylene Oxide	1031
By Coating type	
Thinning	1016
Lacquer	1017
Enamel	1018
Primer	1019
Adhesives	1020
Composite Profiles	
Surface Coating (solvent based)	1003
Surface Coating (average)	9021

TOXIC POLLUTANT EMISSION FACTORS

Emission factors for these pollutants have not yet been identified.

OTHER AVAILABLE METHODS

Speciation of VOC emissions

The EIIP has consolidated a number of separate categories under the definition of "Industrial Surface Coating".

Pennsylvania has used the employee emission factors for these categories that were found in the EPA's May 1991 procedures document. Other per capita emission factors used were all EPA approved.

Table T-2: VOC emission factors for Industrial Surface Coating

Coating Type	VOC emission Factor	Units
Furniture and Fixtures	1,597	lb./employee
Metal Containers	6,029	lb./employee
Automobiles (new)	793	lb./employee
Machinery and Equipment	77	lb./employee
Appliances	463	lb./employee
Other Transportation Equipment	35	lb./employee
Sheet, Strip and Coil	2877	lb./employee
Factory Finished Wood	131	lb./employee
Electrical insulation	290	lb./employee
Other Product Coatings	0.6	lb./capita
High Performance Coatings	0.8	lb./capita
Marine Coatings	308	lb./employee
Other Special Purpose Coatings	0.8	lb./capita

RECOMMENDATIONS

A survey of manufactures or trade associations may provide more information on this category. Speciation of the VOC inventory may also be possible; however, a method to validate the profiles used should be developed.

Appendix U: Marine Vessel Loading & 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 U-1: Speciation Profiles for Toxins Associated with Marine Vessel Loading:

Toxic	Speciation (tox/tog), % by weight
Benzene	3.25
Ethylbenzene	4.07
Naphthalene	0.8
Styrene	0.17
Toluene	15.22
Xylene, O	6.41
Xylene, M, P	15.28
Xylene isomers (not in speciation profile)	21.69 (O,M, and P added together)

Note: The Xylene isomers should be added together so that it will correspond w/ the RAPIDS pollutant list.

Method 2

The preferred method found is in *Technical Support Document for the Development of a VOC Rule for Marine Vessel Loading Operations,* U.S. EPA; May 1992.

Table U-2: Toxic emission factors based on gallons transferred.

Toxic	Emission Factor (lb./1000 gal) barges
Benzene	0.029
Toluene	0.048
Xylene	0.015

The amount of fuel loaded and unloaded to barges by state can be found in *Waterborne Commerce of the United States,* 1996; US Army Corps of Engineers, December 1997.

Each states river system and/or city that has gasoline barge loading is available from this document.

Appendix V: 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
- Acrylonitrile
- Benzene
- 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.

There were no point source emission factors for landfills in FIRE or RAPIDS.

REFERENCES

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

- AP-42 Section 2.4 (www.epa.gov/ttn/chief/ap42.html)
- EIIP Document Volume III: Chapter 15 (www.epa.gov/ttn/chief/eiip/techrep.htm)
- LAEEM (www.epa.gov/ttn/chief/software.html)

METHOD TO USE FOR RAPIDS CALCULATIONS

In my opinion, you are either going to have the data handy (for either method) or you're not. Through pure coincidence while I was writing this, there was a notification sent to me that a Landfill Capacity report for 1996 had been placed on our web site (www.epa.state.il.us). This report gave me all the data I need. Using the population based method would be acceptable, but how many of the states can get population data for the last 25 years?

The EIIP document also makes mention of a method of calculation emissions by a regression model. In this case, you use data you've collected through a survey or permitting (or other states calculations) and relate that data to surrogate data (e.g., population, population density, rural/urban population mix, property values, land use, etc.). If states who calculate emissions in a detailed manner can relate those emissions (or landfill capacity, etc.) to a value that another state has that didn't have the data available to calculate landfill emissions, the second

state could then calculate emissions. Basically, this method is creating an emission factor in one or more states to be used by others.

Really the only method to calculate emissions is by using the LAEEM/AP-42 method. How you use this methodology depends upon your available data. Having states create emission factors for others to use remains to be seen. My recommendation is to use the preferred method.

Appendix W: Open Burning

OVERVIEW

This area source category includes three categories.

- Municipal Solid Waste (MSW) burning
- Land clearing waste burning
- Yard waste burning

METHODOLOGIES

MSW Burning (Table 16.3-1 of EIIP)

Method	**Activity Data Required**
Preferred local estimate of MSW open burned times emission factor	tons of waste burned
Alternate 1 local estimate of MSW generated then subtract the amount disposed of by other means	tons of waste generated tons of waste disposed by other means
Alternate 2 obtain data from an area that is similar to your study area and extrapolate the data	data from similar area population ratio

Land Clearing Waste Burning (Table 16.3-2 of EIIP)

Method	**Activity Data Required**
Preferred local estimate of MSW open burned times emission factor	tons of waste burned
Alternate 1 local estimate of MSW generated then subtract the amount disposed of by other means	tons of waste generated tons of waste disposed by other means
Alternate 2 obtain data from an area that is similar to your study area and extrapolate the data	data from similar area population ratio

Yard Waste Burning (Table 16.3-3 of EIIP)

Method	**Activity Data Required**
Preferred local estimate of MSW open burned times emission factor	tons of waste burned
Alternate 1 study a subset of the inventory area using permits to burn and violations of burning to estimate extent of burning. scale to larger area	permits to burn violations fuel loading for each burn scaling factors
Alternate 2 obtain data from an area that is similar to your study area and extrapolate the data	data from similar area scaling factors
Alternate 3 develop a local per residence or per acre waste generation rate	tons of waste generated scaling factor

EMISSION FACTORS

Municipal Solid Waste (Table 16.4-1 of EIIP)

Pollutant	**Emission factor (lb/ton burned**
PM10	38
VOC	8.556
Acenapthylene	0.022
Benzene	2.48
Dichlorobenzenes	0.00032
HCL	0.568
HCN	0.936
Hexachlorobenzene	0.000044
Naphthalene	0.036
PCB	0.00572
PCDD	0.000076
PCDF	0.0000122
Phenanthrene	0.0146
Phenol	0.28
Styrene	1.48

Land clearing emission factors depend upon what material is being burned and whether it is in a pile or spread out. Emission factors exist for the pollutants MEK, ethylbenzene, styrene, cumene, phenol and dibenzofuran. These factors depend upon whether or not a blower is used and are based upon a small number of tests. The table also does not have units associated with it so I'm assuming they are lb/ton burned. There are also factors available for other fuel models.

Yard waste factors also depend upon the type of material being burned (leaves, forest residues or weeds). The EIIP document only gives PM and TOC factors and no speciation profiles could be found.

DATA SOURCES

- State or Local Air Quality Agencies
- Federal, state and local forest service and agricultural extension agents
- Local planning departments
- State or local transportation departments
- Local health and sanitation departments
- Local fire and public safety departments

CONCLUSION

If it is readily available to you, calculating emissions by amount of waste burned is the appropriate method. In many places, the burning of municipal waste may be banned so that source may not be applicable. It will probably be difficult to get data for the yard waste burning. It may be possible to get data from open burning of landscape waste from any permitting programs your Agency may have.

But overall, I'd say with the time it would take to get good (any) data, this could be an area source category to skip.

REFERENCES

United States Environmental Protection Agency (U.S. EPA). *EIIP document Volume III: Chapter 16: Open Burning.* May 08, 2000.

Appendix X: 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. Atrizine 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 (lbs./yr./person).

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

Appendix Y: Prescribed Burns & Forest Fires

METHODOLOGY

Michigan recommends that the Great Lakes states and provinces utilize the following method for calculating emissions from forest and wildfires.

For Michigan, the number of forest fires (tree, brush and grass wildfires) is available at the county level from the Michigan Department of State Police, Fire Marshall Division, Fire Incident Count database. The other states may be able to obtain similar information from their own local or state police and fire response agencies, or natural resources management agencies.

If county data is not available, a state total number for forest and wildfires may be available, which can be apportioned to the county level by acres forested, or some other basis which might correlate to the number of forest fires. This data may be available from the natural resources management agencies in each state.

Based on data supplied by the Michigan Department of Natural Resources, Forest Management Division, Michigan assumed that the fuel loading for each fire was 2.0 tons per acre. It was assumed, based on available data, that each fire burned one acre if in an urbanized county, and 4.54 acres if in a rural county.

If fire acreage data is not available, the other Great Lakes states may use Michigan's numbers for a default acreage per fire value.

The document *Documentation for the 1996 Base Year National Toxics Inventory for Area Sources* provided a different fuel loading value for forest and wildfires. A biomass consumption rate of 10.4 tons per acre was selected. 75% of the biomass was presumed to burn under flaming conditions, and 25% under smoldering conditions. In the absence of state specific data, Michigan recommends that these values be used.

The following calculation should be utilized to estimate emissions from forest and wildfires:

$$\text{Emissions} = \text{emission factor} * \text{number of acres burned} * \text{fuel loading per acre}$$

Or, if NTI fuel loading values are used:

$$\textit{Emissions (flaming)} = \textit{Number of acres burned} * \frac{\textit{biomass consumption}}{\text{acre}} * \textit{75\% (flaming)} * \textit{emission factor (flaming)}$$

$$\textit{Emissions (smoldering)} = \textit{Number of acres burned} * \frac{\textit{biomass consumption}}{\text{acre}} * \textit{25\% (smoldering)} * \textit{emission factor (smoldering)}$$

The range of available emission factors is presented below.

NTI Emission Factors

Emission factors from the NTI document, for pollutants that are on the list of EPA toxics, are shown below.

HAP	Flaming Fuel Emission Factor	Smoldering Fuel Emission Factor
1,3-butadiene	2.40E-01	9.00E-01
2,3,7,8-TCDD TEQ	2.00E-09	2.00E-09
acetaldehyde	4.73E-01	2.14E-01
acrolein	4.68E-01	2.92E-01
benz(a)anthracene	6.20E-03	6.20E-03
benzene	6.60E-01	2.52E+00
benzo(a)pyrene	1.48E-03	1.48E-03
chrysene	6.20E-03	6.20E-03
fluoranthene	6.73E-03	6.73E-03
formaldehyde	1.50E+00	5.80E+00
methyl chloride	1.01E-02	4.83E-01
o,m,p-xylene	2.79E-01	1.31E-01
toluene	6.55E-01	3.08E-01

RAPIDS' SCC/AMS Code Lookup

2810001000: (Miscellaneous Area Sources, Other Combustion, Forest Wildfires)

Emittant Material Code	Emittant Unit Code	Throughput Material Code	Throughput Unit Code	Amount	Exponent	Quality	EPA Date
BUTADIENE,13	LB	VEGETATION	TON	9.0	E -1	U	08/08/94
BUTADIENE,13	LB	VEGETATION	TON	5.2	E -1	U	08/08/94
BUTADIENE,13	LB	VEGETATION	TON	2.4	E -1	U	08/08/94
TOG	LB	VOC	LB	1.108893	E 0		03/15/88

Please note that these emission factors are identical to several emission factors presented in the SCC/AMS Lookup for 2810015000 (Miscellaneous Area Sources, Other Combustion, Managed Burning/Prescribed). These factors are reproduced below. This comparison will be used to support a request to use FIRE 6.22 emission factors for prescribed burning, in the absence of FIRE 6.22 emission factors for forest fires and wildfires.

2810015000:
(Miscellaneous Area Sources, Other Combustion, Managed Burning/Prescribed)

Emittant Material Code	Emittant Unit Code	Throughput Material Code	Throughput Unit Code	Amount	Exponent	Quality	EPA Date
BUTADIENE,13	LB	VEGETATION	TON	9.0	E -1	U	08/08/94
BUTADIENE,13	LB	VEGETATION	TON	5.2	E -1	U	08/08/94
BUTADIENE,13	LB	VEGETATION	TON	2.4	E -1	U	08/08/94
VOC	LB	VEGETATION	TON	7.0	E 0	A	10/16/97
TOG	LB	VOC	LB	1.108893	E 0		03/15/88

Fire 6.22

Emission factors for SCC 2810001000 are not included in FIRE 6.22. However, various emission factors are available in FIRE 6.22 for SCC 2810015000 (Managed Burning, Prescribed). As indicated in the preceding paragraph, RAPIDS emission factors for prescribed burning and forest wildfires utilize several identical emission factors. Due to this correlation, and the absence of FIRE 6.22 emission factors, Michigan suggests that the Great Lakes states consider the prescribed burning emission factors for the category of forest fires. These factors are presented below.

SCC 2810015000: (Managed Burning, Prescribed), FIRE 6.22

Pollutant	Emission Factor	Quality	Reference	Reason for Duplicate factor
PM10, fltrble	1.600E1 - 4.400 E1 lb. per tons waste burned	D	EPA 1995	line fire, conifer, palmetto/gallberry
PM10, fltrble	1.800E1 lb. per tons waste burned	C	EPA 1995	chaparral
PM10, fltrble	2.000E1 lb. per tons waste burned	B	EPA 1995	range fire, juniper slash
PM10, fltrble	2.000E1 lb. per tons waste burned	D	EPA 1995	chaparral, grasslands
PM10, fltrble	2.200E1 lb. per tons waste burned	A	EPA 1995	range fire, chaparral shrub community
PM10, fltrble	2.400E1 lb. per tons waste burned	C	EPA 1995	broadcast logging slash, hardwood
PM10, fltrble	2.600E1 lb. per tons waste burned	D	EPA 1995	conifer, short needle
PM10, fltrble	2.600E1 lb. per tons waste burned	D	EPA 1995	conifer, long needle
PM10, fltrble	3.000E1 lb. per tons waste burned	B	EPA 1995	range fire, sagebrush
PM10, fltrble	4.000E1 - 8.000E1 lb. per tons waste burned	D	EPA 1995	line fire, conifer, long needle pine
PM10,	8.000E0 lb. per tons waste	D	EPA 1995	logging slash debris, dozer

fltrble	burned			piled conifer, no mineral soil
PM, total	1.20 E1 lb. per tons waste burned	B	EPA 1995	Logging slash debris, dozer piled conifer, no mineral soil
PM, total	2.00 E1 lb. per tons waste burned	D	EPA 1995	Chaparral, grasslands
PM, total	2.80 E1 lb. per tons waste burned	B	EPA 1995	Range fire, juniper slash
PM, total	3.00 E1 lb. per tons waste burned	C	EPA 1995	Chaparral Emissions represent Heading phase
PM, total	3.000E1 - 3.400E1 lb. per tons waste burned	D	EPA 1995	Line fire, conifer, Palmetto/gallberry
PM, total	3.20 E1 lb. per tons waste burned	A	EPA 1995	Range fire, chaparral shrub communities
PM, total	3.40 E1 lb. per tons waste burned	A	EPA 1995	Conifer, short needle
PM, total	3.60 E1 lb. per tons waste burned	A	EPA 1995	Broadcast logging slash, hardwood
PM, total	4.00 E1 lb. per tons waste burned	B	EPA 1995	Conifer, long needle
PM, total	4.000E1 - 1.000E2 lb. per tons waste burned	D	EPA 1995	Line fire, conifer, long needle pine
PM, total	4.60 E1 lb. per tons waste burned	B	EPA 1995	Range fire, sagebrush
PM, total	5.00 E1 lb. per tons waste burned	D	EPA 1995	Logging slash debris, 10-30% mineral soil, smoldering emissions
PM, total	7.00 E1 lb. per tons waste burned	D	EPA 1995	Logging slash debris, 25% organic soil, smoldering emissions
VOC	1.040E1 lb. per tons waste burned	B	EPA 1995	range fire, juniper slash
VOC	1.120E1 lb. per tons waste burned	A	EPA 1995	conifer, short needle
VOC	1.140E1 lb. per tons waste burned	B	EPA 1995	conifer, long needle
VOC	1.200E1 lb. per tons waste burned	B	EPA 1995	range fire, juniper slash
VOC	1.220E1 lb. per tons waste burned	A	EPA 1995	broadcast logging slash
VOC	1.240E1 lb. per tons waste burned	B	EPA 1995	range fire, sagebrush
VOC	1.280E1 lb. per tons waste burned	A	EPA 1995	broadcast logging slash
VOC	1.380E1 lb. per tons waste burned	B	EPA 1995	range fire, sagebrush
VOC	2.500E1 lb. per tons waste burned	A	EPA 1995	range fire, chaparral shrub communities
VOC	3.600E0 lb. per tons waste burned	B	EPA 1995	range fire, logging slash debris, dozer piled conifer, no mineral soil
VOC	5.600E0 lb. per tons waste burned	C	EPA 1995	chaparral
VOC	7.000E0 lb. per tons waste burned	A	EPA 1995	conifer, short needle

VOC	7.000E0 lb. per tons waste burned	C	EPA 1995	chaparral
VOC	8.400E0 lb. per tons waste burned	B	EPA 1995	conifer, long needle
VOC	9.000E0 lb. per tons waste burned	A	EPA 1995	range fire, chaparral shrub communities

Speciation

Speciation profile number 42321 was selected from RAPIDS. Pollutants that appeared in the list of EPA toxics are shown below.

Profile Code	Emittant Material Code	Emittant Unit Code	Throughput Code	Throughout Unit Code	Amount	Exponent	EPA Date
42321	BENZO(A)PYRE	LB	PM	LB	0.00001	0	03/15/88
42321	BENZO(A)PY10	LB	PM10	LB	0.00001	0	03/15/88
42321	CADMIUM	LB	PM	LB	0.00031	0	03/15/88
42321	CADMIUM10	LB	PM10	LB	0.00031	0	03/15/88
42321	CHROMIUM	LB	PM	LB	0.00002	0	03/15/88
42321	CHROMIUM10	LB	PM10	LB	0.00002	0	03/15/88
42321	CHRYSENE	LB	PM	LB	0.00001	0	03/15/88
42321	CHRYSENE10	LB	PM10	LB	0.00001	0	03/15/88
42321	CHLORINE	LB	PM	LB	0.00239	0	03/15/88
42321	CHLORINE10	LB	PM10	LB	0.00239	0	03/15/88
42321	COPPER	LB	PM	LB	0.00002	0	03/15/88
42321	COPPER10	LB	PM10	LB	0.00002	0	03/15/88
42321	FLUORANTHENE	LB	PM	LB	0.00001	0	03/15/88
42321	FLUORANTHE10	LB	PM10	LB	0.00001	0	03/15/88
42321	LEAD	LB	PM	LB	0.0001	0	03/15/88
42321	LEAD10	LB	PM10	LB	0.0001	0	03/15/88
42321	MANGANESE	LB	PM	LB	0.00011	0	03/15/88
42321	MANGANESE10	LB	PM10	LB	0.00011	0	03/15/88
42321	NICKEL	LB	PM	LB	0.00002	0	03/15/88
42321	NICKEL10	LB	PM10	LB	0.00002	0	03/15/88
42321	PHOSPHORUS	LB	PM	LB	0.0006	0	03/15/88
42321	PHOSPHORUS10	LB	PM10	LB	0.0006	0	03/15/88

Additional EPA Toxics

Additional EPA toxic pollutants are emitted from wood combustion. Emission factors provided for woodburning stoves, in EIIP Volume III Chapter 2, *Residential Wood Combustion,* indicate other pollutants that would be expected, even though the quantities emitted will likely be different for forest and wildfires. Any suggestions on appropriate speciation profiles for these pollutants would be appreciated.

Acenaphthene
Acenaphthylene
Benz(a)anthracene
Benzo(b)fluoranthene
Benzo(ghi)perylene
Benzo(k)fluoranthene
Dibenz(ah)anthracene

Fluorene
Indeno(123-cd)pyrene
Naphthalene
Phenanthrene
Pyrene
Xylene, ortho

REFERENCES

Michigan Department of Environmental Quality, Air Quality Division. 1996 State Implementation Plan Submittal. 1999.

Eastern Research Group, Inc. *Documentation for the 1996 Base Year National Toxics Inventory for Area Sources.* April 27, 1999.

Environmental Protection Agency (EPA). *STAPPA-ALAPCO-EPA Emission Inventory Improvement Program (EIIP).* Volume III - Area Sources Preferred and Alternative Methods. Chapter 2, Residential Woodburning. September 1997.

Appendix Z: Public Owned Treatment Works (POTW)

OVERVIEW

POTWs are municipal treatment facilities where wastewater from different industrial, commercial, and residential sources is directed for treatment. Hence, POTW wastewater may have large concentrations of many toxic compounds. Specific industrial and commercial activities are the largest source of organic compounds entering the municipal collection systems. However, other residential sources of organic compounds such as home maintenance and cleaning products contribute to the total organic compounds that enter the POTWs. These organic compounds produce emissions through volatilization at the surface of the wastewater during treatment processes. Nationwide estimates indicate that POTWs are significant sources of volatile organic compounds (VOC) in the United States (Water Environment Federation, 1995). Thus, this section considers toxic air emissions (VOCs) from POTWs.

SOURCE IDENTIFICATION

POTWs are associated with the Standard Industrial Code (SIC) 4952: Sewerage Systems. Searching through the Factor Information Retrieval System Version 6.01 (FIRE) provides all the Source Classification Codes (SCC) for POTW. The following SCCs were found:

50100700: Solid Waste Disposal - Government - Sewerage Treatment

50100707: POTW: Headworks Screening
50100715: POTW: Aerated Grit Chamber
50100719: POTW: Lift Stations
50100720: POTW: Primary Settling Tank
50100731: POTW: Diffused Air Activated Sludge
50100732: POTW: Mechanical Mix Air Activated Sludge
50100733: POTW: Pure Oxygen Activated Sludge
50100734: POTW: Trickling Filters
50100740: POTW: Secondary Clarifier
50100750: POTW: Tertiary Filters
50100760: POTW: Chlorine Contact Tank
50100761: POTW: Dechlorination
50100771: POTW: Gravity Sludge Thickener
50100772: POTW: DAF Sludge Thickener
50100781: POTW: Anaerobic Digester
50100789: POTW: Sludge Digester Gas Flare
50100791: POTW: Belt Filter Press
50100792: POTW: Sludge Centrifuge
50100793: POTW: Sludge Drying Bed

Because the emissions from POTWs will be classified as area source emissions, the AMS code A2630020000, wastewater treatment-publicly owned-total processed, will be used to classify emissions in the inventory system.

POLLUTANTS

The FIRE database contained emission factors for the pollutants and processes listed in below.

Table Z-1: Processes with Available Emission Factors for Pollutants of Concern

Pollutant	Processes with Available Emission Factors
1,1,1-Trichloroethane	50100707, 50100715, 50100720, 50100731, 50100734, 50100760, 50100761, 50100771, 50100791, 50100792, 50100793
1,2-Dichloroethane	50100707, 50100734, 50100760
Acetaldehyde	50100793
Benzene	50100707, 50100715, 50700720, 50100731, 50100734, 50100740, 50100760, 50100771, 50100781, 50100791, 50100792, 50100793
Carbon tetrachloride	50100707, 50100720, 50100731, 50100740, 50100760, 50100792
Chloroform	50100707, 50100715, 50700720, 50100731, 50100734, 50100740, 50100760, 50100771, 50100781, 50100791, 50100792
Ethylbenzene	50100707, 50100760
Ethylene dibromide	50100760
Formaldehyde	50100715, 50700720, 50100731, 50100734, 50100740, 50100760, 50100771, 50100781, 50100791, 50100792, 50100793
Methylene chloride	50100707, 50100715, 50700720, 50100731, 50100734, 50100740, 50100760, 50100771, 50100781, 50100791, 50100792, 50100793
Perchloroethylene	50100707, 50100715, 50700720, 50100731, 50100734, 50100740, 50100760, 50100761, 50100771, 50100781, 50100792, 50100793
Styrene	50100715, 50100720, 50100734, 50100771, 50100781, 50100792
Toluene	50100707, 50100715, 50700720, 50100731, 50100734, 50100740, 50100760, 50100761, 50100771, 50100781, 50100791, 50100792, 50100793
Trichloroethylene	50100707, 50100715, 50700720, 50100731, 50100734, 50100760, 50100761, 50100771, 50100781, 50100791, 50100792
Vinyl chloride	50100760, 50100781, 50100792
Vinylidene chloride	50100720, 50100734, 50100761, 50100771, 50100781, 50100792
Xylenes	50100707, 50100715, 50700720, 50100731, 50100734, 50100740, 50100760, 50100761, 50100771, 50100781, 50100791, 50100792, 50100793

EMISSION FACTORS

The compounds and their concentrations in wastewater vary with time for each facility. There are no practical or feasible methods to accurately estimate emissions based on this time variation without continuous monitoring (Water Environment Federation, 1995). Therefore, emission factors are developed based on the estimation of the volatilization of the compounds from the discharge influent of the individual processes and operations. Emission factors for the various treatment processes were available from FIRE for all the SCCs listed in the "Source Identification" section except for SCC 50100789 and SCC 50100719, which are sludge digester gas flares and lift stations, respectively. Minnesota does not have any sludge digester gas flaring systems (WWTFIR, 1995). No information was available for SCC 50100719.

Since a variety of treatment processes and equipment are used in POTWs, it would be very difficult and would require a great deal of effort, to estimate individual emissions for all of the POTWs in Minnesota. To simplify the emission estimation, AP-42 was used as a reference to establish the standard processes at a typical POTW. Per AP-42, a typical POTW usually consists of a grit chamber for storage, a lift station for collection, a primary clarifier for settling solids, a biotreatment process for biological waste treatment, a secondary clarifier for settling, a sludge digester, and a chlorine contact tank for disinfecting. In addition, the vast majority of the POTWs in Minnesota have additional equipment and processes such as a dechlorination process, a screening process, and a trickling filter (WWTFIR, 1995).

