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 2002. 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). The stationary source inventory includes point 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 2002. 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 October 2003. 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. The County Business Patterns report from the Census Bureau reports employment by NAICS (North American Industrial Classification System) rather than SIC (Standard Industrial Classification). A cross-reference table, provided by the Census Bureau, between NAICS and SIC was used to apportion the data to the correct SIC. 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 "MA325F(02)-1 – Paint and Allied Products", July 2003 (www.census.gov/cir/www/325/mq325f.html). These values were then apportioned to county level using population. Emissions were then calculated by using per capita factors.

Autobody Refinishing

Emissions were calculated based on population using an emission factor of 1.9 lb VOC/person. A reduction of 33% was claimed for the ozone attainment areas while a reduction of 72% was claimed for the ozone nonattainment areas of the state. VOC emissions were then speciated using profile 1194.

Chrome Plating

Inventoried as a point source.

Commercial Cooking

The document "Methods for Developing a National Emission Inventory for Commercial Cooking Processes" (E.H. Pechan & Associates for USEPA, July 2003) was used using the number of restaurants of each type to calculate emissions. This is the same methodology USEPA used for the 2002 NEI.

Consumer Solvent Use

County population was multiplied by the overall emission factor, from USEPA's 2002 NEI methodology document to obtain emissions. Appropriate emission reductions were taken for each category due to national reductions.

Dry Cleaning

Employment data was used to calculate emissions. The EIIP emission factors were then used to calculate perchloroethylene emissions.

Ethylene Oxide Sterilizers

Inventoried as a point source.

Forest Fires

The number of acres burned for the state was obtained from USEPA's 2002 NEI. This value was apportioned to the county level by the number of forested acres in a county. Emission factors from USEPA's 2002 NEI were then used to calculate emissions.

Gasoline Marketing

The amount of gasoline and gasohol sold in Illinois was obtained from Monthly Gasoline Reported by States 2002 (Federal Highway Administration Highway Statistics, Table MF-33GA, November 2003) . 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 the speciation profile for gasoline from USEPA's NEI.

Vehicle Refueling (Stage II) – Multiplied monthly gasoline use times the monthly emission factor obtained from MOBILE 6.x in combination with the speciation profile for gasoline from USEPA's NEI.

Underground Tank Breathing – Used EIIP calculation methodology in combination with the speciation profile for gasoline from USEPA's NEI.

Gasoline Trucks in Transit – Used EIIP calculation methodology in combination with the speciation profile for gasoline from USEPA's NEI.

Graphic Arts

Inventoried as a point source.

Incineration/Crematories

Inventoried as a point source.

Industrial Surface Coating

Inventoried as a point source.

Lamp Breakage and Lamp Recycling

Data from USEPA's 2002 NEI inventory was used.

Landfills

Inventoried as a point source.

Pesticides

Pesticide use and application by county was obtained from the Illinois Agricultural Statistics website (www.agstats.state.il.us). Emission factors from EIIP were then used to calculate emissions.

Open Burning

This category includes burning of yard wastes (leaves and brush) and residential household waste. For both categories, emissions were calculated on a per-capita basis using the rural population of the county. Emission factors from USEPA's 2002 NEI were then used to calculate the emissions for pollutants of interest.

Prescribed Burning

The amount of acres burned due to prescribed burning was obtained from USEPA's 2002 NEI. This value was apportioned to the county level by the number of acres of forest, scrub and grass. Emission factors and speciation profiles from USEPA's 2002 NEI were then used to calculate emissions.

Publicly Owned Treatment Works (POTWs)

Emissions from POTWs were calculated using an emission factor for VOC developed for Illinois EPA's periodic emission inventories. This calculation method relies on the gallons of wastewater throughput and the percent industrial load. The speciation profile from USEPA's 2002 NEI inventory was then used to calculate emissions for the pollutants of interest.

Residential Fuel Combustion

The amount of fuel burned in Illinois was obtained from the Department of Energy's Energy Information Administration. Use by county was apportioned by the number of houses in a county (2000 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 fuel burned in Illinois was obtained from the Department of Energy's Energy Information Administration. The American Housing Survey was then used to apportion the appropriate type of stoves and fireplaces to each county. FIRE emission factors were then used to calculate emissions.

Solvent Cleaning

Inventoried as a point source.

Structure Fires

Emissions calculated for 1998 were used for 2002.

Traffic Lane Markings

The number of lane-miles in each county was obtained from the Illinois Department of Transportation. An emission factor of 41.26 lb VOC/lane-mile was used. VOC 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

Landings and take-offs by type of aircraft were obtained for each airport in the state. These values were multiplied by the same emission factors from previous inventories to obtain the emissions.

Off-road Mobile Sources

USEPA's 2002 NEI inventory was used for off-road mobile sources.

On-road Mobile Sources

Input files created to perform Illinois EPA's 2002 annual criteria emission inventory were used. These input files were then slightly modified to account for calculating HAP emissions using MOBILE 6.2. Resulting emission factors were then multiplied by the applicable VMT to obtain emissions.

Illinois - Statewide Emissions (lb/yr)

Pollutant Name (CAS)	Area Source Emissions	Non-road Emissions	On-road Emissions	Point Source Emissions	Total Emissions
Acenaphthene (83-32-9)	2633	2197	1981	82	6893
Acenaphthylene (208-96-8)	53,970	4802	10,470	108.5	69,350
Acetaldehyde (75-07-0)	60,640	1,731,000	2,209,000	54,520	4,054,000
Acetamide (60-35-5)	1.528				1.528
Acetonitrile (75-05-8)	1860			87,290	89,150
Acetophenone (98-86-2)	565.2			21,100	21,670
Acrolein (107-02-8)	71,720	173,500	198,900	21,060	465,200
Acrylamide (79-06-1)				57	57
Acrylic acid (79-10-7)	0.04549			41,610	41,610
Acrylonitrile (107-13-1)	2080			206,300	208,400
Allyl chloride (107-05-1)	104.5				104.5
Aniline (62-53-3)				25	25
Anthracene (120-12-7)	4026	1041	2373	34.39	7474
Antimony (7440-36-0)	0.4572			1924	1924
Arsenic (7440-38-2)	16.82		1614	21,310	22,940
Atrazine (1912-24-9)	1,398,000				1,398,000
Benz(a)anthracene (56-55-3)	5294	341.1	558.6	8856	15,050
Benzo(g,h,i)perylene (191-24-2)	1256	668.6	702.2	1.06	2628
Benzene (71-43-2)	1,327,000	3,825,000	11,960,000	733,100	17,850,000
Benzo(a)pyrene (50-32-8)	1151	218.1	354.3	3414	5137
Benzo(b)fluoranthene (205-99-2)	1578	176.1	390	15.19	2159
Benzo(k)fluoranthene (207-08-9)	549.9	160.8	390	0.8056	1102
Benzyl chloride (100-44-7)	44.01			30,270	30,320
Beryllium (7440-41-7)	5.335	69.79		2656	2731
Biphenyl (92-52-4)	1065			1745	2809
Bromoform (75-25-2)				1606	1606
Methyl bromide (74-83-9)	2,655,000			37,120	2,692,000
1,3-Butadiene (106-99-0)	4096	648,600	1,407,000	264,900	2,325,000
Cadmium (7440-43-9)	15.06	78.22		15,230	15,320
Carbon disulfide (75-15-0)	23,300			2,847,000	2,870,000
Carbon