Although, most POTWs do have a dechlorination process, this process was not included for toxics emissions estimations. Conversation with Tod Ekberg of Minnesota Pollution Control Agency Water Quality Division (11/21/95) indicated that the vast majority of POTWs use sulfur dioxide as a dechlorination agent which is not one of the targeted compounds.

Hence, based on the collected information, a typical Minnesota POTW is characterized to have the following equipment: a screening device, a grit chamber, a primary clarifier (includes a primary settling tank, or a primary sedimentation tank), a diffused activated sludge treatment device for biotreatment (Dunnett, Randy, 1996), a trickling filter, a secondary clarifier, a sludge digester, and a chlorine contact tank.

Table 2 shows the emission factors and corresponding SCC codes for the processes included in the inventory. The individual emission factors are added together to arrive at one general emission factor for the entire wastewater treatment process. This factor will be applied as the total process factor with the appropriate AMS code.

FACILITY IDENTIFICATION

Specific facility identification was collected from Wastewater Treatment Facilities Inventory Report (WWTIR) in the Water Quality Division. This report identified all the treatment facilities and inventoried all the treatment processes within each facility in Minnesota for 1995. Per conversation with Randy Dunnett (MPCA, WQD), equipment has not changed significantly at the facilities since 1995, so that equipment inventory was used for 1996 also.

Emissions will not be considered for many of the small treatment facilities. Most of these facilities have stabilization ponds, surface water discharges, and spray irrigations. This means that these smaller treatment facilities virtually do not have any treatment processes. With a stabilization pond and a surface water discharge or spray irrigation, the wastewater flowrate is small enough that the wastewater has time to biodegrade. In addition, not much emissions information is available for these types of treatment processes.

In summary, there are a total of 204 POTW facilities with treatment processes in Minnesota for 1996. This **excludes** the POTWs with stabilization ponds, surface water discharges, and spray irrigation systems.

The 1996 volumetric flowrates of annual discharge and chlorine consumption for the POTWs were available from the Water Quality Division. Chlorine consumption rates were obtained from the Water Quality Division in average pounds per day for each month chlorine was used at the facility. Those rates were converted to monthly rates by multiplying by the number of days in each month, then added to arrive at an annual total.

Table 3 includes total volumetric flowrates and/or chlorine consumption data for all counties in Minnesota. If all the facilities in a county have stabilization ponds, surface discharges, or spray irrigations and no influent flowrate data available, the county is not included in Table 3.

Three facilities have sludge incinerators. The emissions from these incinerators were included in the point source inventory because they are included as part of the EIS. Therefore, incinerator emissions will not be included in this portion of the inventory. However, toxic emissions from all other processes at these facilities will be included in the area source inventory.

EMISSION ESTIMATION

As mentioned in the “Emission Factor” section, estimating air emissions from wastewater collection, treatment, and storage systems for each POTW is very complex due to the variation of treatment processes from one POTW to the next. Hence, AP-42 was used as a reference to characterize the standard equipment in each POTW facility to provide statewide emission estimations.

Total emissions of a county is estimated by summing the emissions emitted by the annual flow from each treatment plant and the emissions from the chlorine for disinfecting. The following equation provides an example:

$$E_{total} = (EF_{flow} \times PR_{flow}) + (EF_{chlorine} \times PR_{chlorine})$$

where,

E_{total}	=	Total emissions of a pollutant (lb./yr.)
EF_{flow}	=	Generic emission factor based on treated flow (lb./MG)
$EF_{chlorine}$	=	Emission factor based on chlorine (lb./lb. chlorine consumed)
PR_{flow}	=	Total annual volumetric flowrate (MG/yr.)
$PR_{chlorine}$	=	Total annual chlorine consumption (lb./yr.)

To provide the most accurate results, the emissions from a total of the 6 largest POTW facilities (those POTWs with greater than 10 MGD average flows) in Minnesota were calculated based on facility specific equipment inventory as obtained from the WWTIR Report. To estimate the amount of emissions for each process, the amount of wastewater treated by each process is multiplied by the emission factor for each pollutant. The total emissions from all the processes in each facility were then summed and added on to the appropriate county total. These emissions are shown in Table 4.

Total emissions in lb./year from POTWs for each county in Minnesota are listed in Table 3.

REFERENCE

Dunnett, Randall, 1995. Water Quality Division, Minnesota Pollution Control Agency. October 20, 1995.

Eckberg, Tod, 1995. Water Quality Division, Minnesota Pollution Control Agency. November 21, 1995.

Minnesota Pollution Control Agency. (1995) *Wastewater Treatment Facilities Inventory*. Water Quality Division Point Source Compliance Section. August 1995.

U.S. Environmental Protection Agency. (1995) *Waste Water Collection, Treatment and Storage*. AP-42, Compilation of Air Pollution Emission Factors, Section 4.3. 1995.

Water Environment Federation and the American Society of Civil Engineers. (1995) *Toxic Air Emissions from Wastewater Treatment Facilities*. 1995.

Appendix AA. Residential Fuel Combustion

INTRODUCTION

Residential fuel combustion is energy consumed by private households and includes the burning of coal, fuel oil, natural gas, and liquid petroleum gas.

Source Identification

AMS-SCC CODES

AMS CODE	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
A2104002000	Stationary Source Fuel combustion	Residential	Bituminous / Subbituminous Coal	Total: All Combustor Types
A2104004000	Stationary Source Fuel combustion	Residential	Distillate Oil	Total: All Combustor Types
A2104006000	Stationary Source Fuel combustion	Residential	Natural Gas	Total: All Combustor Types
A2104006010	Stationary Source Fuel combustion	Residential	Natural Gas	Residential Furnaces

AMS CODE	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
10300206	External Combustion Boilers	Commercial/ Institutional	Bituminous/ Subbitaminous Coal	Pulverized: Dry Bottom
10100401	External Combustion Boilers	Electric Generation	Residual Oil	Grade 6 Normal Firing
10100501	External Combustion Boilers	Electric Generation	Distillate Oil	Grade 1 and 2
10300401	External Combustion Boilers	Commercial / Institutional	Residual Oil	Grade 6 oil
10300501	External Combustion Boilers	Commercial / Institutional	Distillate Oil	Grade 1 and 2
10300603	External Combustion Boilers	Commercial / Institutional	Natural Gas	< 10 mmbtu/hr
10301001	External Combustion Boilers	Commercial / Institutional	Liquid Petroleum Gas (LPG)	Butane
10301002	External Combustion Boilers	Commercial / Institutional	Liquid Petroleum Gas (LPG)	Propane

Pollutants and Emission Factors

The targeted pollutants with their corresponding emission factors were inventoried for each type of fuel:

Table AA-1: Pollutants and Emission Factors for Coal Combustion Sources
Bituminous coal is by far the largest group of coal being burned in residential furnaces. AP42 was updated in 1998 and included a study on emission factors from ten facilities burning bituminous coal, eight facilities burning subbituminous coal and one facility burning lignite. NTI adopted those factors in their 1996 estimate of area sources. The NTI published factors with those listed in this methodology differs on metal emission factors. The 1998 study applied to boilers utilizing both wet limestone scrubbers or spray dryers with an ESP or fabric filters. Those control devices are targeting particulate matter and not organic compounds. For this reason, metal uncontrolled emission factors are used when available. The table presents emission factors on both weight basis (Lb./tom) and an energy basis (Lb./MMbtu). To convert from Lb./ton to Lb./MMbtu divide by a heating value of 26 MMbtu/ton.

Pollutant	Emission Factors (Lbs./ton of coal)	Emission Factor (Lbs./MMbtu)	Emission Factor Source
Acetaldehyde	5.7E-4	2.2E-5	10300206 Controlled Factor
Acrolein	2.9E-4	1.2E-5	10300206 Controlled Factor
Acenaphthene	5.1E-7	2.0E-8	10300206 Controlled Factor
Acenaphththylene	2.5E-7	9.6E-9	10300206 Controlled Factor
Anthracene	2.1E-7	8.1E-9	10300206 Controlled Factor
Antimony	1.8E-5	6.9E-7	10300206 Controlled Factor
Arsenic	1.8E-2	6.84E-4	10300206 Uncontrolled Factor
Benzene	1.3E-3	5E-5	10300206 Controlled Factor
Benz(a)anthracene	8E-8	3E-9	10300206 Controlled Factor
Benzo(a)pyrene	3.8E-8	1.5E-9	10300206 Controlled Factor
Benzo(g,h,i)perylene	2.7E-8	1.1E-9	10300206 Controlled Factor
Beryllium	2.1E-3	8.1E-5	10300206 Uncontrolled Factor
Cadmium	7.3E-4	2.8E-5	10300206 Uncontrolled Factor
Carbon Monoxide	5E-1	2E-2	10300206 Uncontrolled Factor
Chloroform	5.9E-5	2.3E-6	10300206 Controlled Factor
Chromium	5.5E-3	2.12E-4	10300206 Uncontrolled Factor
Chrysene	1.0E-7		10300206 Controlled Factor
Cobalt	1.1E-4	4.23E-6	10300206 Controlled Factor
Dioctyl phthalate	7.3E-5	2.8E-7	10300206 Controlled Factor
Ethylene dichloride	4.2E-5	1.6E-6	10300206 Controlled Factor
Ethylbenzene	9.4E-5	3.6E-6	10300206 Controlled Factor
Ethylene dibromide	1.2E-6	4.9E-8	10300206 Controlled Factor
Fluoranthene	7.1E-7	2.7E-8	10300206 Controlled Factor
Fluorene	9.1E-7	3.5E-8	10300206 Controlled Factor
Formaldehyde	2.4E-4	9.2E-6	10300206 Controlled Factor
Indeno(1,2,3-c,d) pyrene	6.1E-8	2.34E-9	10300206 Controlled Factor
Lead	1.4E-2	5.7E-4	10300206 Uncontrolled Factor
Manganese	6.0E-3	2.28E-4	10300206 Uncontrolled Factor

Mercury	4.2E-4	1.6E-5	10300206 Uncontrolled Factor
Methylene chloride	2.9E-4	1.1E-6	10300206 Controlled Factor
Nickel	3.4E-2	1.03E-3	10300206 Uncontrolled Factor
Naphthalene	1.3E-5	5.0E-7	10300206 Controlled Factor
Phenenthrene	2.7E-6	1.E-7	10300206 Controlled Factor
Phenol	1.6E-5	6.2E-7	10300206 Controlled Factor
Pyrene	3.3E-7	1.3E-8	10300206 Controlled Factor
Styrene	2.5E-5	9.6E-7	10300206 Controlled Factor
Tetrachloroethylene	4.3E-5	1.7E-6	10300206 Controlled Factor
Toluene	2.4E-4	9.2E-6	10300206 Controlled Factor

Table AA-2: Pollutants and Emission Factors for Distillate Fuel
The PAH emission factors are for residual oil and for uncontrolled processes. Those factors were derived in 1998 with a C quality rating. Residuals oils are more viscous with higher PAH content than distillate oils and provide a conservative estimate of PAHs for distillate oils. The metal emission factors are for distillate oils and for uncontrolled processes. Factors are given in two set of units (lb./MMbtu or in Lb./1000gal of coal.) To convert volume basis units (Lb./1000 gal) to an energy basis (lb./MMBTU), divide by a heating value of 140 MMbtu/1000 gal of oil.

Pollutant	Emission Factor (lb./mmbtu)	Emission Factor (Lb./1000gal)	Emission Factor Source
Acenaphthene	1.5E-07	2.11E-5	10100401 AP-42
Acenapthylene	1.8E-09	2.53E-7	10100401 AP-42
Acetaldehyde	3.5E-05	4.9E-3	From 1996 NTI Inventory
Anthracene	8.7E-09	1.22E-6	10100401 AP-42
Arsenic	4.0E-06	5.6E-4	10300501 AP-42
Benz(a)anthracene	2.9E-08	4.01E-6	10100401 AP-42
Benzene	1.5E-06	2.16E-4	10100401 AP-42
Benzo(b,k)fluoranthene	1.1E-08	1.48E-6	10100401 AP-42
Benzo(g,h,i)perylene	1.6E-08	2.26E-6	10100401 AP-42
Beryllium	3.0E-06	4.2E-4	10300501 AP-42
Cadmium	3.0E-06	4.2E-4	10300501 AP-42
Chromium	3.0E-06	4.2E-4	10300501 AP-42
Chrysene	1.7E-08	2.4E-6	10300501 AP-42
Dibenz(a,h)anthracene	1.2E-08	1.67E-6	10100401 AP-42
Fluoranthene	3.5E-08	4.84E-6	10100401 AP-42
Fluorene	3.2E-08	4.47E-6	10100401 AP-42
Formaldehyde	2.4E-04	3.3E-2	10100401 AP-42
Indeno(1,2,3-c,d)pyrene	1.5E-08	2.14E-6	10100401 AP-42
Lead	9.0E-06	1.26E-3	10300501 AP-42
Manganese	6.0E-06	8.4E-4	10300501 AP-42
Mercury	3.0E-06	4.2E-4	10300501 AP-42
Naphthalene	8.1E-06	1.13E-3	10100401 AP-42
Nickel	3.0E-06	4.2E-4	10300501 AP-42
POM	2.4E-5	3.3E-3	10300501 AP-42
Phenanthrene	7.5E-08	1.05E-5	10100401 AP-42
Pyrene	3.0E-08	4.25E-6	10100401 AP-42
Selenium	1.5E-05	2.1E-3	10300501 AP-42

Table AA-3: Pollutants and Emission Factors for Natural Gas
Pollutants and emission factors from natural gas combustion were taken from AP 42 (which are same as in Fire 6.22) and are presented below. Emission factors units are provided on a volume basis (Lb./MM SCF) and energy basis (Lb./MM Btu). To convert to an energy basis, divide the volume basis by a heating value of 1,020 MMBTU/MMSCF.

Pollutant	Emission Factor (Lb./MMSCF)	Emission Factor (Lb./MMbtu)	Emission Factor Source
Acenaphthene	1.8E-6	1.8E-9	10300603 Uncontrolled Factor
Acenapthylene	1.8E-6	1.8E-9	10300603 Uncontrolled Factor
Anthracene	2.4E-6	2.4E-9	10300603 Uncontrolled Factor
Benz(a)anthracene	1.8E-6	1.8E-9	10300603 Uncontrolled Factor
Benzo(a)pyrene	1.2E-6	1.2E-9	10300603 Uncontrolled Factor
Benzo(b)fluoranthene	1.8E-6	1.8E-9	10300603 Uncontrolled Factor
Benzene	2.1E-3	2.1E-6	10300603 Uncontrolled Factor
Benzo(g,h,i)perylene	1.2E-6	1.2E-9	10300603 Uncontrolled Factor
Benzo(k)fluoranthene	1.8E-6	1.8E-9	10300603 Uncontrolled Factor
Dibenz(a,h)anthracene	8.5E-4	4.5E-7	10300603 Uncontrolled Factor
Fluoranthene	3E-6	3E-9	10300603 Uncontrolled Factor
Fluorene	2.8E-6	2.8E-9	10300603 Uncontrolled Factor
Formaldehyde	7.5E-2	7.5E-5	10300603 Uncontrolled Factor
Naphthalene	6.1E-4	6.1E-7	10300603 Uncontrolled Factor
Phenanthrene	1.7E-5	1.7E-8	10300603 Uncontrolled Factor
Pyrene	5E-6	5E-9	10300603 Uncontrolled Factor
Toluene	3.4E-3	3.4E-6	10300603 Uncontrolled Factor
Arsenic	2E-4	2E-7	10300603 Uncontrolled Factor
Beryllium	1.2E-5	1.2E-8	10300603 Uncontrolled Factor
Cadmium	1.1E-3	1.1E-6	10300603 Uncontrolled Factor
Chromium	1.4E-3	1.4E-6	10300603 Uncontrolled Factor
Cobalt	8.4E-5	8.4E-8	10300603 Uncontrolled Factor
Copper	8.5E-4	8.5E-7	10300603 Uncontrolled Factor
Lead	5E-4	5E-7	10300603 Uncontrolled Factor
Manganese	3.8E-4	3.8E-7	10300603 Uncontrolled Factor
Mercury	2.6E-4	2.6E-7	10300603 Uncontrolled Factor

Table AA-4: Pollutants and Emission Factors for Liquid Petroleum Gas

The AP 42 and Fire database provide only emission factors for criteria pollutants and the speciation profile in the speciate database is in question because of the high emission factors that result from it. The speciate profile for LPG and natural gas was used in the 1996 methodology and resulted to an overestimate of metals. However, emission factors for speciated organic and metal compounds for natural gas combustion were published in 1998 in AP42 but not for liquefied petroleum gases. In most cases, natural gas emission factors dropped by a factor of 100 or 1000 times. The speciation profile for LPG and natural gas is expected to be similar. The combustion processes that use LPG are very similar to those that use natural gas. For the above reasons, the decision is to use the natural gas emission factors and adjust them by the PM and TOC ratios of LPG to natural gas as shown in the table below:

Pollutant	Natural Gas Lb./MMSCF	Natural Gas[1] Lb./MMbtu	LPG Lb./1000 gal	LPG[2] Lb./MMbtu	ratio[3]
PM Filterable	1.9E+0	1.08 E-4	4E-1	4.27E-3	39.5
TOC	11	1.08E-2	5E-1	5.46E-3	0.5

[1] PM filterable and VOC emission factors for natural gas were converted to an energy basis by dividing the Lb./MMSCF by a heating value of 1,020 MMBTU/MMSCF

[2] PM filterable and VOC emission factor for LPG were converted to an energy basis by dividing the Lb./1000 gal factor by a heating value of 91.5 Lb./MMBTU.

[3] Ratios are calculated by dividing LPG (Lb./MMBTU) by Natural Gas (Lb./MMBtu)

Table AA-5: The ratios calculated above are used to adjust the emission factors of the natural gas pollutant table. The natural gas emission factors (expressed in Lb./MMBTU) are multiplied by either, 39.5 for organics or 0.5 for metals, to calculate propane emission factors in Lb./MMBTU. Since activity data for LPG are given in Barrels (42gallons/barrel), LPG units are better expressed on a volume basis (Lb./1000 gal). To convert to a volume basis, multiply the Lb./MMBTU emission factor by a heating value of 91.5 MMBTU/1000 gal for propane.

Pollutant	Emission Factor (Lb./100 Gal)	Emission Factor (Lb./MMBtu)	Emission Factor Source
Acentaphthene	6.5E-6	7.1E-8	10300603 Uncontrolled Adjusted
Acenapthylene	6.5E-6	7.1E-8	10300603 Uncontrolled Adjusted
Anthracene	8.7E-6	9.5E-8	10300603 Uncontrolled Adjusted
Benz(a)anthracene	6.5E-6	7.1E-8	10300603 Uncontrolled Adjusted
Benzo(a)pyrene	4.3E-6	4.7E-8	10300603 Uncontrolled Adjusted
Benzo(b)fluoranthene	6.5E-6	7.1E-8	10300603 Uncontrolled Adjusted
Benzene	7.6E-3	8.3E-5	10300603 Uncontrolled Adjusted
Benzo(g,h,i)perylene	4.3E-6	4.7E-8	10300603 Uncontrolled Adjusted
Benzo(k)fluoranthene	6.5E-6	7.1E-8	10300603 Uncontrolled Adjusted
Dibenz(a,h)anthracene	1.6E-3	1.8E-5	10300603 Uncontrolled Adjusted
Fluoranthene	1.1E-5	1.2E-7	10300603 Uncontrolled Adjusted
Fluorene	1.08E-5	1.1E-7	10300603 Uncontrolled Adjusted
Formaldehyde	1.6E-1	1.8E-3	10300603 Uncontrolled Adjusted
Napthalene	2.2E-3	2.4E-5	10300603 Uncontrolled Adjusted
Phenanthrene	6.1E-5	6.7E-7	10300603 Uncontrolled Adjusted
Pyrene	2.1E-5	2.3E-7	10300603 Uncontrolled Adjusted
Toluene	1.2E-2	1.3E-4	10300603 Uncontrolled Adjusted
Arsenic	9.2E-6	1E-7	10300603 Uncontrolled Adjusted
Berylium	5.5E-7	6E-9	10300603 Uncontrolled Adjusted
Cadmium	5.0E-5	5.5E-7	10300603 Uncontrolled Adjusted
Chromium	6.4E-5	7E-7	10300603 Uncontrolled Adjusted
Cobalt	7.7E-6	8.4E-8	10300603 Uncontrolled Adjusted
Copper	3.9E-5	4.3E-7	10300603 Uncontrolled Adjusted
Lead	2.3E-5	2.5E-7	10300603 Uncontrolled Adjusted
Manganese	1.7E-5	1.9E-7	10300603 Uncontrolled Adjusted
Mercury	1.2E-5	1.3E-7	10300603 Uncontrolled Adjusted

METHODOLOGY

Step 1. State Residential Consumption Estimate

The activity data for all forms of residential fuels come from the State Energy Data Report of the U.S. Department of Energy. Information can be downloaded via their Web site, http://www.eia.doe.gov/emeu/states/states.html. For each inventory, activity data are provided for bituminous coal in thousand tons, natural gas in billion cubic feet, distillate fuel in thousand barrels (42 gallons per barrel) and LPG in thousand barrels.

Step 2. County Apportionment of Statewide Consumption Data

The Bureau of Census compiles housing information every ten years. The 1990 census for the entire country is on http://govinfo.library.orst.edu/index.html web site. Click on the 1990 Census of Population and Housing Section icon and it will take you to http://govinfo.library.orst.edu/stateis.html. Choose the state of you choice, click on the 1990 State of ..... Summaries, select housing and view your state's summary information. Search for detailed county information and you can obtain number of households on each county that use LPG, Natural Gas, Oil or Coal and calculate the county's fuel consumption.

Example Calculation

In 1996, there were 2,787,946 households in Ohio and 1533 households in Adams County that used natural gas. The state's natural gas consumption in 1996 was 375 Billion Cubic Feet. Assuming that all houses across state consume an equal amount of natural gas, consumption in Adams County can calculate to be:

(1,533 /2,787,946 Households) X 375,000 MMSCF = 206 MMSCF

Step 3. Emission Estimate

After having apportioned the house heating fuel to the county level, apply the appropriate toxic emission factor to the county's fuel consumption.

Example Calculation

Benzene Emissions in Adams County from Natural Gas calculate to be:
2.1E-3 Lb./MMSCF X 206MMSCF = .43 lbs. of Benzene.

REFERENCES

AP42 and Fire 6.22 database

Detailed Housing Characteristics, 1990 Census of Housing

State Energy Data Report 1996, Energy Information Administration, Office of Energy Markets and End Use, U.S. Department of Energy

Appendix BB: Residential Wood-Burning

BACKGROUND

Residential woodburning is done in three major types of equipment: woodstoves, furnaces, and fireplaces. Woodstoves and furnaces are commonly used in residences for primary and supplemental heating, and fireplaces are commonly used for pleasure burning. Minnesota does not currently have any regulations put into place for residential wood burning, but most of the woodstoves, furnaces, and fireplaces are equipped with some emission reducing technology or features. This section will focus on the emissions from residential wood burning throughout Minnesota.

SOURCE IDENTIFICATION

Searching through the Standard Industrial Classification Code List (SIC), residential wood burning is not categorized under any SIC Code since residential wood burning is not an industrial activity. Therefore, it is classified as SIC 9999: Non Classifiable Establishments.

Searching through the FIRE6.01 (Factor Information Retrieval System Version 6.01) and Source Summary Database (SSD), the following Area Mobile Source Codes (AMS) were found:

A2104008000: Total woodstoves and fireplaces
A2104008001 (lb./ton dry wood burned): Fireplaces - general
A2104008010 (mg/Mg dry wood burned): Woodstoves - general
A2104008030 (lb./ton dry wood burned): Catalytic woodstoves - general
A2104008050 (lb./ton dry wood burned): Non-catalytic woodstoves - general
A2104008051 (lb./ton dry wood burned): Non-catalytic woodstoves - conventional
A2104008052 (lb./ton dry wood burned): Non-catalytic woodstoves - low emitting
A2104008053 (lb./ton dry wood burned): Non-catalytic woodstoves - pellet fired

POLLUTANTS

All the AMS codes listed above were considered when locating all the possible targeted emission pollutants. Using the FIRE 6.01 database and the information found in the STAPPA-ALAPCO Emission Inventory Improvement Program (EIIP), emission factors were found for 31 pollutants, shown in Table BB-1. In order to create a more complete emission inventory for Minnesota, emission estimates for some greenhouse gases and criteria pollutants were also calculated. They are methane (CH_4), carbon dioxide (CO_2), particulate matter smaller than 10 microns (PM10), carbon monoxide (CO), sulfur oxides (SO_X), nitrogen oxides (NO_X), and total volatile organic compounds (VOC).

EMISSION FACTORS

Since there was not any information found in the FIRE database for furnaces, the emission factors for furnaces are assumed to be grouped with wood burning stoves.

There are many variations in device design and operation characteristics of fireplace, furnace and woodstove burning. Hence, assumptions were made in order to provide the most accurate emission estimates. When considering emission factors for emission estimation, factors for non-catalytic conventional stoves were used, as they were the most conservative factors available. There were five pollutants for which there were no emission factors listed under non-catalytic conventional stoves in FIRE 6.22. For those pollutants, the emission factors listed under non-catalytic general stoves were used instead. Also, there were four instances where no emission factors were available for either non-catalytic conventional or non-catalytic general stoves. General woodstove emission factors were used in those cases. Emission factors for the criteria pollutants were available for residential fireplaces. Thus, emission factors from A2104008050, A2104008051, A2104008001, and A2104008010 were chosen for the emission estimate calculations. They are listed in Table BB-1.

Table BB-1: Emission Factors for Residential Wood Burning

Pollutant	Emission Factor (lb./ton)	AMS Code	Reference
Acenaphthene	0.010	A2104008050	FIRE 6.22
Acenaphthylene	0.212	A2104008051	FIRE 6.22
Anthracene	0.014	A2104008051	FIRE 6.22
Benzene	1.938	A2104008051	FIRE 6.22
Benz(a)anthracene	0.020	A2104008051	FIRE 6.22
Benzo(a)pyrene	0.004	A2104008051	FIRE 6.22
Benzo(b)fluoranthene	0.006	A2104008051	FIRE 6.22
Benzo(g,h,i)perylene	0.004	A2104008051	FIRE 6.22
Benzo(k)fluoranthene	0.002	A2104008051	FIRE 6.22
Cadmium	2.2×10^{-5}	A2104008051	FIRE 6.22
Chromium	1.0×10^{-6}	A2104008051	FIRE 6.22
Chrysene	0.012	A2104008051	FIRE 6.22
Copper	3.4×10^{-4}	A2104008050	FIRE 6.22
Dibenz(a,h)anthracene	0.004	A2104008050	FIRE 6.22
Fluoranthene	0.020	A2104008051	FIRE 6.22
Fluorene	0.024	A2104008051	FIRE 6.22
Indeno(1,2,3-cd)pyrene	0.02	A2104008050	FIRE 6.22
Manganese	1.7×10^{-4}	A2104008051	FIRE 6.22
Naphthalene	0.288	A2104008051	FIRE 6.22
Nickel	1.40×10^{-5}	A2104008051	FIRE 6.22
Phenanthrene	0.078	A2104008051	FIRE 6.22
Phenol	0.001	A2104008050	FIRE 6.22
Pyrene	0.024	A2104008051	FIRE 6.22
2,3,7,8-TCDD	7.4×10^{-9}	A2104008010	FIRE 6.22
2,3,7,8-TCDF	4.4×10^{-7}	A2104008010	FIRE 6.22
PCDD	2.88×10^{-6}	A2104008010	FIRE 6.22
PCDF	1.59×10^{-5}	A2104008010	FIRE 6.22
Toluene	0.73	A2104008051	FIRE 6.22
o-Xylene	0.202	A2104008051	FIRE 6.22
Carbon Monoxide	252.6	A2104008001	FIRE 6.22
Particulate Matter < 10 μg	34.6	A2104008001	FIRE 6.22
Sulfur Oxides	0.4	A2104008001	FIRE 6.22
Nitrogen Oxides	2.6	A2104008001	FIRE 6.22
Volatile Organic Compounds	229.0	A2104008001	FIRE 6.22
Carbon Dioxide	3400	A2104008001	FIRE 6.22
Methane	4.800	A2104008051	FIRE 6.22

FACILITY IDENTIFICATION

Residential wood burning data were obtained from the 1995-1996 Minnesota Residential Fuelwood Survey (DNR, 1996). The survey provides information based on the Minnesota Forest Service Survey Units classified by location. There were a total of 5 units (Table BB-2). Each

county was placed in one of 5 survey units (Refer to Table BB-3 for all the counties listed under the 5 survey units). The survey supplied information relative to total volume of wood consumed for pleasure, supplemental and primary heating, average number of cords burned per survey unit, geographic data, and percent of wood burned in fireplaces, woodstoves, and furnaces.

A summary of the required parameters to estimate emissions are listed in Table BB-2 below.

Table BB-2: Estimated Average Annual Wood Consumption and Percent of Households that Burn Wood (Data from DNR, 1996)

Unit	% of Households Burning Wood	Avg. # Cord Burned per Household for heating (cords/house/year)	Avg. # Cords Burned per Household for pleasure (cords/house/year)
1	21%	1.74	0.64
2	25%	2.90	0.29
3	17%	2.90	0.70
4	31%	3.89	0.70
5	36%	4.9	0.94

Where Unit #1: Metro (Metropolitan)
#2: Central Hardwoods (Central MN)
#3: Prairie (South-West MN)
#4: Aspen-Birch (East MN)
#5: Northern Pine (North MN)
Standard Cord: 4ft x 4ft x 8ft or 128 standard cubic ft

To simplify the calculations, two categories of wood burning were developed. They are pleasure and primary/supplemental heat burning (Table BB-2). The average numbers of cords burned in Table BB-2 were calculated based on the data taken from the appendix in the survey. This was caculated based upon the estimated number of cords burned for each heating purpose in each unit and dividing by the number of households burning wood for that heating purpose.

Note from Table BB-2 that the percent of the households that burn wood and the average number of cords of wood burned per household by pleasure and primary/supplemental heating vary from one unit to the other. This variation is dependent on what part of the state a survey unit is located. Therefore, to obtain the most accurate data and to provide the most accurate emission estimates, the emission estimates for each county were calculated using the appropriate data from the survey unit where the county is located (assuming the same averages over the entire survey unit).

EMISSION ESTIMATION

The total estimated residential consumption of wood burned for each county was determined by taking the average number of cords of wood burned per household in the survey unit (Table BB-3) and multiplying by the number of households that burn wood for pleasure and the number of households that burn wood for supplemental and primary heating, respectively. Combine cords burned for pleasure and heating to arrive at a county-wide total. See Table BB-3 for the total number of cords of wood burned per county for all the counties in Minnesota. The 1997 Household data for the state and all the counties were obtained from the Minnesota Planning.[2] Calculation example:

$$T = (HP * PA) + (HH * WA)$$

Where
- T = Total number of cords burned in a county
- HP = # of Households in county that burn wood for pleasure
- HH = # of Households in county that burn wood for heating
- PA = Average cords burned/household-yr. for pleasure
- HA = Average cords burned/household-yr. for heating.

Total emissions of a pollutant from residential wood burning for each county are achieved by multiplying the total number of cords burned in each county by the density of wood, 2 tons of dry wood per cord[3] and the appropriate emission factor.

Calculation example:

$$TE = T*D*EF$$

Where
- TE = Total emissions of a pollutant (lb./yr.)
- T = Total cords burned in county
- D = Density of wood (2 Tons dry wood/Cord)
- EF = Emission factor for the pollutant (lb./ton)

All calculations were verified by spreadsheets and RAPIDS.

REFERENCES

Minnesota Department of Natural Resources (DNR), 1996. 1995-1996 Minnesota residential Fuelwood Survey.

Minnesota Planning, Population and Household Estimates: County Estimates. http://www.mnplan.state.mn.us/demography/demogpop.html. Accessed 5/19/00.

Dahlman, Rick, 1995. Minnesota Department of Natural Resources. August 07, 1995.

EPA, STAPPA, ALAPCO, Emission Inventory Improvement Program (EIIP), Volume III, July 1997, Chapter 2.

Appendix CC: Industrial Solvent Cleaning

METHODOLOGY

In this category, the use of solvents is broken into two broad classifications. The classifications are solvent cleaning (which is composed of cold cleaning and vapor/in-line cleaning), and solvent cleanup (predominantly wipe cleaning of external surfaces). Michigan recommends that the main emphasis be on solvent cleaning, as that will be the primary source of emissions.

EIIP Preferred Method

Solvent Cleaning Equipment

Cold Cleaners
Conduct survey of suppliers, until cold cleaner NSPS is promulgated.

Vapor/In-line Cleaners
Facility specific data submitted per the halogenated solvent cleaning NESHAP; or data from facilities permitted as VOC and/or HAP sources.

EIIP Alternative Method

Solvent Cleaning Equipment (both Cold Cleaners and Vapor/In-line Cleaners)

Surveys
Useable only if data available for reasonable subset of facilities.

Emission factors
EIIP Table 6.5-2 provides per capita and per employee emission factors, as reproduced below. Throughput for per capita emission factors may be found with the U.S. Department of Commerce, Bureau of the Census (http://www.census.gov/population/www/estimates/countypop.html), in the form of *County Population Estimates for July 1, 1998 and Population Change for July 1, 1997 to July 1, 1998* for individual states. County population estimates for 1997 are provided here.

Recommended Method for Solvent Cleaning Equipment

Michigan opted to utilize the per capita emission factor from Table 6.5-2 of EIIP for calculating solvent cleaning equipment emissions. The document, *Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone: Volume I: General Guidance for Stationary Sources* (EPA, 1991), states "Using per capita factors assumes that emissions in a given area can be reasonably associated with population. This assumption is valid over broad areas for certain activities such as dry cleaning, architectural surface coating, small degreasing operations and solvent evaporation from household and commercial products".

Cold cleaning and vapor/in-line cleaning can be calculated together by the use of the total solvent cleaning emission factor. After total solvent cleaning emissions are calculated with the per capita emission factor, point source emissions must be accounted for. Point source emissions by SIC code, from Michigan's 1997 Emission Inventory System, were subtracted from the total solvent cleaning emissions to generate area source emission estimates for each county.

Per Capita and Per Employee Solvent Cleaning Emission Factors (EIIP Table 6.5-2)

		Per Capita Factor (lb/yr/person)		**Per Employee Factor (lb/yr/person)**	
Subcategory	**SIC Codes**	**VOCs**	**Organics**	**VOCs**	**Organics**
Solvent cleaning (total)	25, 33-39, 417, 423, 551, 552, 554-556, 753	4.3	7.2	87	144
Cold Cleaning					
Automobile Repair	417, 423, 551, 552, 554-556, 753	2.5	2.5	270	270
Manufacturing	25, 33-39	1.1	1.1	24	24
Vapor and In-Line Cleaning					
Electronics and Electrical	36	0.21	1.1	29	150
Other	25, 33-39, 417, 423, 551, 552, 554-556, 753	0.49	25	9.8	49

Great Lakes Toxics

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

These SIC codes each matched Profile Number 1195 in RAPIDS. Under Profile Number 1195, the following pollutants from the GLC Toxics material group are speciated. Next to the pollutants, emission factors from the RAPIDS Generic Speciation Factor table are provided, in lb. of emittants per lb. of throughput. The throughput is TOG. One lb. of TOG is emitted for every lb. of VOC throughput. This relationship came from the RAPIDS emission factor table.

benzene	0.010000 LB/LB TOG
cumene	0.000300 LB/LB TOG
hexane	0.000400 LB/LB TOG
methyl ethyl ketone	0.011000 LB/LB TOG
methylene chloride	0.041000 LB/LB TOG
naphthalene	0.000300 LB/LB TOG
perchloroethylene	0.074000 LB/LB TOG
1,1,1 trichloroethane	0.222900 LB/LB TOG
toluene	0.082900 LB/LB TOG

trichloroethylene	0.210900 LB/LB TOG
xylene, m	0.002300 LB/LB TOG
xylene, o	0.001700 LB/LB TOG
xylene, p	0.002300 LB/LB TOG
xylenes iso	0.034000 LB/LB TOG

REFERENCES

U.S. Environmental Protection Agency (U.S. EPA). *Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone: Volume I: General Guidance for Stationary Sources* (May 1991).

U.S. 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 1997.* September 1999 (http://www.census.gov/prod/www/abs/cbptotal.html).

US Department of Commerce, Bureau of the Census. *County Population Estimates for July 1, 1998 and Population Change for July 1, 1997 to July 1, 1998.* September 1999. (http://www.census.gov/population/www/estimates/countypop.html).

Appendix DD: Traffic Markings

PREFERRED METOHD: Survey of Traffic Marking Usage

Data requirements of the preferred method as per EIIP Document Volume III: Chapter 14 - Traffic Markings.

- product type, including thinning and cleanup solvents
- product amount used by type (gallon)
- product density (lb./gallon)
- estimates of the proportion of products used during the inventory season
- VOC/solvent content or air toxic/solvent content of each product type (lb./gallon or weight percent), depending on the inventory type

ALTERNATIVE METHODS

Data requirement of each alternative approach

1. Alternative Method One: National traffic paint sales and National Paint & Coating Association (NPCA) emission factor
   - National traffic paint usage
   - National and state spending for highway maintenance
   - State and county paved lane miles (preferred approach) or state and county population
   - Proportion of solvent- versus water-based coatings for the state or county to develop a local emission factor from the NPCA solvent and water-based coating factors, or the NPCA national average emission factor

2. Alternative Method Two: Lane miles emission factor
   - Traffic lane miles painted (preferred approach) or total lane miles
   - Proportion of solvent- versus water-based coatings for the state or county to develop a local emission factor (preferred approach), or the solvent-based emission factor

3. Alternative Method Three: Per capita emission factor
   - National traffic paint sales data, in gallons
   - National population and inventory area population figures for the inventory year
   - NPCA per-gallon emission factor

CHOOSING A METHOD & CALCULATING EMISSIONS

All of the alternative methods, even the preferred method to an extent, are based on an assumed proportional relationship between traffic marking usage and some acceptable and accessible surrogate measurement for county/state/national level, i.e. highway maintenance spending, population, traffic lane miles, etc. While the survey method may be a necessity in some states, others need to consider issues of cost and complexity before undertaking this method. A state may have some but not all of the necessary information to do a thorough survey method, i.e. you 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

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

AIR Toxic	Volume Percent (%)	Density (lb./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

The FIRE 6.01 is also checked. The SCC A2401008xxx (traffic markings) has no air toxic emission factors and the SCC 402001-01 (paint: solvent based) is too generic and its Air Toxic emission factors may differ substantially from traffic marking paint formulations.

REFERENCES

Environmental Protection Agency (EPA). *STAPPA-ALAPCO-EPA Emission Inventory Improvement Program (EIIP).* Volume III - Area Sources Preferred and Alternative Methods. Chapter 14 - Traffic Markings. July 1997.

Appendix EE: Index of SIC Codes

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
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
081	Timber Tracts
0811	Timber Tracts
0821	Forest Nurseries & Seed Gather
083	Forest Nurseries & Gathering of Forest Products
0831	Forest Products
0843	Extraction of Pine Gum
0849	Gathering of Forest Products
085	Forestry Services
0851	Forestry Services
09	Fishing, Hunting and Trapping
091	Commercial Fishing
0912	Finfish
0913	Shellfish
0919	Miscellaneous Marine Products
092	Fish Hatcheries and Preserves
0921	Fish Hatcheries and Preserves
097	Hunting, Trapping, & Game Propagation
0971	Hunting, Trapping, & Game Propagation
10	Metal Mining
101	Iron Ores
1011	Iron Ores
102	Copper Ores
1021	Copper Ores
103	Lead and Zinc Ores
1031	Lead and Zinc Ores
104	Gold and Silver Ores
1041	Gold Ores
1044	Silver Ores

SIC	DESCRIPTION
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
138	Oil 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
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
178	Water Well Drilling
1781	Water Well Drilling
179	Misc. Special Trade Contractors
1791	Structural Steel Erection
1793	Glass and Glazing Work
1794	Excavating and Foundation Work
1795	Wrecking and Demolition Work
1796	Installing Building Equipment
1799	Special Trade Contractors, n.e.c.
20	Food and Kindred Products
201	Meat Products
2011	Meat Packing Plants
2013	Sausages & Other Prepared Meat
2015	Poultry Slaughtering & Processing
2016	Poultry Dressing Plants
2017	Poultry and Egg Processing
202	Dairy Products

SIC	DESCRIPTION
2021	Creamery Butter
2022	Cheese Natural and Processed
2023	Condensed and Evaporated Milk
2024	Ice Cream and Frozen Desserts
2026	Fluid Milk
203	Preserved Fruits and Vegetables
2032	Canned Specialties
2033	Canned Fruits and Vegetables
2034	Dehydrated Fruits/Vegetable Soups
2035	Pickles Sauces and Salad Dress
2037	Frozen Fruits and Vegetables
2038	Frozen Specialties
204	Grain Mill Products
2041	Flour & Other Grain Mill Prod
2042	Grain Mill Products
2043	Cereal Breakfast Foods
2044	Rice Milling
2045	Blended and Prepared Flour
2046	Wet Corn Milling
2047	Dog Cat and Other Pet Food
2048	Prepared Feeds, n.e.c.
205	Bakery Products
2051	Bread Cake and Related Product
2052	Cookies and Crackers
2053	Frozen Bakery Products, Except Bread
206	Sugar and Confectionery Products
2061	Raw Cane Sugar
2062	Cane Sugar Refining
2063	Beet Sugar
2064	Candy and Other Confectionery Products
2065	Confectionery Products
2066	Chocolate and Cocoa Products
2067	Chewing Gum
2068	Salted and Roasted Nuts and Seeds
207	Fats and Oils
2074	Cottonseed Oil Mills
2075	Soybean Oil Mills
2076	Vegetable Oil Mills, n.e.c.
2077	Animal and Marine Fats and Oil
2079	Shortening and Cooking Oils
208	Beverages
2082	Malt Beverages
2083	Malt
2084	Wines Brandy & Brandy Spirits
2085	Distilled Liquor Except Brandy
2086	Bottled and Canned Soft Drinks
2087	Flavoring Extracts and Syrups, n.e.c.
209	Misc. Food Preparations & Kindred Products
2091	Canned and Cured Seafoods
2092	Fresh or Frozen Packaged Fish
2095	Roasted Coffee
2096	Potato Chips and Similar Snacks
2097	Manufactured Ice
2098	Macaroni and Spaghetti
2099	Food Preparations, n.e.c.
21	Tobacco Products
211	Cigarettes
2111	Cigarettes
212	Cigars
2121	Cigars
213	Chewing and Smoking Tobacco and Snuff
2131	Chewing and Smoking Tobacco
214	Tobacco Stemming and Redrying
2141	Tobacco Stemming and Redrying
22	Textile Mill Products
221	Broadwoven Fabric Mills, Cotton
2211	Weaving Mills, Cotton
222	Broadwoven Fabric Mills, Manmade Fiber & Silk
2221	Weaving Mills, Synthetics
223	Broadwoven Fabric Mills, Wool (Including Dyeing & Finishing)
2231	Weaving & Finishing Mills Wool
224	Narrow Fabric & Smallwares Mills: Cotton, Wool, Silk, & Manmade Fiber
2241	Narrow Fabric Mills
225	Knitting Mills
2251	Women's Hosiery, Except Socks
2252	Hosiery, n.e.c.
2253	Knit Outerwear Mills
2254	Knit Underwear Mills
2257	Circular Knit Fabric Mills
2258	Warp Knit Fabric Mills
2259	Knitting Mills, n.e.c.
226	Dyeing & Finishing Textiles, Except Wool Fabrics & Knit Goods
2261	Finishing Plants, Cotton
2262	Finishing Plants, Synthetics
2269	Finishing Plants, n.e.c.
227	Carpets and Rugs
2271	Woven Carpets and Rugs
2272	Tufted Carpets and Rugs
2273	Carpets and Rugs
2279	Carpets and Rugs, n.e.c.
228	Yarn and Thread Mills
2281	Yarn Mills, Except Wool
2282	Throwing and Winding Mills
2283	Wool Yarn Mills
2284	Thread Mills
229	Miscellaneous Textile Goods
291	Felt Goods Except Woven Felt/Hats
2292	Lace Goods
2293	Padding & Upholstery Filling
2294	Processed Textile Waste
2295	Coated Fabrics, Not Rubberized
2296	Tire Cord and Fabric
2297	Nonwoven Fabrics
2298	Cordage and Twine
2299	Textile Goods, n.e.c.
23	Apparel & Other Finished Products Made from Fabric
231	Men's and Boys' Suits, Coats, & Overcoats
2311	Men's and Boys' Suits and Coat
232	Men's & Boys' Furnishings, Work Clothing, & Allied Garments
2321	Men & Boys Shirts/nightwear
2322	Men's and Boy's Underwear

SIC	DESCRIPTION
2323	Men's and Boys' Neckwear
2325	Men's and Boy's Trousers and Slacks
2326	Men's and Boy's Work Clothing
2327	Men & Boys Separate Trousers
2328	Men's and Boys' Work Clothing
2329	Men's and Boys' Clothing, n.e.c.
233	Outerwear: Women, Misses, & Juniors
2331	Women's & Misses' Blouses & Shirts
2335	Women's and Misses' Dresses
2337	Women's & Misses Suits & Coats
2339	Women's & Misses Outerwear n.e.c.
234	Undergarments: Women, Misses, Childrens, & Infants
2341	Women's & Children's Underwear
2342	Brassieres and Allied Garments
235	Hats, Caps, and Millinery
2351	Millinery
2352	Hats & Caps Except Millinery
2353	Hats, Caps, and Millinery
236	Outerwear: Girls, Children, & Infants
2361	Children's Dresses and Blouses
2363	Children's Coats and Suits
2369	Children's Outerwear, n.e.c.
237	Fur Goods
2371	Fur Goods
238	Miscellaneous Apparel & Accessories
2381	Fabric Dress and Work Gloves
2384	Robes and Dressing Gowns
2385	Waterproof Outergarments
2386	Leather & Sheep Lined Clothing
2387	Apparel Belts
2389	Apparel and Accessories, n.e.c.
239	Misc. Fabricated Textile Products
2391	Curtains and Draperies
2392	House Furnishings, n.e.c.
2393	Textile Bags
2394	Canvas and Related Products
2395	Pleating and Stitching
2396	Automotive & Apparel Trimmings
2397	Schiffli Machine Embroideries
2399	Fabricated Textile Products
24	Lumber & Wood Products, Except Furniture
241	Logging
2411	Logging
242	Sawmills and Planing Mills
2421	Sawmills & Planing Mills General
2426	Hardwood Dimension & Flooring
2429	Special Product Sawmills, n.e.c.
243	Millwork, Veneer, Plywood & Structural Members
2431	Millwork
2434	Wood Kitchen Cabinets
2435	Hardwood Veneer and Plywood
2436	Softwood Veneer and Plywood
2439	Structural Wood Members, n.e.c.
244	Wood Containers
2441	Nailed Wood Boxes and Shook
2448	Wood Pallets and Skids
2449	Wood Containers, n.e.c.
245	Wood Buildings and Mobile Homes
2451	Mobile Homes
2452	Prefabricated Wood Buildings
249	Miscellaneous Wood Products
2491	Wood Preserving
2492	Particleboard
2493	Reconstituted Wood Products
2499	Wood Products, n.e.c.
25	Furniture and Fixtures
251	Household Furniture
2511	Wood Household Furniture
2512	Upholstered Household Furniture
2514	Metal Household Furniture
2515	Mattresses and Bedsprings
2517	Wood TV and Radio Cabinets
2519	Household Furniture, n.e.c.
252	Office Furniture
2521	Wood Office Furniture
2522	Metal Office Furniture
253	Public Building & Related Furniture
2531	Public Building & Related Furniture
254	Partitions, Shelving, Lockers, & Office & Store Fixtures
2541	Wood Partitions and Fixtures
2542	Metal Partitions and Fixtures
259	Miscellaneous Furniture and Fixtures
2591	Drapery Hardware/Blinds/Shades
2599	Furniture and Fixtures, n.e.c.
26	Paper and Allied Products
261	Pulp Mills
2611	Pulp Mills
262	Paper Mills
2621	Paper Mills Except Building Paper
263	Paperboard Mills
2631	Paperboard Mills
2641	Paper Coating and Glazing
2642	Envelopes
2643	Bags, Except Textile Bags
2645	Die-cut Paper and Board
2646	Pressed and Molded Pulp Goods
2647	Sanitary Paper Products
2648	Stationery Products
2649	Converted Paper Products, n.e.c.
265	Paperboard Containers and Boxes
2651	Folding Paperboard Boxes
2652	Set-up Paperboard Boxes
2653	Corrugated and Solid Fiber Box
2654	Sanitary Food Containers
2655	Fiber Cans Drums like Products
2656	Sanitary Food Containers
2657	Folding Paperboard Boxes
2661	Building Paper and Board Mills
267	Converted Paper & Paperboard Products, Except Containers & Boxes
2671	Paper Coated and Laminated Packaging
2672	Paper Coated and Laminated, n.e.c.
2673	Bags: Plastics, Laminated, and Coated
2674	Bags: Uncoated Paper and Multiwall

SIC	DESCRIPTION
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	Blankbooks, Looseleaf Binders, & Bookbinding & Related Work
2782	Blankbooks & Looseleaf Binders
2789	Bookbinding and Related Work
279	Service Industries for the Printing Trade
2791	Typesetting
2793	Photoengraving
2794	Electrotyping and Stereotyping
2795	Lithographic Platemaking Services
2796	Platemaking Services
28	Chemicals and Allied Products
281	Industrial Inorganic Chemicals
2812	Alkalies and Chlorine
2813	Industrial Gases
2816	Inorganic Pigments
2819	Industrial Inorganic Chemicals
282	Plastics Materials and Synthetics
2821	Plastics Materials and Resins
2822	Synthetic Rubber
2823	Cellulosic Man-Made Fibers
2824	Organic Fibers, Noncellulosic
283	Drugs
2831	Biological Products
2833	Medicinals and Botanicals
2834	Pharmaceutical Preparations
2835	Diagnostic Substances
2836	Biological Products, Except Diagnostic
284	Soap, Cleaners, and Toilet Goods
2841	Soap and Other Detergents
2842	Polishes and Sanitation Goods
2843	Surface Active Agents
2844	Toilet Preparations
285	Paints, Varnishes, Lacquers, Enamels, & Allied Products
2851	Paints and Allied Products
286	Industrial Organic Chemicals
2861	Gum and Wood Chemicals
2865	Cyclic Crudes and Intermediate
2869	Industrial Organic Chemicals, n.e.c.
287	Agricultural Chemicals
2873	Nitrogenous Fertilizers
2874	Phosphatic Fertilizers
2875	Fertilizers, Mixing Only
2879	Agricultural Chemicals, n.e.c.
289	Miscellaneous Chemical Products
2891	Adhesives and Sealants
2892	Explosives
2893	Printing Ink
2895	Carbon Black
2899	Chemical Preparations, n.e.c.
29	Petroleum Refining and Related Industries
291	Petroleum Refining
2911	Petroleum Refining
295	Asphalt Paving and Roofing Materials
2951	Paving Mixtures and Blocks
2952	Asphalt Felts and Coatings
299	Misc. Petroleum and Coal Products
2992	Lubricating Oils and Greases
2999	Petroleum and Coal Products, n.e.c.
30	Rubber and Miscellaneous Plastics Products
301	Tires and Inner Tubes
3011	Tires and Inner Tubes
302	Rubber and Plastics Footwear
3021	Rubber and Plastics Footwear
3031	Reclaimed Rubber
3041	Rubber & Plastics Hose and Belting
305	Gaskets, Packing, Sealing Devices, & Rubber & Plastics Hose & Belting
3052	Rubber and Plastics Hose and Belting
3053	Gaskets, Packing and Sealing Devices
306	Fabricated Rubber Products, n.e.c.
3061	Mechanical Rubber Goods
3069	Fabricated Rubber Products, n.e.c.
3079	Miscellaneous Plastics Products
308	Miscellaneous Plastics Products, n.e.c.
3081	Unsupported Plastics Film and Sheet
3082	Unsupported Plastics Profile Shapes
3083	Laminated Plastics Plate and Sheet
3084	Plastics Pipe
3085	Plastics Bottles
3086	Plastics Foam Products
3087	Custom Compound Purchased Resins
3088	Plastics Plumbing Fixtures
3089	Plastics Products, n.e.c.
31	Leather and Leather Products
311	Leather Tanning and Finishing
3111	Leather Tanning and Finishing
313	Boot & Shoe Cut Stock & Findings
3131	Boot and Shoe Cut Stock and Findings
314	Footwear, Except Rubber

SIC	DESCRIPTION
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
3269	Pottery Products, n.e.c.
327	Concrete, Gypsum, and Plaster Products
3271	Concrete Block and Brick
3272	Concrete Products, n.e.c.
3273	Ready-mixed Concrete
3274	Lime
3275	Gypsum Products
328	Cut Stone and Stone Products
3281	Cut Stone and Stone Products
329	Abrasive, Asbestos, & Misc. Nonmetallic Mineral Products
3291	Abrasive Products
3292	Asbestos Products
3293	Gaskets/packing/sealing Device
3295	Minerals, Ground or Treated
3296	Mineral Wool
3297	Nonclay Refractories
3299	Nonmetallic Mineral Products
33	Primary Metal Industries
331	Steel Works, Blast Furnaces, & Rolling & Finishing Mills
3312	Blast Furnaces and Steel Mills
3313	Electrometalurgical Products
3315	Steel Wire and Related Products
3316	Cold Finishing of Steel Shapes
3317	Steel Pipe and Tubes
332	Iron and Steel Foundries
3321	Gray Iron Foundries
3322	Malleable Iron Foundries
3324	Steel Investment Foundries
3325	Steel Foundries, n.e.c.
333	Primary Smelting & Refining of Nonferrous Metals
3331	Primary Copper
3332	Primary Lead
3333	Primary Zinc
3334	Primary Aluminum
3339	Primary Nonferrous Metals, n.e.c.
334	Secondary Smelting & Refining of Nonferrous Metals
3341	Secondary Nonferrous Metals
335	Rolling, Drawing, & Extruding of Nonferrous Metals
3351	Copper Rolling and Drawing
3353	Aluminum Sheet Plate & Foil
3354	Aluminum Extruded Products
3355	Aluminum Rolling & Drawing n.e.c.
3356	Nonferrous Rolling and Drawing
3357	Nonferrous Wire Drawing/Insulating
336	Nonferrous Foundries (Castings)
3361	Aluminum Foundries
3362	Brass Bronze & Copper Foundry
3363	Aluminum Die-castings
3364	Nonferrous Die-castings, Except Aluminum
3365	Aluminum Foundries
3366	Copper Foundries
3369	Nonferrous Foundries, n.e.c.
339	Miscellaneous Primary Metal Products
3398	Metal Heat Treating
3399	Primary Metal Products, n.e.c.
34	Fabricated Metal Products, Except Machinery & Transportation Equipment
341	Metal Cans and Shipping Containers
3411	Metal Cans
3412	Metal Barrels, Drums & Pails
342	Cutlery, Handtools, and General Hardware
3421	Cutlery
3423	Hand and Edge Tools, n.e.c.
3425	Hand Saws and Saw Blades
3429	Hardware, n.e.c.
343	Heating Equipment, Except Electric & Warm Air; & Plumbing Fixtures
3431	Metal Sanitary Ware
3432	Plumbing Fittings & Brass Good
3433	Heating Equipment, Except Elec.
344	Fabricated Structural Metal Products
3441	Fabricated Structural Metal
3442	Metal Doors, Sash, and Trim
3443	Fabricated Plate Work (Boiler Shops)
3444	Sheet Metal Work
3446	Architectural Metal Work
3448	Prefabricated Metal Buildings
3449	Miscellaneous Metal Work

SIC	DESCRIPTION
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 Services
3471	Electroplating, Polishing, Anodizing, and Coloring
3479	Metal Coating and Allied Services, n.e.c.
348	Ordnance and Accessories, Except Vehicles and 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 and Equipment
3523	Farm Machinery and Equipment
3524	Lawn and Garden Equipment
353	Construction, Mining, and Materials Handling Machinery & Equipment
3531	Construction Machinery
3532	Mining Machinery
3533	Oil Field Machinery
3534	Elevators and Moving Stairways
3535	Conveyors and Conveying Equipment
3536	Hoists, Cranes, and Monorails
3537	Industrial Trucks and Tractors
354	Metalworking Machinery and Equipment
3541	Machine Tools Metal Cutting Types
3542	Machine Tools Metal Forming Types
3543	Industrial Patterns
3544	Special Dies/Tools/Jigs/Fixtures
3545	Machine Tool Accessories
3546	Power Driven Hand Tools
3547	Rolling Mill Machinery
3548	Welding Apparatus
3549	Metalworking Machinery, n.e.c.
355	Special Industry Machinery, Except Metalworking Machinery
3551	Food Products Machinery
3552	Textile Machinery
3553	Woodworking Machinery
3554	Paper Industries Machinery
3555	Printing Trades Machinery
3556	Food Products Machinery
3559	Special Industry Machinery, n.e.c.
356	General Industrial Machinery and Equipment
3561	Pumps and Pumping Equipment
3562	Ball and Roller Bearings
3563	Air and Gas Compressors
3564	Blowers and Fans
3565	Packaging Machinery
3566	Speed Changers Drives & Gears
3567	Industrial Furnaces and Ovens
3568	Power Transmission Equipment
3569	General Industrial Machinery, n.e.c.
357	Computer and Office Equipment
3571	Electronic Computers
3572	Computer Storage Devices
3573	Electronic Computing Equipment
3574	Calculating & Accounting Mach
3575	Computer Terminals
3576	Scales & Balances Except Lab
3577	Computer Peripheral Equipment, n.e.c.
3578	Calculating and Accounting Equipment
3579	Office Machines, n.e.c.
358	Refrigeration & Service Industry Machinery
3581	Automatic Vending Machines
3582	Commercial Laundry Equipment
3585	Refrigeration & Heating Equipment
3586	Measuring and Dispensing Pumps
3589	Service Industry Machinery, n.e.c.
359	Misc. Industrial & Commercial Machinery and Equipment
3592	Carburetors, Pistons, Rings, & Valves
3593	Fluid Power Cylinders and Actuators
3594	Fluid Power Pumps and Motors
3596	Scales and Balances, Except Laboratory
3599	Machinery Except Electrical, n.e.c.
36	Electronic & Other Electrical Equipment & Components
361	Electric Transmission and Distribution Equipment
3612	Transformers
3613	Switchgear & Switchboard Apparatus
362	Electrical Industrial Apparatus
3621	Motors and Generators
3622	Industrial Controls
3623	Welding Apparatus, Electric
3624	Carbon and Graphite Products
3625	Relays and Industrial Controls
3629	Electrical Industrial Apparatus, n.e.c.
363	Household Appliances
3631	Household Cooking Equipment
3632	Household Refrigerators/Freezers
3633	Household Laundry Equipment
3634	Electric Housewares and Fans
3635	Household Vacuum Cleaners

SIC	DESCRIPTION
3636	Sewing Machines
3639	Household Appliances, n.e.c.
364	Electric Lighting and Wiring Equipment
3641	Electric Lamps
3643	Current-carrying Wiring Device
3644	Noncurrent-carrying Wiring Devices
3645	Residential Lighting Fixtures
3646	Commercial Lighting Fixtures
3647	Vehicular Lighting Equipment
3648	Lighting Equipment, N.e.c.
365	Household Audio and Video Equipment, and Audio Recordings
3651	Radio and TV Receiving Sets
3652	Phonograph Records
366	Communications Equipment
3661	Telephone/Telegraph Apparatus
3662	Radio & TV Communication Equipment
3663	Radio and TV Communications Equipment
3669	Communications Equipment, n.e.c.
367	Electronic Components and Accessories
3671	Electron Tubes, Receiving Type
3672	Printed Circuit Boards
3673	Electron Tubes, Transmitting
3674	Semiconductors & Related Devices
3675	Electronic Capacitors
3676	Electronic Resistors
3677	Electronic Coils & Transformer
3678	Electronic Connectors
3679	Electronic Components, n.e.c.
369	Misc. Electrical Machinery, Equipment, and Supplies
3691	Storage Batteries
3692	Primary Batteries, Dry and Wet
3693	X-ray Apparatus and Tubes
3694	Engine Electrical Equipment
3695	Magnetic and Optical Recording Media
3699	Electrical Equipment & Supply
37	Transportation Equipment
371	Motor Vehicles & Motor Vehicle Equipment
3711	Motor Vehicles and Car Bodies
3713	Truck and Bus Bodies
3714	Motor Vehicle Parts & Accessories
3715	Truck Trailers
3716	Motor Homes
372	Aircraft and Parts
3721	Aircraft
3724	Aircraft Engines & Engine Part
3728	Aircraft Equipment, n.e.c.
373	Ship and Boat Building and Repairing
3731	Ship Building and Repairing
3732	Boat Building and Repairing
374	Railroad Equipment
3743	Railroad Equipment
375	Motorcycles, Bicycles, and Parts
3751	Motorcycles Bicycles & Parts
376	Guided Missiles and Space Vehicles and Parts
3761	Guided Missiles and Space Vehicles
3764	Missile/space Propulsion Units & Parts
3769	Space Vehicle Equipment, n.e.c.
379	Miscellaneous Transportation Equipment
3792	Travel Trailers and Campers
3795	Tanks and Tank Components
3799	Transportation Equipment, n.e.c.
38	Measuring, Analyzing & Controlling Instruments
381	Search and Navigation Equipment
3811	Engineering & Scientific Instruments
3812	Search and Navigation Equipment
382	Lab Apparatus, Analytical, Optical, Measure, & Control Instruments
3821	Laboratory Apparatus and Furniture
3822	Environmental Controls
3823	Process Control Instruments
3824	Fluid Meters & Counting Device
3825	Instruments to Measure Elec.
3826	Analytical Instruments
3827	Optical Instruments and Lenses
3829	Measuring & Controlling Device
3832	Optical Instruments and Lenses
384	Surgical, Medical, Dental Instruments, & Supplies
3841	Surgical & Medical Instruments
3842	Surgical Appliances & Supplies
3843	Dental Equipment and Supplies
3844	X-ray Apparatus and Tubes
3845	Electromedical Equipment
385	Ophthalmic Goods
3851	Ophthalmic Goods
386	Photographic Equipment and Supplies
3861	Photograph Equipment & Supplies
387	Watches, Clocks, Clockwork Operated Devices, & Parts
3873	Watches Clocks & Watchcases
39	Miscellaneous Manufacturing Industries
391	Jewelry, Silverware, and Plated Ware
3911	Jewelry, Precious Metal
3914	Silverware and Plated Ware
3915	Jewelers' Materials & Lapidary
393	Musical Instruments
3931	Musical Instruments
394	Dolls, Toys, Games, and Sporting and Athletic Goods
3942	Dolls
3944	Games/Toys/Children's Vehicles
3949	Sporting & Athletic Goods, n.e.c.
395	Pens, Pencils, and Other Artists' Materials
3951	Pens and Mechanical Pencils
3952	Lead Pencils and Art Goods
3953	Marking Devices
3955	Carbon Paper and Inked Ribbons
396	Costume Jewelry and Notions, Except Precious Metal
3961	Costume Jewelry
3962	Artificial Flowers
3963	Buttons
3964	Needles, Pins, and Fasteners
3965	Fasteners, Buttons, Needles and Pins
399	Miscellaneous Manufacturing Industries

SIC	DESCRIPTION
3991	Brooms and Brushes
3993	Signs and Advertising Displays
3995	Burial Caskets
3996	Hard Surface Floor Coverings
3999	Manufacturing Industries, n.e.c.
40	Railroad Transportation
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
42	Motor Freight Transportation and Warehousing
421	Trucking and Courier Services, Except Air
4212	Local/Trucking w/o Storage
4213	Trucking, Except Local
4214	Local Trucking and Storage
4215	Courier Services, Except by Air
422	Public Warehousing and Storage
4221	Farm Product Warehousing/Store
4222	Refrigerated Warehousing
4224	Household Goods Warehousing
4225	General Warehousing & Storage
4226	Special Warehousing & Storage
423	Terminal & Joint Terminal Maintenance Facilities: Motor Freight Trans
4231	Trucking Terminal Facilities
43	United States Postal Service
431	Unite States Postal Service
4311	United States Postal Service
44	Water Transportation
441	Deep Sea Foreign Transportation of Freight
4411	Deep Sea Foreign Transportation
4412	Deep Sea Foreign Transportation of Freight
442	Deep Sea Domestic Transportation of Freight
4421	Noncontiguous Area Transportation
4422	Coastwise Transportation
4423	Intracoastal Transportation
4424	Deep Sea Domestic Transportation of Freight
443	Freight Transportation on the Great Lakes -St Lawrence Seaway
4431	Great Lakes Transportation
4432	Freight Transportation on the Great Lakes
444	Water Transportation of Freight, n.e.c.
4441	Transport on Rivers & Canals
4449	Water Transportation of Freight, n.e.c.
4452	Ferries
4453	Lighterage
4454	Towing and Tugboat Service
4459	Local Water Transportation, n.e.c.
4463	Marine Cargo Handling
4464	Canal Operation
4469	Water Transportation Services
448	Water Transportation of Passengers
4481	Deep Sea Passenger Transportation, Except by Ferry
4482	Ferries
4489	Water Passenger Transportation, n.e.c.
449	Water Transportation Services
4491	Marine Cargo Handling
4492	Towing and Tug Boat Service
4493	Marinas
4499	Water Transportation Services, n.e.c.
45	Transportation by Air
451	Air Transportation, Scheduled, & Air Courier Services
4511	Certificated Air Transportation
4512	Air Transportation, Scheduled
4513	Air Courier Services
452	Air Transportation, Nonscheduled
4521	Noncertified Air Transportation
4522	Air Transportation, Non-scheduled
458	Airports, Flying Fields, and Airport Terminal Services
4581	Airports, Flying Fields, and Services
4582	Airports and Flying Fields
4583	Airport Terminal Services
46	Pipelines, Except Natural Gas
461	Pipelines, Except Natural Gas
4612	Crude Petroleum Pipe Lines
4613	Refined Petroleum Pipe Lines
4619	Pipe Lines, n.e.c.
47	Transportation Services
4712	Freight Forwarding
472	Passenger Transportation Arrangement
4722	Passenger Transport Arrangement
4723	Freight Transport Arrangement
4724	Travel Agencies
4725	Tour Operators
4729	Passenger Transport Management, n.e.c.
473	Freight and Cargo Transportation Arrangement
4731	Freight Transportation Management
474	Rental of Railroad Cars
4741	Rental of Railroad Cars
4742	Railroad Car Rental with Services
4743	Railroad Rental Car w/o Services
478	Miscellaneous Transportation Services
4782	Inspection & Weighing Services
4783	Packing and Crating
4784	Fixed Facilities for Vehicles
4785	Inspection and Fixed Facilities

SIC	DESCRIPTION
4789	Transportation Services, n.e.c.
48	Communications
481	Telephone Communications
4811	Telephone Communication
4812	Radio Telephone Communications
4813	Telephone Communications, Except Radio
482	Telegraph and Other Message Communications
4821	Telegraph Communication
4822	Telegraph and Other Communications
483	Radio & Television Broadcasting Stations
4832	Radio Broadcasting
4833	Television Broadcasting
484	Cable and Other Pay Television Services
4841	Cable and Other Pay TV Services
489	Communications Services, n.e.c.
4899	Communication Services, n.e.c.
49	Electric, Gas and Sanitary Services
491	Electric Services
4911	Electric Services
492	Gas Production and Distribution
4922	Natural Gas Transmission
4923	Gas Transmission and Distribution
4924	Natural Gas Distribution
4925	Gas Production/distribution
493	Combination Electric, Gas, and Other Utility Services
4931	Elec. & Other Services Combined
4932	Gas & Other Services Combined
4939	Combination Utility Services
494	Water Supply
4941	Water Supply
4950	Sanitary Services
4952	Sewerage Systems
4953	Refuse Systems
4959	Sanitary Services, n.e.c.
496	Steam and Air-conditioning Supply
4961	Steam Supply
497	Irrigation Systems
4971	Irrigation Systems
50	Wholesale Trade-durable Goods
501	Motor Vehicles, Parts, and Supplies
5012	Autos & Other Motor Vehicles
5013	Automotive Parts and Supplies
5014	Tires and Tubes
5015	Motor Vehicle Parts, Used
502	Furniture and Homefurnishings
5021	Furniture
5023	Home Furnishings
503	Lumber and Construction Materials
5031	Lumber, Plywood and Millwork
5032	Brick, Stove, and Related Materials
5033	Roofing, Siding and Insulation
5039	Construction Materials, n.e.c.
504	Professional and Commercial Equipment and Supplies
5041	Sporting & Recreational Goods
5042	Toys & Hobby Goods and Supplies
5043	Photograph Equipment & Supply
5044	Office Equipment
5045	Computers, Peripherals, and Software
5046	Commercial Equipment, n.e.c.
5047	Medical and Hospital Equipment
5048	Ophthalmic Goods
5049	Professional Equipment, n.e.c.
505	Metals and Minerals, Except Petroleum
5051	Metals Services Centers & Offices
5052	Coal & Other Minerals & Ores
506	Electrical Goods
5063	Elec. Apparatus & Equipment
5064	Elec. Appliances TV & Radios
5065	Electronic Parts and Equipment
507	Hardware, Plumbing, Heating Equipment, and Supplies
5072	Hardware
5074	Plumbing/Hydronics Heat Supply
5075	Warm Air Heat & Air Condition
5078	Refrigeration Equip & Supplies
508	Machinery, Equipment, and Supplies
5081	Commercial Machines & Equipment
5086	Professional Equipment & Supplies
5087	Service Establishment Equipment
5088	Transportation Equipment & Supplies
509	Miscellaneous Durable Goods
5091	Sporting and Recreational Goods
5092	Toys and Hobby Goods and Supplies
5093	Scrap and Waste Materials
5094	Jewelry, Watches, & Precious Stones
5099	Durable Goods, n.e.c.
51	Wholesale Trade-Nondurable Goods
511	Paper and Paper Products
5111	Printing and Writing Paper
5112	Stationery Supplies
5113	Industrial & Personal Service
512	Drugs, Drug Proprietaries, & Druggists' Sundries
5122	Drugs, Proprietaries, and Sundries
513	Apparel, Piece Goods, and Notions
5131	Piece Goods and Notions
5133	Piece Goods
5134	Notions and Other Dry Goods
5136	Men's Clothing and Furnishings
5137	Women's and Children's Clothing
5139	Footwear
514	Groceries and Related Products
5141	Groceries, General Line
5142	Frozen Foods
5143	Dairy Products
5144	Poultry and Poultry Products
5145	Confectionery
5146	Fish and Seafoods
5147	Meats and Meat Products
5148	Fresh Fruits and Vegetables
5149	Groceries and Related Products
515	Farm-product Raw Materials
5152	Cotton
5153	Grain
5154	Livestock

SIC	DESCRIPTION
5159	Farm-product Raw Materials, n.e.c.
516	Chemicals and Allied Products
5161	Chemicals and Allied Products
5162	Plastics Materials and Basic Shapes
5169	Chemicals and Allied Products, n.e.c.
517	Petroleum and Petroleum Products
5171	Petroleum Bulk Stations & Terminals
5172	Petroleum Products, n.e.c.
518	Beer, Wine, and Distilled Alcoholic Beverages
5181	Beer and Ale
5182	Wines and Distilled Beverages
519	Misc. Nondurable Goods
5191	Farm Supplies
5192	Books, Periodicals and Newspapers
5193	Flowers and Florists Supplies
5194	Tobacco and Tobacco Products
5198	Paints, Varnishes, and Supplies
5199	Nondurable Goods, n.e.c.
52	Building Materials, Hardware, Garden Supply, Mobil
521	Lumber and Other Building Materials Dealers
5211	Lumber and Other Building Materials
523	Paint, Glass, and Wallpaper Stores
5231	Paint, Glass, and Wallpaper Stores
525	Hardware Stores
5251	Hardware Stores
526	Retail Nurseries, Lawn & Garden Supply Stores
5261	Retail Nurseries and Garden Stores
527	Mobile Home Dealers
5271	Mobile Home Dealers
53	General Merchandise Stores
531	Department Stores
5311	Department Stores
533	Variety Stores
5331	Variety Stores
539	Misc. General Merchandise Stores
5399	Misc. General Merchandise Stores
54	Food Stores
541	Grocery Stores
5411	Grocery Stores
542	Meat and Seafood Markets, Including Freezer Provisioners
5421	Meat and Fish Markets
5422	Freezer and Locker Meat Provisions
5423	Meat and Fish (Seafood) Market
543	Fruit and Vegetable Markets
5431	Fruit Stores and Vegetable Markets
544	Candy, Nut, and Confectionery Stores
5441	Candy, Nut, and Confectionery
545	Dairy Products Stores
5451	Dairy Products Stores
546	Retail Bakeries
5461	Retail Bakeries
5462	Retail Bakeries-Baking and Selling
5463	Retail Bakeries-Selling Only
5490	Miscellaneous Food Stores
5499	Miscellaneous Food Stores
55	Automotive Dealers and Gasoline Service Stations
551	Motor Vehicle Dealers (New & Used)
5511	New and Used Car Dealers
552	Motor Vehicle Dealers (Used Only)
5521	Used Car Dealers
553	Auto and Home Supply Stores
5531	Auto and Home Supply Stores
554	Gasoline Service Stations
5541	Gasoline Service Stations
555	Boat Dealers
5551	Boat Dealers
556	Recreational Vehicle Dealers
5561	Recreational Vehicle Dealers
557	Motorcycle Dealers
5571	Motorcycle Dealers
559	Automotive Dealer, n.e.c.
5599	Automotive Dealers, n.e.c.
56	Apparel and Accessory Stores
561	Men's & Boys' Clothing & Accessory Stores
5611	Men's & Boys' Clothing & Accessory Stores
562	Women's Clothing Stores
5621	Women's Ready-to-wear Stores
563	Women's Accessory & Specialty Stores
5631	Women's Accessory and Specialty Stores
5632	Women's Accessory and Specialty Stores
564	Children's & Infants' Wear Stores
5641	Children's and Infants' Wear Stores
565	Family Clothing Stores
5651	Family Clothing Stores
566	Shoe Stores
5661	Shoe Stores
5681	Furriers and Fur Shops
569	Misc. Apparel & Accessory Stores
5699	Miscellaneous Apparel & Access
57	Home Furniture, Furnishings & Equipment Stores
571	Home Furniture & Furnishings Stores
5712	Furniture Stores
5713	Floor Covering Stores
5714	Drapery and Upholstery Stores
5719	Misc. Home Furnishings Stores
572	Household Appliance Stores
5722	Household Appliance Stores
573	Radio, Television, Consumer Electronics, and Music Stores
5731	Radio, Television and Electronic Stores
5732	Radio and Television Stores
5733	Music Stores
5734	Computer and Software Stores
5735	Record and Prerecorded Tape Stores
5736	Musical Instrument Stores
58	Eating and Drinking Places
581	Eating and Drinking Places
5812	Eating Places
5813	Drinking Places
59	Miscellaneous Retail
591	Drug Stores and Proprietary Stores
5912	Drug Stores and Proprietary Stores
592	Liquor Stores
5921	Liquor Stores

SIC	DESCRIPTION
593	Used Merchandise Stores
5931	Used Merchandise Stores
5932	Used Merchandise Stores
594	Misc. Shopping Goods Stores
5941	Sporting Goods and Bicycle Shops
5942	Book Stores
5943	Stationery Stores
5944	Jewelry Stores
5945	Hobby, Toy, and Game Shops
5946	Camera & Photographic Supply Stores
5947	Gift, Novelty, and Souvenir Shops
5948	Luggage and Leather Goods Store
5949	Sewing, Needlework, and Piece Goods Stores
596	Nonstore Retailers
5961	Mail Order Houses
5962	Merchandising Machine Operator
5963	Direct Selling Organizations
598	Fuel Dealers
5982	Fuel and Ice Dealers, n.e.c.
5983	Fuel Oil Dealers
5984	Liquefied Petroleum Gas Dealers
5989	Fuel Dealers, n.e.c.
599	Retail Stores, n.e.c.
5992	Florists
5993	Cigar Stores and Stands
5994	News Dealers and Newsstands
5995	Optical Goods Stores
5999	Miscellaneous Retail Stores, n.e.c.
60	Depository Institutions
601	Central Reserve Depository Institutions
6011	Federal Reserve Banks
6019	Central Reserve Depository, n.e.c.
602	Commercial Banks
6021	National Commercial Banks
6022	State Banks, Federal Reserve
6023	State Banks, Not Fed. Reserve
6024	State Banks, Not Fed Reserve, Not FDIC
6025	National Banks, Federal Reserve
6026	National Banks, Not Fed. Reserve
6027	National Banks, Not FDIC
6028	Private Banks, Not Incorporated, Not FDIC
6029	Commercial Banks, n.e.c.
603	Savings Institutions
6032	Mutual Savings Banks, Federal
6033	Mutual Savings Banks, n.e.c.
6034	Mutual Savings Banks, Not FDIC
6035	Federal Savings Institutions
6036	Savings Institutions, Except Federal
6042	Nondeposit Trusts, Federal Res.
6044	Nondeposit Trusts, Not FDIC
6052	Foreign Exchange Establishment
6054	Safe Deposit Companies
6055	Clearinghouse Associations
6056	Corporations for Banking Abroad
6059	Functions Related to Banking
606	Credit Unions
6061	Federal Credit Unions
6062	State Credit Unions
608	Foreign Banking and Branches & Agencies of Foreign Banks
6081	Foreign Bank and Branches and Agencies
6082	Foreign Trade and International Banks
609	Depository Banking Functions
6091	Nondeposit Trust Facilities
6099	Functions Related to Deposit Banking
61	Nondepository Credit Institutions
611	Federal & Federally-sponsored Credit Agencies
6111	Federal and Federally-sponsored Credit
6112	Rediscounting, Not for Agriculture
6113	Rediscounting, for Agriculture
6122	Federal Saving & Loan Associations
6123	State Associations, Insured
6124	State Associations, Noninsured
6125	State Associations, Noninsured
6131	Agricultural Credit Institutions
614	Personal Credit Institutions
6141	Personal Credit Institutions
6142	Federal Credit Unions
6143	State Credit Unions
6144	Nondeposit Industrial Loan Companies
6145	Licensed Small Loan Lenders
6146	Installment Sales Finance Companies
6149	Misc. Personal Credit Institutions
615	Business Credit Institutions
6153	Short-term Business Credit
6159	Misc. Business Credit Institute
616	Mortgage Bankers and Brokers
6162	Mortgage Bankers and Correspondents
6163	Loan Brokers
62	Security & Commodity Brokers, Dealers, Exchanges
621	Security Brokers, Dealers, & Flotation Companies
6211	Security Brokers and Dealers
622	Commodity Contracts Brokers & Dealers
6221	Commodity Contracts Brokers, Dealers
623	Security and Commodity Exchanges
6231	Security and Commodity Exchanges
628	Exchange of Security and Commodity Services
6281	Security and Commodity Service
6282	Investment Advice
6289	Security and Commodity Services, n.e.c.
63	Insurance Carriers
631	Life Insurance
6311	Life Insurance
632	Accident & Health Insurance & Medical Service Plans
6321	Accident and Health Insurance
6324	Hospital and Medical Service Plans
633	Fire, Marine, and Casualty Insurance
6331	Fire, Marine, and Casualty Ins
635	Surety Insurance
6351	Surety Insurance
636	Title Insurance
6361	Title Insurance
637	Pension, Health, and Welfare Funds
6371	Pension, Health, and Welfare Funds

SIC	DESCRIPTION
639	Insurance Carriers, n.e.c.
6399	Insurance Carriers, n.e.c.
64	Insurance Agents, Brokers and Service
641	Insurance Agents, Brokers, and Service
6411	Insurance Agents, Brokers & Service
65	Real Estate
651	Real Estate Operators (Except Developers) & Lessors
6512	Nonresidential Building Operators
6513	Apartment Building Operators
6514	Dwelling Operators, Except Apart
6515	Mobile Home Site Operators
6517	Railroad Property Lessors
6519	Real Property Lessors, n.e.c.
653	Real Estate Agents and Managers
6531	Real Estate Agents and Manager
654	Title Abstract Offices
6541	Title Abstract Offices
655	Land Subdividers and Developers
6552	Subdividers & Developers, Except Cemeteries
6553	Cemetery Subdividers and Developers
6611	Combined Real Estate, Insurance
67	Holding and Other Investment Offices
671	Holding Offices
6711	Holding Offices
6712	Bank Holding Companies
6719	Holding Companies, n.e.c.
672	Investment Offices
6722	Management Investment, Open-end
6723	Management Investment, Closed-end
6724	Unit Investment Trusts
6725	Face-amount Certificate Offices
6726	Investment Offices, n.e.c.
673	Trusts
6732	Educational, Religious, and Charitable Trusts
6733	Trusts, n.e.c.
679	Miscellaneous Investing
6792	Oil Royalty Traders
6793	Commodity Traders
6794	Patent Owners and Lessors
6798	Real Estate Investment Trusts
6799	Investors, n.e.c.
70	Hotels, Rooming Houses, Camps, & Other Lodging Place
701	Hotels and Motels
7011	Hotels and Motels
702	Rooming and Boarding Houses
7021	Rooming and Boarding Houses
703	Camps and Recreational Vehicle Parks
7032	Sporting and Recreational Camp
7033	Recreational Vehicle Parks and Campsites
704	Membership-basis: Organization Hotels & Lodging Houses
7041	Membership-basis Organization
72	Personal Services
721	Laundry, Cleaning, and Garment Services
7211	Power Laundries, Family & Commercial
7212	Garment Pressing & Cleaners' Agents
7213	Linen Supply
7214	Diaper Service
7215	Coin-operated Laundries and Drycleaning
7216	Dry Cleaning Plants, Except Rugs
7217	Carpet and Upholstery Cleaning
7218	Industrial Launderers
7219	Laundry and Garment Services
722	Photographic Studios, Portrait
7221	Photographic Studios, Portrait
723	Beauty Shops
7231	Beauty Shops
724	Barber Shops
7241	Barber Shops
725	Shoe Repair and Shoeshine Parlors
7251	Shoe Repair Shops and Shoeshine Parlors
726	Funeral Service and Crematories
7261	Funeral Service and Crematories
729	Miscellaneous Personal Services
7291	Tax Return Preparation Services
7299	Miscellaneous Personal Service
73	Business Services
731	Advertising
7311	Advertising Agencies
7312	Outdoor Advertising Services
7313	Radio, TV, Publisher Advertising Representatives
7319	Advertising, n.e.c.
732	Credit & Mercantile Reporting, Adjustment & Collection Agencies
7321	Credit Reporting and Collection
7322	Adjustment and Collection Services
7323	Credit Reporting Services
733	Mailing, reproduction, Commercial Art, Photography, & Steno Services
7331	Direct Mail Advertising Service
7332	Blueprinting and Photocopying
7333	Commercial Photography and Art
7334	Photocopying and Duplicating Services
7335	Commercial Photography
7336	Commercial Art and Graphic Design
7338	Secretarial and Court Reporting
7339	Stenographic and Reproduction, n.e.c.
734	Services to Dwellings & Other n.e.c. Buildings
7341	Window Cleaning
7342	Disinfecting and Exterminating
7349	Building Maintenance Services,
735	Misc. Equipment Rental & Leasing
7351	News Syndicates
7352	Medical Equipment Rental
7353	Heavy Construction Equipment Rental
7359	Equipment Rental and Leasing, n.e.c.
736	Personnel Supply Services
7361	Employment Agencies
7362	Temporary Help Supply Services
7363	Help Supply Services
7369	Personnel Supply Services, n.e.c.
737	Computer and Data Processing Services
7371	Custom Computer Programming Services
7372	Prepackaged Software

SIC	DESCRIPTION
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	Photofinishing Laboratories
7396	Trading Stamp Services
7397	Commercial Testing Laboratories
7399	Business Services, n.e.c.
75	Automotive Repair, Services & Parking
751	Automotive Rental and Leasing, Without Drivers
7512	Passenger Car Rental and Leasing
7513	Truck Rental and Leasing
7514	Passenger Car Rental
7515	Passenger Car Leasing
7519	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

SIC	DESCRIPTION
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.
8092	Kidney Dialysis Centers
8099	Health and Allied Services, n.e.c.
81	Legal Services
811	Legal Services
8111	Legal Services
82	Educational Services
821	Elementary and Secondary Schools
8211	Elementary and Secondary Schools
822	Colleges, Universities, Professional Schools, & Junior Colleges
8221	Colleges and Universities, n.e.c.
8222	Junior Colleges
823	Libraries
8231	Libraries and Information Centers
824	Vocational Schools
8241	Correspondence Schools
8243	Data Processing Schools
8244	Business and Secretarial Schools
8249	Vocational School, n.e.c.
829	Schools & Educational Services, n.e.c.
8299	Schools & Educational Services
83	Social Services
832	Individual and Family Social Services
8321	Individual and Family Services
8322	Individual and Family Services
833	Job Training, Vocational Rehabilitation Services
8331	Job Training and Related Services
835	Child Day Care Services
8351	Child Day Care Services
836	Residential Care
8361	Residential Care
839	Social Services, n.e.c.
8399	Social Services, n.e.c.
84	Museums, Art Galleries & Botanical & Zoological Gardens
841	Museums and Art Galleries
8411	Museums and Art Galleries
8412	Museums and Art Galleries
842	Arboreta, Botanical, or Zoological Gardens
8421	Botanical and Zoological Gardens
8422	Botanical and Zoological Gardens
86	Membership Organizations
861	Business Associations
8611	Business Associations
862	Professional Membership Organizations
8621	Professional Organizations
863	Labor Unions/similar Labor Organizations
8631	Labor Organizations
864	Civic, Social, & Fraternal Associations
8641	Civic and Social Associations
865	Political Organizations
8651	Political Organizations
866	Religious Organizations
8661	Religious Organizations
869	Membership Organizations, n.e.c.
8699	Membership Organizations, n.e.c.
87	Engineering, Accounting, Research, Management
871	Engineering, Architectural, & Surveying Services
8711	Engineering Services
8712	Architectural Services
8713	Surveying Services
872	Accounting, Auditing, & Bookkeeping Services
8721	Accounting, Auditing, and Bookkeeping
873	Research, Development, & Testing Services
8731	Commercial Physical Research
8732	Commercial Nonphysical Research
8733	Noncommercial Research Organizations
8734	Testing Laboratories
874	Management & Public Relations Services
8741	Management Services
8742	Management Consulting Services
8743	Public Relations Services
8744	Facilities Support Services
8748	Business Consulting, n.e.c.
88	Private Households
881	Private Households
8811	Private Households
89	Services Not Elsewhere Classified
8911	Engineering & Architectural Services
8922	Noncommercial Research Organizations
8931	Accounting, Auditing & Bookkeeping
899	Services, n.e.c.
8999	Services, n.e.c.
91	Executive, Legislative, & General Government Except Finance
911	Executive Offices
9111	Executive Offices
9120	Legislative Bodies
9121	Legislative Bodies
913	Executive & Legislative Offices Combined
9131	Executive and Legislative Combined
919	General Government, n.e.c.
9199	General Government, n.e.c.
92	Justice, Public Order and Safety
921	Courts
9211	Courts
922	Public Order and Safety
9221	Police Protection
9222	Legal Counsel and Prosecution
9223	Correctional Institutions
9224	Fire Protection
9229	Public Order and Safety, n.e.c.
93	Public Finance, Taxation, & Monetary Policy
931	Public Finance, Taxation, & Monetary Policy
9311	Finance, Taxation, & Monetary Policy
94	Administration of Human Resource Programs
941	Educational Programs Administration
9411	Educational Programs Administration
943	Public Health Programs Administration

SIC	DESCRIPTION
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
9651	Regulation Misc. Commercial Sectors
966	Space Research and Technology
9661	Space Research and Technology
97	National Security and International Affairs
971	National Security
9711	National Security
972	International Affairs
9721	International Affairs
999	Nonclassifiable Establishments
9999	Nonclassifiable Establishments

Appendix FF: Index of SCC/AMS Codes

SCC Code	Description
2201001000	Light Duty Gasoline Vehicles (LDGV), Total: All Road Types
2201001110	Light Duty Gasoline Vehicles (LDGV), Interstate: Rural Total
2201001111	Light Duty Gasoline Vehicles (LDGV), Interstate: Rural Time 1
2201001112	Light Duty Gasoline Vehicles (LDGV), Interstate: Rural Time 2
2201001113	Light Duty Gasoline Vehicles (LDGV), Interstate: Rural Time 3
2201001114	Light Duty Gasoline Vehicles (LDGV), Interstate: Rural Time 4
2201001130	Light Duty Gasoline Vehicles (LDGV), Other Principal Arterial: Rural Total
2201001131	Light Duty Gasoline Vehicles (LDGV), Other Principal Arterial: Rural Time 1
2201001132	Light Duty Gasoline Vehicles (LDGV), Other Principal Arterial: Rural Time 2
2201001133	Light Duty Gasoline Vehicles (LDGV), Other Principal Arterial: Rural Time 3
2201001134	Light Duty Gasoline Vehicles (LDGV), Other Principal Arterial: Rural Time 4
2201001150	Light Duty Gasoline Vehicles (LDGV), Minor Arterial: Rural Total
2201001151	Light Duty Gasoline Vehicles (LDGV), Minor Arterial: Rural Time 1
2201001152	Light Duty Gasoline Vehicles (LDGV), Minor Arterial: Rural Time 2
2201001153	Light Duty Gasoline Vehicles (LDGV), Minor Arterial: Rural Time 3
2201001154	Light Duty Gasoline Vehicles (LDGV), Minor Arterial: Rural Time 4
2201001170	Light Duty Gasoline Vehicles (LDGV), Major Collector: Rural Total
2201001171	Light Duty Gasoline Vehicles (LDGV), Major Collector: Rural Time 1
2201001172	Light Duty Gasoline Vehicles (LDGV), Major Collector: Rural Time 2
2201001173	Light Duty Gasoline Vehicles (LDGV), Major Collector: Rural Time 3
2201001174	Light Duty Gasoline Vehicles (LDGV), Major Collector: Rural Time 4
2201001190	Light Duty Gasoline Vehicles (LDGV), Minor Collector: Rural Total
2201001191	Light Duty Gasoline Vehicles (LDGV), Minor Collector: Rural Time 1
2201001192	Light Duty Gasoline Vehicles (LDGV), Minor Collector: Rural Time 2
2201001193	Light Duty Gasoline Vehicles (LDGV), Minor Collector: Rural Time 3
2201001194	Light Duty Gasoline Vehicles (LDGV), Minor Collector: Rural Time 4
2201001210	Light Duty Gasoline Vehicles (LDGV), Local: Rural Total
2201001211	Light Duty Gasoline Vehicles (LDGV), Local: Rural Time 1
2201001212	Light Duty Gasoline Vehicles (LDGV), Local: Rural Time 2
2201001213	Light Duty Gasoline Vehicles (LDGV), Local: Rural Time 3
2201001214	Light Duty Gasoline Vehicles (LDGV), Local: Rural Time 4
2201001230	Light Duty Gasoline Vehicles (LDGV), Interstate: Urban Total
2201001231	Light Duty Gasoline Vehicles (LDGV), Interstate: Urban Time 1
2201001232	Light Duty Gasoline Vehicles (LDGV), Interstate: Urban Time 2
2201001233	Light Duty Gasoline Vehicles (LDGV), Interstate: Urban Time 3
2201001234	Light Duty Gasoline Vehicles (LDGV), Interstate: Urban Time 4
2201001250	Light Duty Gasoline Vehicles (LDGV), Other Freeways and Expressways: Urban Total
2201001251	Light Duty Gasoline Vehicles (LDGV), Other Freeways and Expressways: Urban Time 1
2201001252	Light Duty Gasoline Vehicles (LDGV), Other Freeways and Expressways: Urban Time 2
2201001253	Light Duty Gasoline Vehicles (LDGV), Other Freeways and Expressways: Urban Time 3
2201001254	Light Duty Gasoline Vehicles (LDGV), Other Freeways and Expressways: Urban Time 4
2201001270	Light Duty Gasoline Vehicles (LDGV), Other Principal Arterial: Urban Total
2201001271	Light Duty Gasoline Vehicles (LDGV), Other Principal Arterial: Urban Time 1
2201001272	Light Duty Gasoline Vehicles (LDGV), Other Principal Arterial: Urban Time 2
2201001273	Light Duty Gasoline Vehicles (LDGV), Other Principal Arterial: Urban Time 3
2201001274	Light Duty Gasoline Vehicles (LDGV), Other Principal Arterial: Urban Time 4

SCC Code	Description
2201001290	Light Duty Gasoline Vehicles (LDGV), Minor Arterial: Urban Total
2201001291	Light Duty Gasoline Vehicles (LDGV), Minor Arterial: Urban Time 1
2201001292	Light Duty Gasoline Vehicles (LDGV), Minor Arterial: Urban Time 2
2201001293	Light Duty Gasoline Vehicles (LDGV), Minor Arterial: Urban Time 3
2201001294	Light Duty Gasoline Vehicles (LDGV), Minor Arterial: Urban Time 4
2201001310	Light Duty Gasoline Vehicles (LDGV), Collector: Urban Total
2201001311	Light Duty Gasoline Vehicles (LDGV), Collector: Urban Time 1
2201001312	Light Duty Gasoline Vehicles (LDGV), Collector: Urban Time 2
2201001313	Light Duty Gasoline Vehicles (LDGV), Collector: Urban Time 3
2201001314	Light Duty Gasoline Vehicles (LDGV), Collector: Urban Time 4
2201001330	Light Duty Gasoline Vehicles (LDGV), Local: Urban Total
2201001331	Light Duty Gasoline Vehicles (LDGV), Local: Urban Time 1
2201001332	Light Duty Gasoline Vehicles (LDGV), Local: Urban Time 2
2201001333	Light Duty Gasoline Vehicles (LDGV), Local: Urban Time 3
2201001334	Light Duty Gasoline Vehicles (LDGV), Local: Urban Time 4
2201020000	Light Duty Gasoline Trucks 1 (LDGT1), Total: All Road Types
2201020110	Light Duty Gasoline Trucks 1 (LDGT1), Interstate: Rural Total
2201020111	Light Duty Gasoline Trucks 1 (LDGT1), Interstate: Rural Time 1
2201020112	Light Duty Gasoline Trucks 1 (LDGT1), Interstate: Rural Time 2
2201020113	Light Duty Gasoline Trucks 1 (LDGT1), Interstate: Rural Time 3
2201020114	Light Duty Gasoline Trucks 1 (LDGT1), Interstate: Rural Time 4
2201020130	Light Duty Gasoline Trucks 1 (LDGT1), Other Principal Arterial: Rural Total
2201020131	Light Duty Gasoline Trucks 1 (LDGT1), Other Principal Arterial: Rural Time 1
2201020132	Light Duty Gasoline Trucks 1 (LDGT1), Other Principal Arterial: Rural Time 2
2201020133	Light Duty Gasoline Trucks 1 (LDGT1), Other Principal Arterial: Rural Time 3
2201020134	Light Duty Gasoline Trucks 1 (LDGT1), Other Principal Arterial: Rural Time 4
2201020150	Light Duty Gasoline Trucks 1 (LDGT1), Minor Arterial: Rural Total
2201020151	Light Duty Gasoline Trucks 1 (LDGT1), Minor Arterial: Rural Time 1
2201020152	Light Duty Gasoline Trucks 1 (LDGT1), Minor Arterial: Rural Time 2
2201020153	Light Duty Gasoline Trucks 1 (LDGT1), Minor Arterial: Rural Time 3
2201020154	Light Duty Gasoline Trucks 1 (LDGT1), Minor Arterial: Rural Time 4
2201020170	Light Duty Gasoline Trucks 1 (LDGT1), Major Collector: Rural Total
2201020171	Light Duty Gasoline Trucks 1 (LDGT1), Major Collector: Rural Time 1
2201020172	Light Duty Gasoline Trucks 1 (LDGT1), Major Collector: Rural Time 2
2201020173	Light Duty Gasoline Trucks 1 (LDGT1), Major Collector: Rural Time 3
2201020174	Light Duty Gasoline Trucks 1 (LDGT1), Major Collector: Rural Time 4
2201020190	Light Duty Gasoline Trucks 1 (LDGT1), Minor Collector: Rural Total
2201020191	Light Duty Gasoline Trucks 1 (LDGT1), Minor Collector: Rural Time 1
2201020192	Light Duty Gasoline Trucks 1 (LDGT1), Minor Collector: Rural Time 2
2201020193	Light Duty Gasoline Trucks 1 (LDGT1), Minor Collector: Rural Time 3
2201020194	Light Duty Gasoline Trucks 1 (LDGT1), Minor Collector: Rural Time 4
2201020210	Light Duty Gasoline Trucks 1 (LDGT1), Local: Rural Total
2201020211	Light Duty Gasoline Trucks 1 (LDGT1), Local: Rural Time 1
2201020212	Light Duty Gasoline Trucks 1 (LDGT1), Local: Rural Time 2
2201020213	Light Duty Gasoline Trucks 1 (LDGT1), Local: Rural Time 3
2201020214	Light Duty Gasoline Trucks 1 (LDGT1), Local: Rural Time 4
2201020230	Light Duty Gasoline Trucks 1 (LDGT1), Interstate: Urban Total
2201020231	Light Duty Gasoline Trucks 1 (LDGT1), Interstate: Urban Time 1
2201020232	Light Duty Gasoline Trucks 1 (LDGT1), Interstate: Urban Time 2
2201020233	Light Duty Gasoline Trucks 1 (LDGT1), Interstate: Urban Time 3
2201020234	Light Duty Gasoline Trucks 1 (LDGT1), Interstate: Urban Time 4
2201020250	Light Duty Gasoline Trucks 1 (LDGT1), Other Freeways and Expressways: Urban Total

SCC Code	Description
2201020251	Light Duty Gasoline Trucks 1 (LDGT1), Other Freeways and Expressways: Urban Time 1
2201020252	Light Duty Gasoline Trucks 1 (LDGT1), Other Freeways and Expressways: Urban Time 2
2201020253	Light Duty Gasoline Trucks 1 (LDGT1), Other Freeways and Expressways: Urban Time 3
2201020254	Light Duty Gasoline Trucks 1 (LDGT1), Other Freeways and Expressways: Urban Time 4
2201020270	Light Duty Gasoline Trucks 1 (LDGT1), Other Principal Arterial: Urban Total
2201020271	Light Duty Gasoline Trucks 1 (LDGT1), Other Principal Arterial: Urban Time 1
2201020272	Light Duty Gasoline Trucks 1 (LDGT1), Other Principal Arterial: Urban Time 2
2201020273	Light Duty Gasoline Trucks 1 (LDGT1), Other Principal Arterial: Urban Time 3
2201020274	Light Duty Gasoline Trucks 1 (LDGT1), Other Principal Arterial: Urban Time 4
2201020290	Light Duty Gasoline Trucks 1 (LDGT1), Minor Arterial: Urban Total
2201020291	Light Duty Gasoline Trucks 1 (LDGT1), Minor Arterial: Urban Time 1
2201020292	Light Duty Gasoline Trucks 1 (LDGT1), Minor Arterial: Urban Time 2
2201020293	Light Duty Gasoline Trucks 1 (LDGT1), Minor Arterial: Urban Time 3
2201020294	Light Duty Gasoline Trucks 1 (LDGT1), Minor Arterial: Urban Time 4
2201020310	Light Duty Gasoline Trucks 1 (LDGT1), Collector: Urban Total
2201020311	Light Duty Gasoline Trucks 1 (LDGT1), Collector: Urban Time 1
2201020312	Light Duty Gasoline Trucks 1 (LDGT1), Collector: Urban Time 2
2201020313	Light Duty Gasoline Trucks 1 (LDGT1), Collector: Urban Time 3
2201020314	Light Duty Gasoline Trucks 1 (LDGT1), Collector: Urban Time 4
2201020330	Light Duty Gasoline Trucks 1 (LDGT1), Local: Urban Total
2201020331	Light Duty Gasoline Trucks 1 (LDGT1), Local: Urban Time 1
2201020332	Light Duty Gasoline Trucks 1 (LDGT1), Local: Urban Time 2
2201020333	Light Duty Gasoline Trucks 1 (LDGT1), Local: Urban Time 3
2201020334	Light Duty Gasoline Trucks 1 (LDGT1), Local: Urban Time 4
2201040000	Light Duty Gasoline Trucks 2 (LDGT2), Total: All Road Types
2201040110	Light Duty Gasoline Trucks 2 (LDGT2), Interstate: Rural Total
2201040111	Light Duty Gasoline Trucks 2 (LDGT2), Interstate: Rural Time 1
2201040112	Light Duty Gasoline Trucks 2 (LDGT2), Interstate: Rural Time 2
2201040113	Light Duty Gasoline Trucks 2 (LDGT2), Interstate: Rural Time 3
2201040114	Light Duty Gasoline Trucks 2 (LDGT2), Interstate: Rural Time 4
2201040130	Light Duty Gasoline Trucks 2 (LDGT2), Other Principal Arterial: Rural Total
2201040131	Light Duty Gasoline Trucks 2 (LDGT2), Other Principal Arterial: Rural Time 1
2201040132	Light Duty Gasoline Trucks 2 (LDGT2), Other Principal Arterial: Rural Time 2
2201040133	Light Duty Gasoline Trucks 2 (LDGT2), Other Principal Arterial: Rural Time 3
2201040134	Light Duty Gasoline Trucks 2 (LDGT2), Other Principal Arterial: Rural Time 4
2201040150	Light Duty Gasoline Trucks 2 (LDGT2), Minor Arterial: Rural Total
2201040151	Light Duty Gasoline Trucks 2 (LDGT2), Minor Arterial: Rural Time 1
2201040152	Light Duty Gasoline Trucks 2 (LDGT2), Minor Arterial: Rural Time 2
2201040153	Light Duty Gasoline Trucks 2 (LDGT2), Minor Arterial: Rural Time 3
2201040154	Light Duty Gasoline Trucks 2 (LDGT2), Minor Arterial: Rural Time 4
2201040170	Light Duty Gasoline Trucks 2 (LDGT2), Major Collector: Rural Total
2201040171	Light Duty Gasoline Trucks 2 (LDGT2), Major Collector: Rural Time 1
2201040172	Light Duty Gasoline Trucks 2 (LDGT2), Major Collector: Rural Time 2
2201040173	Light Duty Gasoline Trucks 2 (LDGT2), Major Collector: Rural Time 3
2201040174	Light Duty Gasoline Trucks 2 (LDGT2), Major Collector: Rural Time 4
2201040190	Light Duty Gasoline Trucks 2 (LDGT2), Minor Collector: Rural Total
2201040191	Light Duty Gasoline Trucks 2 (LDGT2), Minor Collector: Rural Time 1
2201040192	Light Duty Gasoline Trucks 2 (LDGT2), Minor Collector: Rural Time 2
2201040193	Light Duty Gasoline Trucks 2 (LDGT2), Minor Collector: Rural Time 3
2201040194	Light Duty Gasoline Trucks 2 (LDGT2), Minor Collector: Rural Time 4
2201040210	Light Duty Gasoline Trucks 2 (LDGT2), Local: Rural Total
2201040211	Light Duty Gasoline Trucks 2 (LDGT2), Local: Rural Time 1
2201040212	Light Duty Gasoline Trucks 2 (LDGT2), Local: Rural Time 2

SCC Code	Description
2201040213	Light Duty Gasoline Trucks 2 (LDGT2), Local: Rural Time 3
2201040214	Light Duty Gasoline Trucks 2 (LDGT2), Local: Rural Time 4
2201040230	Light Duty Gasoline Trucks 2 (LDGT2), Interstate: Urban Total
2201040231	Light Duty Gasoline Trucks 2 (LDGT2), Interstate: Urban Time 1
2201040232	Light Duty Gasoline Trucks 2 (LDGT2), Interstate: Urban Time 2
2201040233	Light Duty Gasoline Trucks 2 (LDGT2), Interstate: Urban Time 3
2201040234	Light Duty Gasoline Trucks 2 (LDGT2), Interstate: Urban Time 4
2201040250	Light Duty Gasoline Trucks 2 (LDGT2), Other Freeways and Expressways: Urban Total
2201040251	Light Duty Gasoline Trucks 2 (LDGT2), Other Freeways and Expressways: Urban Time 1
2201040252	Light Duty Gasoline Trucks 2 (LDGT2), Other Freeways and Expressways: Urban Time 2
2201040253	Light Duty Gasoline Trucks 2 (LDGT2), Other Freeways and Expressways: Urban Time 3
2201040254	Light Duty Gasoline Trucks 2 (LDGT2), Other Freeways and Expressways: Urban Time 4
2201040270	Light Duty Gasoline Trucks 2 (LDGT2), Other Principal Arterial: Urban Total
2201040271	Light Duty Gasoline Trucks 2 (LDGT2), Other Principal Arterial: Urban Time 1
2201040272	Light Duty Gasoline Trucks 2 (LDGT2), Other Principal Arterial: Urban Time 2
2201040273	Light Duty Gasoline Trucks 2 (LDGT2), Other Principal Arterial: Urban Time 3
2201040274	Light Duty Gasoline Trucks 2 (LDGT2), Other Principal Arterial: Urban Time 4
2201040290	Light Duty Gasoline Trucks 2 (LDGT2), Minor Arterial: Urban Total
2201040291	Light Duty Gasoline Trucks 2 (LDGT2), Minor Arterial: Urban Time 1
2201040292	Light Duty Gasoline Trucks 2 (LDGT2), Minor Arterial: Urban Time 2
2201040293	Light Duty Gasoline Trucks 2 (LDGT2), Minor Arterial: Urban Time 3
2201040294	Light Duty Gasoline Trucks 2 (LDGT2), Minor Arterial: Urban Time 4
2201040310	Light Duty Gasoline Trucks 2 (LDGT2), Collector: Urban Total
2201040311	Light Duty Gasoline Trucks 2 (LDGT2), Collector: Urban Time 1
2201040312	Light Duty Gasoline Trucks 2 (LDGT2), Collector: Urban Time 2
2201040313	Light Duty Gasoline Trucks 2 (LDGT2), Collector: Urban Time 3
2201040314	Light Duty Gasoline Trucks 2 (LDGT2), Collector: Urban Time 4
2201040330	Light Duty Gasoline Trucks 2 (LDGT2), Local: Urban Total
2201040331	Light Duty Gasoline Trucks 2 (LDGT2), Local: Urban Time 1
2201040332	Light Duty Gasoline Trucks 2 (LDGT2), Local: Urban Time 2
2201040333	Light Duty Gasoline Trucks 2 (LDGT2), Local: Urban Time 3
2201040334	Light Duty Gasoline Trucks 2 (LDGT2), Local: Urban Time 4
2201060000	Light Duty Gasoline Trucks 1 & 2 (LDGT), Total: All Road Types
2201060110	Light Duty Gasoline Trucks 1 & 2 (LDGT), Interstate: Rural Total
2201060111	Light Duty Gasoline Trucks 1 & 2 (LDGT), Interstate: Rural Time 1
2201060112	Light Duty Gasoline Trucks 1 & 2 (LDGT), Interstate: Rural Time 2
2201060113	Light Duty Gasoline Trucks 1 & 2 (LDGT), Interstate: Rural Time 3
2201060114	Light Duty Gasoline Trucks 1 & 2 (LDGT), Interstate: Rural Time 4
2201060130	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Principal Arterial: Rural Total
2201060131	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Principal Arterial: Rural Time 1
2201060132	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Principal Arterial: Rural Time 2
2201060133	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Principal Arterial: Rural Time 3
2201060134	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Principal Arterial: Rural Time 4
2201060150	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Arterial: Rural Total
2201060151	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Arterial: Rural Time 1
2201060152	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Arterial: Rural Time 2
2201060153	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Arterial: Rural Time 3
2201060154	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Arterial: Rural Time 4
2201060170	Light Duty Gasoline Trucks 1 & 2 (LDGT), Major Collector: Rural Total
2201060171	Light Duty Gasoline Trucks 1 & 2 (LDGT), Major Collector: Rural Time 1
2201060172	Light Duty Gasoline Trucks 1 & 2 (LDGT), Major Collector: Rural Time 2
2201060173	Light Duty Gasoline Trucks 1 & 2 (LDGT), Major Collector: Rural Time 3
2201060174	Light Duty Gasoline Trucks 1 & 2 (LDGT), Major Collector: Rural Time 4

SCC Code	Description
2201060190	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Collector: Rural Total
2201060191	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Collector: Rural Time 1
2201060192	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Collector: Rural Time 2
2201060193	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Collector: Rural Time 3
2201060194	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Collector: Rural Time 4
2201060210	Light Duty Gasoline Trucks 1 & 2 (LDGT), Local: Rural Total
2201060211	Light Duty Gasoline Trucks 1 & 2 (LDGT), Local: Rural Time 1
2201060212	Light Duty Gasoline Trucks 1 & 2 (LDGT), Local: Rural Time 2
2201060213	Light Duty Gasoline Trucks 1 & 2 (LDGT), Local: Rural Time 3
2201060214	Light Duty Gasoline Trucks 1 & 2 (LDGT), Local: Rural Time 4
2201060230	Light Duty Gasoline Trucks 1 & 2 (LDGT), Interstate: Urban Total
2201060231	Light Duty Gasoline Trucks 1 & 2 (LDGT), Interstate: Urban Time 1
2201060232	Light Duty Gasoline Trucks 1 & 2 (LDGT), Interstate: Urban Time 2
2201060233	Light Duty Gasoline Trucks 1 & 2 (LDGT), Interstate: Urban Time 3
2201060234	Light Duty Gasoline Trucks 1 & 2 (LDGT), Interstate: Urban Time 4
2201060250	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Freeways and Expressways: Urban Total
2201060251	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Freeways and Expressways: Urban Time 1
2201060252	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Freeways and Expressways: Urban Time 2
2201060253	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Freeways and Expressways: Urban Time 3
2201060254	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Freeways and Expressways: Urban Time 4
2201060270	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Principal Arterial: Urban Total
2201060271	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Principal Arterial: Urban Time 1
2201060272	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Principal Arterial: Urban Time 2
2201060273	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Principal Arterial: Urban Time 3
2201060274	Light Duty Gasoline Trucks 1 & 2 (LDGT), Other Principal Arterial: Urban Time 4
2201060290	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Arterial: Urban Total
2201060291	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Arterial: Urban Time 1
2201060292	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Arterial: Urban Time 2
2201060293	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Arterial: Urban Time 3
2201060294	Light Duty Gasoline Trucks 1 & 2 (LDGT), Minor Arterial: Urban Time 4
2201060310	Light Duty Gasoline Trucks 1 & 2 (LDGT), Collector: Urban Total
2201060311	Light Duty Gasoline Trucks 1 & 2 (LDGT), Collector: Urban Time 1
2201060312	Light Duty Gasoline Trucks 1 & 2 (LDGT), Collector: Urban Time 2
2201060313	Light Duty Gasoline Trucks 1 & 2 (LDGT), Collector: Urban Time 3
2201060314	Light Duty Gasoline Trucks 1 & 2 (LDGT), Collector: Urban Time 4
2201060330	Light Duty Gasoline Trucks 1 & 2 (LDGT), Local: Urban Total
2201060331	Light Duty Gasoline Trucks 1 & 2 (LDGT), Local: Urban Time 1
2201060332	Light Duty Gasoline Trucks 1 & 2 (LDGT), Local: Urban Time 2
2201060333	Light Duty Gasoline Trucks 1 & 2 (LDGT), Local: Urban Time 3
2201060334	Light Duty Gasoline Trucks 1 & 2 (LDGT), Local: Urban Time 4
2201070000	Heavy Duty Gasoline Vehicles (HDGV), Total: All Road Types
2201070110	Heavy Duty Gasoline Vehicles (HDGV), Interstate: Rural Total
2201070111	Heavy Duty Gasoline Vehicles (HDGV), Interstate: Rural Time 1
2201070112	Heavy Duty Gasoline Vehicles (HDGV), Interstate: Rural Time 2
2201070113	Heavy Duty Gasoline Vehicles (HDGV), Interstate: Rural Time 3
2201070114	Heavy Duty Gasoline Vehicles (HDGV), Interstate: Rural Time 4
2201070130	Heavy Duty Gasoline Vehicles (HDGV), Other Principal Arterial: Urban Total
2201070131	Heavy Duty Gasoline Vehicles (HDGV), Other Principal Arterial: Urban Time 1
2201070132	Heavy Duty Gasoline Vehicles (HDGV), Other Principal Arterial: Urban Time 2
2201070133	Heavy Duty Gasoline Vehicles (HDGV), Other Principal Arterial: Urban Time 3
2201070134	Heavy Duty Gasoline Vehicles (HDGV), Other Principal Arterial: Urban Time 4
2201070150	Heavy Duty Gasoline Vehicles (HDGV), Minor Arterial: Rural Total
2201070151	Heavy Duty Gasoline Vehicles (HDGV), Minor Arterial: Rural Time 1

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2201070152	Heavy Duty Gasoline Vehicles (HDGV), Minor Arterial: Rural Time 2
2201070153	Heavy Duty Gasoline Vehicles (HDGV), Minor Arterial: Rural Time 3
2201070154	Heavy Duty Gasoline Vehicles (HDGV), Minor Arterial: Rural Time 4
2201070170	Heavy Duty Gasoline Vehicles (HDGV), Major Collector: Rural Total
2201070171	Heavy Duty Gasoline Vehicles (HDGV), Major Collector: Rural Time 1
2201070172	Heavy Duty Gasoline Vehicles (HDGV), Major Collector: Rural Time 2
2201070173	Heavy Duty Gasoline Vehicles (HDGV), Major Collector: Rural Time 3
2201070174	Heavy Duty Gasoline Vehicles (HDGV), Major Collector: Rural Time 4
2201070190	Heavy Duty Gasoline Vehicles (HDGV), Minor Collector: Rural Total
2201070191	Heavy Duty Gasoline Vehicles (HDGV), Minor Collector: Rural Time 1
2201070192	Heavy Duty Gasoline Vehicles (HDGV), Minor Collector: Rural Time 2
2201070193	Heavy Duty Gasoline Vehicles (HDGV), Minor Collector: Rural Time 3
2201070194	Heavy Duty Gasoline Vehicles (HDGV), Minor Collector: Rural Time 4
2201070210	Heavy Duty Gasoline Vehicles (HDGV), Local: Rural Total
2201070211	Heavy Duty Gasoline Vehicles (HDGV), Local: Rural Time 1
2201070212	Heavy Duty Gasoline Vehicles (HDGV), Local: Rural Time 2
2201070213	Heavy Duty Gasoline Vehicles (HDGV), Local: Rural Time 3
2201070214	Heavy Duty Gasoline Vehicles (HDGV), Local: Rural Time 4
2201070230	Heavy Duty Gasoline Vehicles (HDGV), Interstate: Urban Total
2201070231	Heavy Duty Gasoline Vehicles (HDGV), Interstate: Urban Time 1
2201070232	Heavy Duty Gasoline Vehicles (HDGV), Interstate: Urban Time 2
2201070233	Heavy Duty Gasoline Vehicles (HDGV), Interstate: Urban Time 3
2201070234	Heavy Duty Gasoline Vehicles (HDGV), Interstate: Urban Time 4
2201070250	Heavy Duty Gasoline Vehicles (HDGV), Other Freeways and Expressways: Urban Total
2201070251	Heavy Duty Gasoline Vehicles (HDGV), Other Freeways and Expressways: Urban Time 1
2201070252	Heavy Duty Gasoline Vehicles (HDGV), Other Freeways and Expressways: Urban Time 2
2201070253	Heavy Duty Gasoline Vehicles (HDGV), Other Freeways and Expressways: Urban Time 3
2201070254	Heavy Duty Gasoline Vehicles (HDGV), Other Freeways and Expressways: Urban Time 4
2201070270	Heavy Duty Gasoline Vehicles (HDGV), Other Principal Arterial: Urban Total
2201070271	Heavy Duty Gasoline Vehicles (HDGV), Other Principal Arterial: Urban Time 1
2201070272	Heavy Duty Gasoline Vehicles (HDGV), Other Principal Arterial: Urban Time 2
2201070273	Heavy Duty Gasoline Vehicles (HDGV), Other Principal Arterial: Urban Time 3
2201070274	Heavy Duty Gasoline Vehicles (HDGV), Other Principal Arterial: Urban Time 4
2201070290	Heavy Duty Gasoline Vehicles (HDGV), Minor Arterial: Urban Total
2201070291	Heavy Duty Gasoline Vehicles (HDGV), Minor Arterial: Urban Time 1
2201070292	Heavy Duty Gasoline Vehicles (HDGV), Minor Arterial: Urban Time 2
2201070293	Heavy Duty Gasoline Vehicles (HDGV), Minor Arterial: Urban Time 3
2201070294	Heavy Duty Gasoline Vehicles (HDGV), Minor Arterial: Urban Time 4
2201070310	Heavy Duty Gasoline Vehicles (HDGV), Collector: Urban Total
2201070311	Heavy Duty Gasoline Vehicles (HDGV), Collector: Urban Time 1
2201070312	Heavy Duty Gasoline Vehicles (HDGV), Collector: Urban Time 2
2201070313	Heavy Duty Gasoline Vehicles (HDGV), Collector: Urban Time 3
2201070314	Heavy Duty Gasoline Vehicles (HDGV), Collector: Urban Time 4
2201070330	Heavy Duty Gasoline Vehicles (HDGV), Local: Urban Total
2201070331	Heavy Duty Gasoline Vehicles (HDGV), Local: Urban Time 1
2201070332	Heavy Duty Gasoline Vehicles (HDGV), Local: Urban Time 2
2201070333	Heavy Duty Gasoline Vehicles (HDGV), Local: Urban Time 3
2201070334	Heavy Duty Gasoline Vehicles (HDGV), Local: Urban Time 4
2201080000	Motorcycles (MC), Total: All Road Types
2201080110	Motorcycles (MC), Interstate: Rural Total
2201080111	Motorcycles (MC), Interstate: Rural Time 1
2201080112	Motorcycles (MC), Interstate: Rural Time 2
2201080113	Motorcycles (MC), Interstate: Rural Time 3

SCC Code	Description
2201080114	Motorcycles (MC), Interstate: Rural Time 4
2201080130	Motorcycles (MC), Other Principal Arterial: Rural Total
2201080131	Motorcycles (MC), Other Principal Arterial: Rural Time 1
2201080132	Motorcycles (MC), Other Principal Arterial: Rural Time 2
2201080133	Motorcycles (MC), Other Principal Arterial: Rural Time 3
2201080134	Motorcycles (MC), Other Principal Arterial: Rural Time 4
2201080150	Motorcycles (MC), Minor Arterial: Rural Total
2201080151	Motorcycles (MC), Minor Arterial: Rural Time 1
2201080152	Motorcycles (MC), Minor Arterial: Rural Time 2
2201080153	Motorcycles (MC), Minor Arterial: Rural Time 3
2201080154	Motorcycles (MC), Minor Arterial: Rural Time 4
2201080170	Motorcycles (MC), Major Collector: Rural Total
2201080171	Motorcycles (MC), Major Collector: Rural Time 1
2201080172	Motorcycles (MC), Major Collector: Rural Time 2
2201080173	Motorcycles (MC), Major Collector: Rural Time 3
2201080174	Motorcycles (MC), Major Collector: Rural Time 4
2201080190	Motorcycles (MC), Minor Collector: Rural Total
2201080191	Motorcycles (MC), Minor Collector: Rural Time 1
2201080192	Motorcycles (MC), Minor Collector: Rural Time 2
2201080193	Motorcycles (MC), Minor Collector: Rural Time 3
2201080194	Motorcycles (MC), Minor Collector: Rural Time 4
2201080210	Motorcycles (MC), Local: Rural Total
2201080211	Motorcycles (MC), Local: Rural Time 1
2201080212	Motorcycles (MC), Local: Rural Time 2
2201080213	Motorcycles (MC), Local: Rural Time 3
2201080214	Motorcycles (MC), Local: Rural Time 4
2201080230	Motorcycles (MC), Interstate: Urban Total
2201080231	Motorcycles (MC), Interstate: Urban Time 1
2201080232	Motorcycles (MC), Interstate: Urban Time 2
2201080233	Motorcycles (MC), Interstate: Urban Time 3
2201080234	Motorcycles (MC), Interstate: Urban Time 4
2201080250	Motorcycles (MC), Other Freeways and Expressways: Urban Total
2201080251	Motorcycles (MC), Other Freeways and Expressways: Urban Time 1
2201080252	Motorcycles (MC), Other Freeways and Expressways: Urban Time 2
2201080253	Motorcycles (MC), Other Freeways and Expressways: Urban Time 3
2201080254	Motorcycles (MC), Other Freeways and Expressways: Urban Time 4
2201080270	Motorcycles (MC), Other Principal Arterial: Urban Total
2201080271	Motorcycles (MC), Other Principal Arterial: Urban Time 1
2201080272	Motorcycles (MC), Other Principal Arterial: Urban Time 2
2201080273	Motorcycles (MC), Other Principal Arterial: Urban Time 3
2201080274	Motorcycles (MC), Other Principal Arterial: Urban Time 4
2201080290	Motorcycles (MC), Minor Arterial: Urban Total
2201080291	Motorcycles (MC), Minor Arterial: Urban Time 1
2201080292	Motorcycles (MC), Minor Arterial: Urban Time 2
2201080293	Motorcycles (MC), Minor Arterial: Urban Time 3
2201080294	Motorcycles (MC), Minor Arterial: Urban Time 4
2201080310	Motorcycles (MC), Collector: Urban Total
2201080311	Motorcycles (MC), Collector: Urban Time 1
2201080312	Motorcycles (MC), Collector: Urban Time 2
2201080313	Motorcycles (MC), Collector: Urban Time 3
2201080314	Motorcycles (MC), Collector: Urban Time 4
2201080330	Motorcycles (MC), Local: Urban Total
2201080331	Motorcycles (MC), Local: Urban Time 1

SCC Code	Description
2201080332	Motorcycles (MC), Local: Urban Time 2
2201080333	Motorcycles (MC), Local: Urban Time 3
2201080334	Motorcycles (MC), Local: Urban Time 4
2230001000	Light Duty Diesel Vehicles (LDDV), Total: All Road Types
2230001110	Light Duty Diesel Vehicles (LDDV), Interstate: Rural Total
2230001111	Light Duty Diesel Vehicles (LDDV), Interstate: Rural Time 1
2230001112	Light Duty Diesel Vehicles (LDDV), Interstate: Rural Time 2
2230001113	Light Duty Diesel Vehicles (LDDV), Interstate: Rural Time 3
2230001114	Light Duty Diesel Vehicles (LDDV), Interstate: Rural Time 4
2230001130	Light Duty Diesel Vehicles (LDDV), Other Principal Arterial: Rural Total
2230001131	Light Duty Diesel Vehicles (LDDV), Other Principal Arterial: Rural Time 1
2230001132	Light Duty Diesel Vehicles (LDDV), Other Principal Arterial: Rural Time 2
2230001133	Light Duty Diesel Vehicles (LDDV), Other Principal Arterial: Rural Time 3
2230001134	Light Duty Diesel Vehicles (LDDV), Other Principal Arterial: Rural Time 4
2230001150	Light Duty Diesel Vehicles (LDDV), Minor Arterial: Rural Total
2230001151	Light Duty Diesel Vehicles (LDDV), Minor Arterial: Rural Time 1
2230001152	Light Duty Diesel Vehicles (LDDV), Minor Arterial: Rural Time 2
2230001153	Light Duty Diesel Vehicles (LDDV), Minor Arterial: Rural Time 3
2230001154	Light Duty Diesel Vehicles (LDDV), Minor Arterial: Rural Time 4
2230001170	Light Duty Diesel Vehicles (LDDV), Major Collector: Rural Total
2230001171	Light Duty Diesel Vehicles (LDDV), Major Collector: Rural Time 1
2230001172	Light Duty Diesel Vehicles (LDDV), Major Collector: Rural Time 2
2230001173	Light Duty Diesel Vehicles (LDDV), Major Collector: Rural Time 3
2230001174	Light Duty Diesel Vehicles (LDDV), Major Collector: Rural Time 4
2230001190	Light Duty Diesel Vehicles (LDDV), Minor Collector: Rural Total
2230001191	Light Duty Diesel Vehicles (LDDV), Minor Collector: Rural Time 1
2230001192	Light Duty Diesel Vehicles (LDDV), Minor Collector: Rural Time 2
2230001193	Light Duty Diesel Vehicles (LDDV), Minor Collector: Rural Time 3
2230001194	Light Duty Diesel Vehicles (LDDV), Minor Collector: Rural Time 4
2230001210	Light Duty Diesel Vehicles (LDDV), Local: Rural Total
2230001211	Light Duty Diesel Vehicles (LDDV), Local: Rural Time 1
2230001212	Light Duty Diesel Vehicles (LDDV), Local: Rural Time 2
2230001213	Light Duty Diesel Vehicles (LDDV), Local: Rural Time 3
2230001214	Light Duty Diesel Vehicles (LDDV), Local: Rural Time 4
2230001230	Light Duty Diesel Vehicles (LDDV), Interstate: Urban Total
2230001231	Light Duty Diesel Vehicles (LDDV), Interstate: Urban Time 1
2230001232	Light Duty Diesel Vehicles (LDDV), Interstate: Urban Time 2
2230001233	Light Duty Diesel Vehicles (LDDV), Interstate: Urban Time 3
2230001234	Light Duty Diesel Vehicles (LDDV), Interstate: Urban Time 4
2230001250	Light Duty Diesel Vehicles (LDDV), Other Freeways and Expressways: Urban Total
2230001251	Light Duty Diesel Vehicles (LDDV), Other Freeways and Expressways: Urban Time 1
2230001252	Light Duty Diesel Vehicles (LDDV), Other Freeways and Expressways: Urban Time 2
2230001253	Light Duty Diesel Vehicles (LDDV), Other Freeways and Expressways: Urban Time 3
2230001254	Light Duty Diesel Vehicles (LDDV), Other Freeways and Expressways: Urban Time 4
2230001270	Light Duty Diesel Vehicles (LDDV), Other Principal Arterial: Urban Total
2230001271	Light Duty Diesel Vehicles (LDDV), Other Principal Arterial: Urban Time 1
2230001272	Light Duty Diesel Vehicles (LDDV), Other Principal Arterial: Urban Time 2
2230001273	Light Duty Diesel Vehicles (LDDV), Other Principal Arterial: Urban Time 3
2230001274	Light Duty Diesel Vehicles (LDDV), Other Principal Arterial: Urban Time 4
2230001290	Light Duty Diesel Vehicles (LDDV), Minor Arterial: Urban Total
2230001291	Light Duty Diesel Vehicles (LDDV), Minor Arterial: Urban Time 1
2230001292	Light Duty Diesel Vehicles (LDDV), Minor Arterial: Urban Time 2
2230001293	Light Duty Diesel Vehicles (LDDV), Minor Arterial: Urban Time 3

SCC Code	Description
2230001294	Light Duty Diesel Vehicles (LDDV), Minor Arterial: Urban Time 4
2230001310	Light Duty Diesel Vehicles (LDDV), Collector: Urban Total
2230001311	Light Duty Diesel Vehicles (LDDV), Collector: Urban Time 1
2230001312	Light Duty Diesel Vehicles (LDDV), Collector: Urban Time 2
2230001313	Light Duty Diesel Vehicles (LDDV), Collector: Urban Time 3
2230001314	Light Duty Diesel Vehicles (LDDV), Collector: Urban Time 4
2230001330	Light Duty Diesel Vehicles (LDDV), Local: Urban Total
2230001331	Light Duty Diesel Vehicles (LDDV), Local: Urban Time 1
2230001332	Light Duty Diesel Vehicles (LDDV), Local: Urban Time 2
2230001333	Light Duty Diesel Vehicles (LDDV), Local: Urban Time 3
2230001334	Light Duty Diesel Vehicles (LDDV), Local: Urban Time 4
2230060000	Light Duty Diesel Trucks (LDDT), Total: All Road Types
2230060110	Light Duty Diesel Trucks (LDDT), Interstate: Rural Total
2230060111	Light Duty Diesel Trucks (LDDT), Interstate: Rural Time 1
2230060112	Light Duty Diesel Trucks (LDDT), Interstate: Rural Time 2
2230060113	Light Duty Diesel Trucks (LDDT), Interstate: Rural Time 3
2230060114	Light Duty Diesel Trucks (LDDT), Interstate: Rural Time 4
2230060130	Light Duty Diesel Trucks (LDDT), Other Principal Arterial: Rural Total
2230060131	Light Duty Diesel Trucks (LDDT), Other Principal Arterial: Rural Time 1
2230060132	Light Duty Diesel Trucks (LDDT), Other Principal Arterial: Rural Time 2
2230060133	Light Duty Diesel Trucks (LDDT), Other Principal Arterial: Rural Time 3
2230060134	Light Duty Diesel Trucks (LDDT), Other Principal Arterial: Rural Time 4
2230060150	Light Duty Diesel Trucks (LDDT), Minor Arterial: Rural Total
2230060151	Light Duty Diesel Trucks (LDDT), Minor Arterial: Rural Time 1
2230060152	Light Duty Diesel Trucks (LDDT), Minor Arterial: Rural Time 2
2230060153	Light Duty Diesel Trucks (LDDT), Minor Arterial: Rural Time 3
2230060154	Light Duty Diesel Trucks (LDDT), Minor Arterial: Rural Time 4
2230060170	Light Duty Diesel Trucks (LDDT), Major Collector: Rural Total
2230060171	Light Duty Diesel Trucks (LDDT), Major Collector: Rural Time 1
2230060172	Light Duty Diesel Trucks (LDDT), Major Collector: Rural Time 2
2230060173	Light Duty Diesel Trucks (LDDT), Major Collector: Rural Time 3
2230060174	Light Duty Diesel Trucks (LDDT), Major Collector: Rural Time 4
2230060190	Light Duty Diesel Trucks (LDDT), Minor Collector: Rural Total
2230060191	Light Duty Diesel Trucks (LDDT), Minor Collector: Rural Time 1
2230060192	Light Duty Diesel Trucks (LDDT), Minor Collector: Rural Time 2
2230060193	Light Duty Diesel Trucks (LDDT), Minor Collector: Rural Time 3
2230060194	Light Duty Diesel Trucks (LDDT), Minor Collector: Rural Time 4
2230060210	Light Duty Diesel Trucks (LDDT), Local: Rural Total
2230060211	Light Duty Diesel Trucks (LDDT), Local: Rural Time 1
2230060212	Light Duty Diesel Trucks (LDDT), Local: Rural Time 2
2230060213	Light Duty Diesel Trucks (LDDT), Local: Rural Time 3
2230060214	Light Duty Diesel Trucks (LDDT), Local: Rural Time 4
2230060230	Light Duty Diesel Trucks (LDDT), Interstate: Urban Total
2230060231	Light Duty Diesel Trucks (LDDT), Interstate: Urban Time 1
2230060232	Light Duty Diesel Trucks (LDDT), Interstate: Urban Time 2
2230060233	Light Duty Diesel Trucks (LDDT), Interstate: Urban Time 3
2230060234	Light Duty Diesel Trucks (LDDT), Interstate: Urban Time 4
2230060250	Light Duty Diesel Trucks (LDDT), Other Freeways and Expressways: Urban Total
2230060251	Light Duty Diesel Trucks (LDDT), Other Freeways and Expressways: Urban Time 1
2230060252	Light Duty Diesel Trucks (LDDT), Other Freeways and Expressways: Urban Time 2
2230060253	Light Duty Diesel Trucks (LDDT), Other Freeways and Expressways: Urban Time 3
2230060254	Light Duty Diesel Trucks (LDDT), Other Freeways and Expressways: Urban Time 4
2230060270	Light Duty Diesel Trucks (LDDT), Other Principal Arterial: Urban Total

SCC Code	Description
2230060271	Light Duty Diesel Trucks (LDDT), Other Principal Arterial: Urban Time 1
2230060272	Light Duty Diesel Trucks (LDDT), Other Principal Arterial: Urban Time 2
2230060273	Light Duty Diesel Trucks (LDDT), Other Principal Arterial: Urban Time 3
2230060274	Light Duty Diesel Trucks (LDDT), Other Principal Arterial: Urban Time 4
2230060290	Light Duty Diesel Trucks (LDDT), Minor Arterial: Urban Total
2230060291	Light Duty Diesel Trucks (LDDT), Minor Arterial: Urban Time 1
2230060292	Light Duty Diesel Trucks (LDDT), Minor Arterial: Urban Time 2
2230060293	Light Duty Diesel Trucks (LDDT), Minor Arterial: Urban Time 3
2230060294	Light Duty Diesel Trucks (LDDT), Minor Arterial: Urban Time 4
2230060310	Light Duty Diesel Trucks (LDDT), Collector: Urban Total
2230060311	Light Duty Diesel Trucks (LDDT), Collector: Urban Time 1
2230060312	Light Duty Diesel Trucks (LDDT), Collector: Urban Time 2
2230060313	Light Duty Diesel Trucks (LDDT), Collector: Urban Time 3
2230060314	Light Duty Diesel Trucks (LDDT), Collector: Urban Time 4
2230060330	Light Duty Diesel Trucks (LDDT), Local: Urban Total
2230060331	Light Duty Diesel Trucks (LDDT), Local: Urban Time 1
2230060332	Light Duty Diesel Trucks (LDDT), Local: Urban Time 2
2230060333	Light Duty Diesel Trucks (LDDT), Local: Urban Time 3
2230060334	Light Duty Diesel Trucks (LDDT), Local: Urban Time 4
2230070000	Heavy Duty Diesel Vehicles (HDDV), Total: All Road Types
2230070110	Heavy Duty Diesel Vehicles (HDDV), Interstate: Rural Total
2230070111	Heavy Duty Diesel Vehicles (HDDV), Interstate: Rural Time 1
2230070112	Heavy Duty Diesel Vehicles (HDDV), Interstate: Rural Time 2
2230070113	Heavy Duty Diesel Vehicles (HDDV), Interstate: Rural Time 3
2230070114	Heavy Duty Diesel Vehicles (HDDV), Interstate: Rural Time 4
2230070130	Heavy Duty Diesel Vehicles (HDDV), Other Principal Arterial: Rural Total
2230070131	Heavy Duty Diesel Vehicles (HDDV), Other Principal Arterial: Rural Time 1
2230070132	Heavy Duty Diesel Vehicles (HDDV), Other Principal Arterial: Rural Time 2
2230070133	Heavy Duty Diesel Vehicles (HDDV), Other Principal Arterial: Rural Time 3
2230070134	Heavy Duty Diesel Vehicles (HDDV), Other Principal Arterial: Rural Time 4
2230070150	Heavy Duty Diesel Vehicles (HDDV), Minor Arterial: Rural Total
2230070151	Heavy Duty Diesel Vehicles (HDDV), Minor Arterial: Rural Time 1
2230070152	Heavy Duty Diesel Vehicles (HDDV), Minor Arterial: Rural Time 2
2230070153	Heavy Duty Diesel Vehicles (HDDV), Minor Arterial: Rural Time 3
2230070154	Heavy Duty Diesel Vehicles (HDDV), Minor Arterial: Rural Time 4
2230070170	Heavy Duty Diesel Vehicles (HDDV), Major Collector: Rural Total
2230070171	Heavy Duty Diesel Vehicles (HDDV), Major Collector: Rural Time 1
2230070172	Heavy Duty Diesel Vehicles (HDDV), Major Collector: Rural Time 2
2230070173	Heavy Duty Diesel Vehicles (HDDV), Major Collector: Rural Time 3
2230070174	Heavy Duty Diesel Vehicles (HDDV), Major Collector: Rural Time 4
2230070190	Heavy Duty Diesel Vehicles (HDDV), Minor Collector: Rural Total
2230070191	Heavy Duty Diesel Vehicles (HDDV), Minor Collector: Rural Time 1
2230070192	Heavy Duty Diesel Vehicles (HDDV), Minor Collector: Rural Time 2
2230070193	Heavy Duty Diesel Vehicles (HDDV), Minor Collector: Rural Time 3
2230070194	Heavy Duty Diesel Vehicles (HDDV), Minor Collector: Rural Time 4
2230070210	Heavy Duty Diesel Vehicles (HDDV), Local: Rural Total
2230070211	Heavy Duty Diesel Vehicles (HDDV), Local: Rural Time 1
2230070212	Heavy Duty Diesel Vehicles (HDDV), Local: Rural Time 2
2230070213	Heavy Duty Diesel Vehicles (HDDV), Local: Rural Time 3
2230070214	Heavy Duty Diesel Vehicles (HDDV), Local: Rural Time 4
2230070230	Heavy Duty Diesel Vehicles (HDDV), Interstate: Urban Total
2230070231	Heavy Duty Diesel Vehicles (HDDV), Interstate: Urban Time 1
2230070232	Heavy Duty Diesel Vehicles (HDDV), Interstate: Urban Time 2

SCC Code	Description
2230070233	Heavy Duty Diesel Vehicles (HDDV), Interstate: Urban Time 3
2230070234	Heavy Duty Diesel Vehicles (HDDV), Interstate: Urban Time 4
2230070250	Heavy Duty Diesel Vehicles (HDDV), Other Freeways and Expressways: Urban Total
2230070251	Heavy Duty Diesel Vehicles (HDDV), Other Freeways and Expressways: Urban Time 1
2230070252	Heavy Duty Diesel Vehicles (HDDV), Other Freeways and Expressways: Urban Time 2
2230070253	Heavy Duty Diesel Vehicles (HDDV), Other Freeways and Expressways: Urban Time 3
2230070254	Heavy Duty Diesel Vehicles (HDDV), Other Freeways and Expressways: Urban Time 4
2230070270	Heavy Duty Diesel Vehicles (HDDV), Other Principal Arterial: Urban Total
2230070271	Heavy Duty Diesel Vehicles (HDDV), Other Principal Arterial: Urban Time 1
2230070272	Heavy Duty Diesel Vehicles (HDDV), Other Principal Arterial: Urban Time 2
2230070273	Heavy Duty Diesel Vehicles (HDDV), Other Principal Arterial: Urban Time 3
2230070274	Heavy Duty Diesel Vehicles (HDDV), Other Principal Arterial: Urban Time 4
2230070290	Heavy Duty Diesel Vehicles (HDDV), Minor Arterial: Urban Total
2230070291	Heavy Duty Diesel Vehicles (HDDV), Minor Arterial: Urban Time 1
2230070292	Heavy Duty Diesel Vehicles (HDDV), Minor Arterial: Urban Time 2
2230070293	Heavy Duty Diesel Vehicles (HDDV), Minor Arterial: Urban Time 3
2230070294	Heavy Duty Diesel Vehicles (HDDV), Minor Arterial: Urban Time 4
2230070310	Heavy Duty Diesel Vehicles (HDDV), Collector: Urban Total
2230070311	Heavy Duty Diesel Vehicles (HDDV), Collector: Urban Time 1
2230070312	Heavy Duty Diesel Vehicles (HDDV), Collector: Urban Time 2
2230070313	Heavy Duty Diesel Vehicles (HDDV), Collector: Urban Time 3
2230070314	Heavy Duty Diesel Vehicles (HDDV), Collector: Urban Time 4
2230070330	Heavy Duty Diesel Vehicles (HDDV), Local: Urban Total
2230070331	Heavy Duty Diesel Vehicles (HDDV), Local: Urban Time 1
2230070332	Heavy Duty Diesel Vehicles (HDDV), Local: Urban Time 2
2230070333	Heavy Duty Diesel Vehicles (HDDV), Local: Urban Time 3
2230070334	Heavy Duty Diesel Vehicles (HDDV), Local: Urban Time 4
2260000000	All Off-highway Vehicle: Gasoline, 2-Stroke, Total
2260001000	Gasoline, 2-Stroke, Recreational Vehicles, Total
2260001010	Gasoline, 2-Stroke, Recreational Vehicles, Motorcycles: Off-Road
2260001020	Gasoline, 2-Stroke, Recreational Vehicles, Snowmobiles
2260001030	Gasoline, 2-Stroke, Recreational Vehicles, All Terrain Vehicles
2260001040	Gasoline, 2-Stroke, Recreational Vehicles, Minibikes
2260001050	Gasoline, 2-Stroke, Recreational Vehicles, Golf Carts
2260001060	Gasoline, 2-Stroke, Recreational Vehicles, Speciality Vehicle Carts
2260002000	Gasoline, 2-Stroke, Construction Equipment, Total
2260002003	Gasoline, 2-Stroke, Construction Equipment, Asphalt Pavers
2260002006	Gasoline, 2-Stroke, Construction Equipment, Tampers/Rammers
2260002009	Gasoline, 2-Stroke, Construction Equipment, Plate Compactors
2260002012	Gasoline, 2-Stroke, Construction Equipment, Concrete Pavers
2260002015	Gasoline, 2-Stroke, Construction Equipment, Rollers
2260002018	Gasoline, 2-Stroke, Construction Equipment, Scrapers
2260002021	Gasoline, 2-Stroke, Construction Equipment, Paving Equipment
2260002024	Gasoline, 2-Stroke, Construction Equipment, Surfacing Equipment
2260002027	Gasoline, 2-Stroke, Construction Equipment, Signal Boards
2260002030	Gasoline, 2-Stroke, Construction Equipment, Trenchers
2260002033	Gasoline, 2-Stroke, Construction Equipment, Bore/Drill Rigs
2260002036	Gasoline, 2-Stroke, Construction Equipment, Excavators
2260002039	Gasoline, 2-Stroke, Construction Equipment, Concrete/Industrial Saws
2260002042	Gasoline, 2-Stroke, Construction Equipment, Cement and Mortar Mixers
2260002045	Gasoline, 2-Stroke, Construction Equipment, Cranes
2260002048	Gasoline, 2-Stroke, Construction Equipment, Graders
2260002051	Gasoline, 2-Stroke, Construction Equipment, Off-highway Trucks

SCC Code	Description
2260002054	Gasoline, 2-Stroke, Construction Equipment, Crushing/Processing Equipment
2260002057	Gasoline, 2-Stroke, Construction Equipment, Rough Terrain Forklifts
2260002060	Gasoline, 2-Stroke, Construction Equipment, Rubber Tire Loaders
2260002063	Gasoline, 2-Stroke, Construction Equipment, Rubber Tire Dozers
2260002066	Gasoline, 2-Stroke, Construction Equipment, Tractors/Loaders/Backhoes
2260002069	Gasoline, 2-Stroke, Construction Equipment, Crawler Tractors
2260002072	Gasoline, 2-Stroke, Construction Equipment, Skid Steer Loaders
2260002075	Gasoline, 2-Stroke, Construction Equipment, Off-Highway Tractors
2260002078	Gasoline, 2-Stroke, Construction Equipment, Dumpers/Tenders
2260002081	Gasoline, 2-Stroke, Construction Equipment, Other Construction Equipment
2260003000	Gasoline, 2-Stroke, Industrial Equipment, Total
2260003010	Gasoline, 2-Stroke, Industrial Equipment, Aerial Lifts
2260003020	Gasoline, 2-Stroke, Industrial Equipment, Forklifts
2260003030	Gasoline, 2-Stroke, Industrial Equipment, Sweepers/Scrubbers
2260003040	Gasoline, 2-Stroke, Industrial Equipment, Other General Industrial Equipment
2260003050	Gasoline, 2-Stroke, Industrial Equipment, Other Material Handling Equipment
2260004000	Gasoline, 2-Stroke, Lawn and Garden Equipment, Total
2260004010	Gasoline, 2-Stroke, Lawn and Garden Equipment, Lawn mowers
2260004015	Gasoline, 2-Stroke, Lawn and Garden Equipment, Rotary Tillers < 5 HP
2260004020	Gasoline, 2-Stroke, Lawn and Garden Equipment, Chain Saws < 4 HP
2260004025	Gasoline, 2-Stroke, Lawn and Garden Equipment, Trimmers/Edgers/Brush Cutters
2260004030	Gasoline, 2-Stroke, Lawn and Garden Equipment, Leafblowers/Vacuums
2260004035	Gasoline, 2-Stroke, Lawn and Garden Equipment, Snowblowers
2260004040	Gasoline, 2-Stroke, Lawn and Garden Equipment, Rear Engine Riding Mowers
2260004045	Gasoline, 2-Stroke, Lawn and Garden Equipment, Front Mowers
2260004050	Gasoline, 2-Stroke, Lawn and Garden Equipment, Shredders < 5 HP
2260004055	Gasoline, 2-Stroke, Lawn and Garden Equipment, Lawn and Garden Tractors
2260004060	Gasoline, 2-Stroke, Lawn and Garden Equipment, Wood Splitters
2260004065	Gasoline, 2-Stroke, Lawn and Garden Equipment, Chippers/Stump Grinders
2260004070	Gasoline, 2-Stroke, Lawn and Garden Equipment, Commercial Turf Equipment
2260004075	Gasoline, 2-Stroke, Lawn and Garden Equipment, Other Lawn and Garden Equipment
2260005000	Gasoline, 2-Stroke, Farm Equipment, Total
2260005010	Gasoline, 2-Stroke, Farm Equipment, 2-Wheel Tractors
2260005015	Gasoline, 2-Stroke, Farm Equipment, Agricultural Tractors
2260005020	Gasoline, 2-Stroke, Farm Equipment, Combines
2260005025	Gasoline, 2-Stroke, Farm Equipment, Balers
2260005030	Gasoline, 2-Stroke, Farm Equipment, Agricultural Mowers
2260005035	Gasoline, 2-Stroke, Farm Equipment, Sprayers
2260005040	Gasoline, 2-Stroke, Farm Equipment, Tillers > 5 HP
2260005045	Gasoline, 2-Stroke, Farm Equipment, Swathers
2260005050	Gasoline, 2-Stroke, Farm Equipment, Hydro-power Units
2260005055	Gasoline, 2-Stroke, Farm Equipment, Other Agricultural Equipment
2260006000	Gasoline, 2-Stroke, Light Commercial, Total
2260006005	Gasoline, 2-Stroke, Light Commercial, Generator Sets < 50 HP
2260006010	Gasoline, 2-Stroke, Light Commercial, Pumps < 50 HP
2260006015	Gasoline, 2-Stroke, Light Commercial, Air Compressors < 50 HP
2260006020	Gasoline, 2-Stroke, Light Commercial, Gas Compressors < 50 HP
2260006025	Gasoline, 2-Stroke, Light Commercial, Welders < 50 HP
2260006030	Gasoline, 2-Stroke, Light Commercial, Pressure Washers < 50 HP
2260007000	Gasoline, 2-Stroke, Logging Equipment, Total
2260007005	Gasoline, 2-Stroke, Logging Equipment, Chain Saws > 4 HP
2260007010	Gasoline, 2-Stroke, Logging Equipment, Shredders > 5 HP
2260007015	Gasoline, 2-Stroke, Logging Equipment, Skidders

SCC Code	Description
2260007020	Gasoline, 2-Stroke, Logging Equipment, Fellers/Bunchers
2260008000	Gasoline, 2-Stroke, Airport Service Equipment, Total
2260008005	Gasoline, 2-Stroke, Airport Service Equipment, Airport Support Equipment
2260008010	Gasoline, 2-Stroke, Airport Service Equipment, Terminal Tractors
2265000000	All Off-highway Vehicle: Gasoline, 4-Stroke, Total
2265001000	Gasoline, 4-Stroke, Recreational Vehicles, Total
2265001010	Gasoline, 4-Stroke, Recreational Vehicles, Motorcycles: Off-Road
2265001020	Gasoline, 4-Stroke, Recreational Vehicles, Snowmobiles
2265001030	Gasoline, 4-Stroke, Recreational Vehicles, All Terrain Vehicles
2265001040	Gasoline, 4-Stroke, Recreational Vehicles, Minibikes
2265001050	Gasoline, 4-Stroke, Recreational Vehicles, Golf Carts
2265001060	Gasoline, 4-Stroke, Recreational Vehicles, Speciality Vehicle Carts
2265002000	Gasoline, 4-Stroke, Construction Equipment, Total
2265002003	Gasoline, 4-Stroke, Construction Equipment, Asphalt Pavers
2265002006	Gasoline, 4-Stroke, Construction Equipment, Tampers/Rammers
2265002009	Gasoline, 4-Stroke, Construction Equipment, Plate Compactors
2265002012	Gasoline, 4-Stroke, Construction Equipment, Concrete Pavers
2265002015	Gasoline, 4-Stroke, Construction Equipment, Rollers
2265002018	Gasoline, 4-Stroke, Construction Equipment, Scrapers
2265002021	Gasoline, 4-Stroke, Construction Equipment, Paving Equipment
2265002024	Gasoline, 4-Stroke, Construction Equipment, Surfacing Equipment
2265002027	Gasoline, 4-Stroke, Construction Equipment, Signal Boards
2265002030	Gasoline, 4-Stroke, Construction Equipment, Trenchers
2265002033	Gasoline, 4-Stroke, Construction Equipment, Bore/Drill Rigs
2265002036	Gasoline, 4-Stroke, Construction Equipment, Excavators
2265002039	Gasoline, 4-Stroke, Construction Equipment, Concrete/Industrial Saws
2265002042	Gasoline, 4-Stroke, Construction Equipment, Cement and Mortar Mixers
2265002045	Gasoline, 4-Stroke, Construction Equipment, Cranes
2265002048	Gasoline, 4-Stroke, Construction Equipment, Graders
2265002051	Gasoline, 4-Stroke, Construction Equipment, Off-highway Trucks
2265002054	Gasoline, 4-Stroke, Construction Equipment, Crushing/Processing Equipment
2265002057	Gasoline, 4-Stroke, Construction Equipment, Rough Terrain Forklifts
2265002060	Gasoline, 4-Stroke, Construction Equipment, Rubber Tire Loaders
2265002063	Gasoline, 4-Stroke, Construction Equipment, Rubber Tire Dozers
2265002066	Gasoline, 4-Stroke, Construction Equipment, Tractors/Loaders/Backhoes
2265002069	Gasoline, 4-Stroke, Construction Equipment, Crawler Tractors
2265002072	Gasoline, 4-Stroke, Construction Equipment, Skid Steer Loaders
2265002075	Gasoline, 4-Stroke, Construction Equipment, Off-Highway Tractors
2265002078	Gasoline, 4-Stroke, Construction Equipment, Dumpers/Tenders
2265002081	Gasoline, 4-Stroke, Construction Equipment, Other Construction Equipment
2265003000	Gasoline, 4-Stroke, Industrial Equipment, Total
2265003010	Gasoline, 4-Stroke, Industrial Equipment, Aerial Lifts
2265003020	Gasoline, 4-Stroke, Industrial Equipment, Forklifts
2265003030	Gasoline, 4-Stroke, Industrial Equipment, Sweepers/Scrubbers
2265003040	Gasoline, 4-Stroke, Industrial Equipment, Other General Industrial Equipment
2265003050	Gasoline, 4-Stroke, Industrial Equipment, Other Material Handling Equipment
2265004000	Gasoline, 4-Stroke, Lawn and Garden Equipment, Total
2265004010	Gasoline, 4-Stroke, Lawn and Garden Equipment, Lawn mowers
2265004015	Gasoline, 4-Stroke, Lawn and Garden Equipment, Rotary Tillers < 5 HP
2265004020	Gasoline, 4-Stroke, Lawn and Garden Equipment, Chain Saws < 4 HP
2265004025	Gasoline, 4-Stroke, Lawn and Garden Equipment, Trimmers/Edgers/Brush Cutters
2265004030	Gasoline, 4-Stroke, Lawn and Garden Equipment, Leafblowers/Vacuums
2265004035	Gasoline, 4-Stroke, Lawn and Garden Equipment, Snowblowers

SCC Code	Description
2265004040	Gasoline, 4-Stroke, Lawn and Garden Equipment, Rear Engine Riding Mowers
2265004045	Gasoline, 4-Stroke, Lawn and Garden Equipment, Front Mowers
2265004050	Gasoline, 4-Stroke, Lawn and Garden Equipment, Shredders < 5 HP
2265004055	Gasoline, 4-Stroke, Lawn and Garden Equipment, Lawn and Garden Tractors
2265004060	Gasoline, 4-Stroke, Lawn and Garden Equipment, Wood Splitters
2265004065	Gasoline, 4-Stroke, Lawn and Garden Equipment, Chippers/Stump Grinders
2265004070	Gasoline, 4-Stroke, Lawn and Garden Equipment, Commercial Turf Equipment
2265004075	Gasoline, 4-Stroke, Lawn and Garden Equipment, Other Lawn and Garden Equipment
2265005000	Gasoline, 4-Stroke, Farm Equipment, Total
2265005010	Gasoline, 4-Stroke, Farm Equipment, 2-Wheel Tractors
2265005015	Gasoline, 4-Stroke, Farm Equipment, Agricultural Tractors
2265005020	Gasoline, 4-Stroke, Farm Equipment, Combines
2265005025	Gasoline, 4-Stroke, Farm Equipment, Balers
2265005030	Gasoline, 4-Stroke, Farm Equipment, Agricultural Mowers
2265005035	Gasoline, 4-Stroke, Farm Equipment, Sprayers
2265005040	Gasoline, 4-Stroke, Farm Equipment, Tillers > 5 HP
2265005045	Gasoline, 4-Stroke, Farm Equipment, Swathers
2265005050	Gasoline, 4-Stroke, Farm Equipment, Hydro-power Units
2265005055	Gasoline, 4-Stroke, Farm Equipment, Other Agricultural Equipment
2265006000	Gasoline, 4-Stroke, Light Commercial, Total
2265006005	Gasoline, 4-Stroke, Light Commercial, Generator Sets < 50 HP
2265006010	Gasoline, 4-Stroke, Light Commercial, Pumps < 50 HP
2265006015	Gasoline, 4-Stroke, Light Commercial, Air Compressors < 50 HP
2265006020	Gasoline, 4-Stroke, Light Commercial, Gas Compressors < 50 HP
2265006025	Gasoline, 4-Stroke, Light Commercial, Welders < 50 HP
2265006030	Gasoline, 4-Stroke, Light Commercial, Pressure Washers < 50 HP
2265007000	Gasoline, 4-Stroke, Logging Equipment, Total
2265007005	Gasoline, 4-Stroke, Logging Equipment, Chain Saws > 4 HP
2265007010	Gasoline, 4-Stroke, Logging Equipment, Shredders > 5 HP
2265007015	Gasoline, 4-Stroke, Logging Equipment, Skidders
2265007020	Gasoline, 4-Stroke, Logging Equipment, Fellers/Bunchers
2265008000	Gasoline, 4-Stroke, Airport Service Equipment, Total
2265008005	Gasoline, 4-Stroke, Airport Service Equipment, Airport Support Equipment
2265008010	Gasoline, 4-Stroke, Airport Service Equipment, Terminal Tractors
2270000000	All Off-Highway Vehicle: Diesel, Total
2270001000	Diesel, Recreational Vehicles, Total
2270001010	Diesel, Recreational Vehicles, Motorcycles: Off-Road
2270001020	Diesel, Recreational Vehicles, Snowmobiles
2270001030	Diesel, Recreational Vehicles, All Terrain Vehicles
2270001040	Diesel, Recreational Vehicles, Minibikes
2270001050	Diesel, Recreational Vehicles, Golf Carts
2270001060	Diesel, Recreational Vehicles, Speciality Vehicle Carts
2270002000	Diesel, Construction Equipment, Total
2270002003	Diesel, Construction Equipment, Asphalt Pavers
2270002006	Diesel, Construction Equipment, Tampers/Rammers
2270002009	Diesel, Construction Equipment, Plate Compactors
2270002012	Diesel, Construction Equipment, Concrete Pavers
2270002015	Diesel, Construction Equipment, Rollers
2270002018	Diesel, Construction Equipment, Scrapers
2270002021	Diesel, Construction Equipment, Paving Equipment
2270002024	Diesel, Construction Equipment, Surfacing Equipment
2270002027	Diesel, Construction Equipment, Signal Boards
2270002030	Diesel, Construction Equipment, Trenchers

SCC Code	Description
2270002033	Diesel, Construction Equipment, Bore/Drill Rigs
2270002036	Diesel, Construction Equipment, Excavators
2270002039	Diesel, Construction Equipment, Concrete/Industrial Saws
2270002042	Diesel, Construction Equipment, Cement and Mortar Mixers
2270002045	Diesel, Construction Equipment, Cranes
2270002048	Diesel, Construction Equipment, Graders
2270002051	Diesel, Construction Equipment, Off-highway Trucks
2270002054	Diesel, Construction Equipment, Crushing/Processing Equipment
2270002057	Diesel, Construction Equipment, Rough Terrain Forklifts
2270002060	Diesel, Construction Equipment, Rubber Tire Loaders
2270002063	Diesel, Construction Equipment, Rubber Tire Dozers
2270002066	Diesel, Construction Equipment, Tractors/Loaders/Backhoes
2270002069	Diesel, Construction Equipment, Crawler Tractors
2270002072	Diesel, Construction Equipment, Skid Steer Loaders
2270002075	Diesel, Construction Equipment, Off-Highway Tractors
2270002078	Diesel, Construction Equipment, Dumpers/Tenders
2270002081	Diesel, Construction Equipment, Other Construction Equipment
2270003000	Diesel, Industrial Equipment, Total
2270003010	Diesel, Industrial Equipment, Aerial Lifts
2270003020	Diesel, Industrial Equipment, Forklifts
2270003030	Diesel, Industrial Equipment, Sweepers/Scrubbers
2270003040	Diesel, Industrial Equipment, Other General Industrial Equipment
2270003050	Diesel, Industrial Equipment, Other Material Handling Equipment
2270004000	Diesel, Lawn and Garden Equipment, Total
2270004010	Diesel, Lawn and Garden Equipment, Lawn mowers
2270004015	Diesel, Lawn and Garden Equipment, Rotary Tillers < 5 HP
2270004020	Diesel, Lawn and Garden Equipment, Chain Saws < 4 HP
2270004025	Diesel, Lawn and Garden Equipment, Trimmers/Edgers/Brush Cutters
2270004030	Diesel, Lawn and Garden Equipment, Leafblowers/Vacuums
2270004035	Diesel, Lawn and Garden Equipment, Snowblowers
2270004040	Diesel, Lawn and Garden Equipment, Rear Engine Riding Mowers
2270004045	Diesel, Lawn and Garden Equipment, Front Mowers
2270004050	Diesel, Lawn and Garden Equipment, Shredders < 5 HP
2270004055	Diesel, Lawn and Garden Equipment, Lawn and Garden Tractors
2270004060	Diesel, Lawn and Garden Equipment, Wood Splitters
2270004065	Diesel, Lawn and Garden Equipment, Chippers/Stump Grinders
2270004070	Diesel, Lawn and Garden Equipment, Commercial Turf Equipment
2270004075	Diesel, Lawn and Garden Equipment, Other Lawn and Garden Equipment
2270005000	Diesel, Farm Equipment, Total
2270005010	Diesel, Farm Equipment, 2-Wheel Tractors
2270005015	Diesel, Farm Equipment, Agricultural Tractors
2270005020	Diesel, Farm Equipment, Combines
2270005025	Diesel, Farm Equipment, Balers
2270005030	Diesel, Farm Equipment, Agricultural Mowers
2270005035	Diesel, Farm Equipment, Sprayers
2270005040	Diesel, Farm Equipment, Tillers > 5 HP
2270005045	Diesel, Farm Equipment, Swathers
2270005050	Diesel, Farm Equipment, Hydro-power Units
2270005055	Diesel, Farm Equipment, Other Agricultural Equipment
2270006000	Diesel, Light Commercial, Total
2270006005	Diesel, Light Commercial, Generator Sets < 50 HP
2270006010	Diesel, Light Commercial, Pumps < 50 HP
2270006015	Diesel, Light Commercial, Air Compressors < 50 HP

SCC Code	Description
2270006020	Diesel, Light Commercial, Gas Compressors < 50 HP
2270006025	Diesel, Light Commercial, Welders < 50 HP
2270006030	Diesel, Light Commercial, Pressure Washers < 50 HP
2270007000	Diesel, Logging Equipment, Total
2270007005	Diesel, Logging Equipment, Chain Saws > 4 HP
2270007010	Diesel, Logging Equipment, Shredders > 5 HP
2270007015	Diesel, Logging Equipment, Skidders
2270007020	Diesel, Logging Equipment, Fellers/Bunchers
2270008000	Diesel, Airport Service Equipment, Total
2270008005	Diesel, Airport Service Equipment, Airport Support Equipment
2270008010	Diesel, Airport Service Equipment, Terminal Tractors
2275000000	All Aircraft Types and Operations, Total
2275001000	Military Aircraft, Total
2275020000	Commercial Aircraft, Total: All Types
2275050000	General Aviation, Total
2275060000	Air Taxi, Total
2275070000	Aircraft Auxiliary Power Units, Total
2275085000	Unpaved Airstrips, Total
2275900000	Aircraft, Refueling: All Fuels, All Processes
2275900101	Aircraft, Refueling: All Fuels, Displacement Loss/Uncontrolled
2275900102	Aircraft, Refueling: All Fuels, Displacement Loss/Controlled
2275900103	Aircraft, Refueling: All Fuels, Spillage
2275900201	Aircraft, Refueling: All Fuels, Underground Tank: Total
2275900202	Aircraft, Refueling: All Fuels, Underground Tank: Breathing and Emptying
2280001000	Coal, Total, All Vessel Types
2280001010	Coal, Ocean-Going Vessels
2280001020	Coal, Harbor Vessels
2280001030	Coal, Fishing Vessels
2280001040	Coal, Military Vessels
2280002000	Diesel, Total, All Vessel Types
2280002010	Diesel, Ocean-Going Vessels
2280002020	Diesel, Harbor Vessels
2280002030	Diesel, Fishing Vessels
2280002040	Diesel, Military Vessels
2280003000	Residual, Total, All Vessel Types
2280003010	Residual, Ocean-Going Vessels
2280003020	Residual, Harbor Vessels
2280003030	Residual, Fishing Vessels
2280003040	Residual, Military Vessels
2280004000	Gasoline, Total, All Vessel Types
2280004010	Gasoline, Ocean-Going Vessels
2280004020	Gasoline, Harbor Vessels
2280004030	Gasoline, Fishing Vessels
2280004040	Gasoline, Military Vessels
2282005000	Pleasure Craft, Gasoline 2-Stroke, Total
2282005005	Pleasure Craft, Gasoline 2-Stroke, Inboards
2282005010	Pleasure Craft, Gasoline 2-Stroke, Outboards
2282005015	Pleasure Craft, Gasoline 2-Stroke, Sterndrive
2282005020	Pleasure Craft, Gasoline 2-Stroke, Sailboat Auxiliary Inboard
2282005025	Pleasure Craft, Gasoline 2-Stroke, Sailboat Auxiliary Outboard
2282010000	Pleasure Craft, Gasoline 4-Stroke, Total
2282010005	Pleasure Craft, Gasoline 4-Stroke, Inboards
2282010010	Pleasure Craft, Gasoline 4-Stroke, Outboards

SCC Code	Description
2282010015	Pleasure Craft, Gasoline 4-Stroke, Sterndrive
2282010020	Pleasure Craft, Gasoline 4-Stroke, Sailboat Auxiliary Inboard
2282010025	Pleasure Craft, Gasoline 4-Stroke, Sailboat Auxiliary Outboard
2282020000	Pleasure Craft, Diesel, Total
2282020005	Pleasure Craft, Diesel, Inboards
2282020010	Pleasure Craft, Diesel, Outboards
2282020015	Pleasure Craft, Diesel, Sterndrive
2282020020	Pleasure Craft, Diesel, Sailboat Auxiliary Inboard
2282020025	Pleasure Craft, Diesel, Sailboat Auxiliary Outboard
2285002000	Diesel, Total
2285002005	Diesel, Line Haul Locomotives
2285002010	Diesel, Yard Locomotives
2294000000	All Paved Roads, Total: Fugitives
2294000001	All Paved Roads, Total: Average Conditions - Fugitives
2294000002	All Paved Roads, Total: Sanding/Salting - Fugitives
2294005000	Interstate/Arterial, Total: Fugitives
2294005001	Interstate/Arterial, Total: Average Conditions - Fugitives
2294005002	Interstate/Arterial, Total: Sanding/Salting - Fugitives
2294010000	All Other Public Paved Roads, Total: Fugitives
2294010001	All Other Public Paved Roads, Total: Average Conditions - Fugitives
2294010002	All Other Public Paved Roads, Total: Sanding/Salting - Fugitives
2294015000	Industrial Roads, Total: Fugitives
2294015001	Industrial Roads, Total: Average Conditions - Fugitives
2294015002	Industrial Roads, Total: Sanding/Salting - Fugitives
2296000000	All Unpaved Roads, Total: Fugitives
2296005000	Public Unpaved Roads, Total: Fugitives
2296010000	Industrial Unpaved Roads, Total: Fugitives

Appendix GG: Carcinogenicity Ratings

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 IRIS Ratings
Non-Metal Compounds (Excluding PAHs)		
Actetaldehyde	75-07-0	B2
Acrolein	107-02-8	C
Acrylamide	79-06-1	B2
Acrylonitrile	107-13-1	B1
Atrazine	1912-24-9	Under Review
Benzene (including benzene from gasoline)	71-43-2	A
1,3-Butadiene	106-99-0	B2
Carbon Tetrachloride	56-23-5	B2
Chlordane	57-74-9	B2
Chloroform	67-66-3	B2
Coke Oven Emissions	8007-45-2	A
Dibutyl Phthalate	84-74-2	D
Dioctyl Phthalate	117-84-0	Under Review
Dichloroethyl ether	111-44-4	B2
Diethylhexyl Phthalate	117-81-7	B2
Ethylbenzene	100-41-4	D
Ethylene dibromide	106-93-4	B2
1,2-Dichloroethane	107-06-2	B2
Ethylene oxide	75-21-8	
Formaldehyde	50-00-0	B1
Glycol ethers		
Heptachlor	76-44-8	B2
Hexachlorobenzene	118-74-1	C
Hexachlorobutadiene	87-68-3	C
Hexachloroethane	67-72-1	C
Hydrazine	302-01-2	B2
Methoxychlor	72-43-5	D
1,1,1-Trichloroethane	71-55-6	D
Methylene Chloride	75-09-2	B2
Methylene diphenyl diisocyanate	101-68-8	D
Parathion	56-38-2	C
Pentachloronitrobenzene	82-68-8	Under Review
Pentachlorophenol (PCP)	87-86-5	B2
Phenol	108-95-2	D
Phosgene	75-44-5	Under Review
Styrene	100-42-5	Under Review
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	B**
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	B**
Tetrachloroethylene	127-18-4	Under Review
Toluene	108-88-3	D
2,4-toluene diisocyanate	26471-62-5	Under Review
Polychlorinated Biphenyls (PCBs)	1336-36-3	B2
Polychlorinated Dibenzodioxins, Total		B**
Polychlorinated Dibenzofurans, Total		B**

Trichloroethylene	79-01-6	In Preparation
2,4,5-Trichlorophenol	95-95-4	To Be Reviewed
2,4,6-Trichlorophenol	88-06-2	B2
Trifluralin	1582-09-8	C
PAH (EPA's 16 PAH approach)		
Acenapthene	83-32-9	Under Review
Acenaphthylene	208-96-8	D
Anthracene	120-12-7	D
Benz(a)anthracene	56-55-3	B2
Benzo(a)pyrene	50-32-8	B2
Benzo(b)fluoranthene	205-99-2	B2
Benzo(ghi)perylene	191-24-2	D
Benzo(k)fluoranthene	207-08-9	B2
Chrysene	218-01-9	B2
Dibenz(a,h)anthracene	53-70-3	B2
Fluoranthene	206-44-0	D
Fluorene	86-73-7	D
Indeno(1,2,3-cd)pyrene	193-39-5	B2
Naphthalene	91-20-3	D
Phenanthrene	85-01-8	D
Pyrene	129-00-0	D
Metal Compounds		
Antimony	7440-36-0	
Arsenic	7440-38-2	A
Beryllium	7440-41-7	B1
Cadmium	7440-43-9	B1
Chromium	7440-47-3	Under Review
Chromium (VI)	18540-29-9	A
Cobalt	7440-48-4	D
Copper	7440-50-8	D
Lead	7439-92-1	B2
Alkylated Lead Compounds		B2
Manganese	7439-96-5	D
Mercury	7439-97-6	Elem. = D, (HgC12 = C)
Nickel	7440-02-0	Ni carbonyl = B2 Ni cyanide = Under Review Ni subsulfied = A (in redining dust) Ni soluble salts = not evaluated

**Not specifically listed or rated in IRIS, but CDD's and CDF's are regarded as likely to present a cancer hazard to humans in the U.S. EPA draft reassessment for 2,3,7,8-TCDD and related compounds.

Key A = human carcinogen
B = probable human carcinogen
B2 = limited human evidence in animals, inadequate evidence in humans
C = possible human carcinogen
D = not classifiable as to human carcinogenicity
E = evidence of non-carcinogenicity for humans

Ratings are from U.S. EPA's Integrated Risk Information System (IRIS) database, containing agency consensus positions on the potential adverse human health effects of approximately 500 substances, updated monthly. The ratings provided above are from August 1998.

Appendix HH: Contact List

Great Lakes Commission Regional Air Toxic Emissions Inventory Project Steering Committee

MEMBERS

Mr. David 'Buzz' Asselmeier
Bureau of Air
IL Envir. Protection Agency
P.O. Box 19276
Springfield, IL 62794-9276
T: 217-782-5811
F: 217-782-6348
E: buzz.asselmeier@epa.state.il.us

Mr. John Bates
Office of Air Management
IN Dept. of Envir. Mgmt.
P.O. Box 6015
101 N. Senate Ave.-Room 1001
Indianapolis, IN 46206-6015
T: 317-233-4226
F: 317-233-5697
E: jbates@dem.state.in.us

Mr. Gary Baker
Air Quality Division
MI Dept. of Envir. Quality
Hollister Building, 4th Floor
P.O. Box 30260 106 W. Allegan
Lansing, MI 48909-7760
T: 517-373-7058
F: 517-373-1265
E: gbaker@great-lakes.net

Ms. Chun Yi Wu
Environmental Outcomes Division
MN Pollution Control Agency
520 Lafayette Rd.
St. Paul, MN 55155-4194
T: 651-282-5855
F: 651-297-7709
E: chun.yi.wu@pca.state.mn.us

Mr. Chris Nelson
Environmental Outcomes Division
MN Pollution Control Agency
520 Lafayette Road N.
St. Paul, MN 55155-4194
T: 651-296-7750
F: 651-297-7709
E: christopher.nelson@pca.state.mn.us

Mr. Rob Sliwinski
Division of Air Resources
NY Dept. of Envir. Conservation
P.O. Box 3250
Albany, NY 12233
T: 518-457-2823
F: 518-457-0794
E: rgsliwin@gw.dec.stat.ny.us

Mr. Rob McDonough
Div. of Air Resources
NY Dept. of Envir. Conservation
P.O. Box 3250
Albany, NY 12233
T: 518-457-2823
F: 518-457-0794
E: rsmcdono@gw.dec.state.ny.us

Mr. Mike Hopkins
Div. of Air Pollution Control
OH Envir. Protection Agency
P.O. Box 1049
Columbus, OH 43215
T: 614-644-3611
F: 614-644-3681
E: mike.hopkins@epa.state.oh.us

Mr. Tom Velalis
Div. of Air Pollution Control
OH Envir. Protection Agency
P.O. Box 1049
Columbus, OH 43215
T: 614-644-4837
F: 614-644-3681
E: tom.velalis@epa.state.oh.us

Mr. Rick St. Louis
Bureau of Air Quality
Rachel Carson State Office Building
PA Dept. of Envir. Protection
P.O. Box 8468
Harrisburg, PA 17105-8468
T: 717-787-4310
F: 717-772-2303
E: stlouis.richard@a1.dep.pader.pa.us

Mr. Rob Altenburg
Bureau of Air Quality
Rachel Carson State Office Building
PA Dept. of Envir. Protection
P.O. Box 8468
Harrisburg, PA 17105-8468
T: 717-787-4310
F: 717-772-2303
E: altenburg.robert@a1.dep.pader.pa.us

* Mr. Orlando Cabrera-Rivera
Bureau of Air Management
WI Dept. of Natural Resources
P.O. 7921
101 S. Webster St. - 7th Floor
Madison, WI 53707
T: 608-267-2466
F: 608-267-0560
E: cabreo@mail01.dnr.state.wi.us

Mr. Peter Wong
Envir. Monitoring & Reporting Branch
ON Ministry of Environment
125 Resources Rd. - East Wing
Etobicoke, ON M9P 3V6
T: 416-235-6130
F: 416-235-5818
E: wongpe@ene.gov.on.ca

*Denotes Steering Committee Chair

OBSERVERS

Dr. Suzanne King
Air Division
U.S. EPA-Region V - AR-18J
77 W. Jackson Blvd.
Chicago, IL 60604-3950
T: 312-886-6054
F: 312-886-0716
E: king.suzanne@epamail.epa.gov

Ms. Anne Pope
Environmental Engineer
Emission Factor and Methodologies Sections
Office of Air Quality Planning and Standards, USEPA
Research Triangle Park, NC 27711
T: 919-541-5373
F: 919-541-0684

Mr. Chuck Mann
Office of Research and Development
USEPA (MD 62)
Research Triangle Park, NC 27711
T: 919-541-4593
F: 919-541-7891
Dr. P.K. Misra
Atmospheric Quality and Meteorology Section
Envir. Monitoring & Reporting Branch
Ontario Ministry of Environment
125 Resources Rd., E. Wing
Etobicoke, ON M9P 3V6
T: 416-235-5768
F: 416-235-6037

Mr. Raynald Brulotte
Ministry of the Environment
Province of Quebec
675 Boul. Rene-Levesque E., 9th floor
Quebec, QC G1R 5V7
T: 418-521-3950
F: 418-646-0001
E: raynald.brulotte@menv.gouv.qc.ca

Mr. Wilfred Jan
Pollution Data Analysis Division
Environment Canada
351 St. Joseph Blvd., 10th Floor
Hull, QC K1A 0X3
T: 613-994-3098
F: 613-953-9542

Mr. Robert Kelly
Regional Air Modeler
Air Programs Branch
USEPA Region 2, 20th Floor
290 Broadway
New York, NY 10007-1866
T: 212-637-4225
F: 212-637-3958
E: kelly.bob@epamail.epa.gov

Mr. Pranas E. Pranckevicius
Data Integration Unit
GLNPO - U.S. EPA - G-9J
77 West Jackson Blvd.
Chicago, IL 60604-3590
T: 312-353-3437
F: 312-353-2018
E: pprancke@ges1.r05.epa.gov

Mr. William Benjey
ORD - USEPA
Research Triangle Park, NC 27711
T: 919-541-0821
F: 919-541-1379
E: benjey@hpcc.epa.gov

GREAT LAKES COMMISSION- STAFF

Ms. Julie Wagemakers
Program Manager
Communications and Information Management
The Argus II Building
400 Fourth Street
Ann Arbor, MI 48103-4816
T: 313-665-9135
F: 313-665-4370
E: juliew@glc.org

Mr. Derek Moy
Project Specialist
Communications and Information Management
The Argus II Building
400 Fourth Street
Ann Arbor, MI 48103-4816
T: 313-665-9135
F: 313-665-4370
E: dmoy@glc.org

Group email: airtoxics@great-lakes.net
URL: http://www.glc.org/air/air3.html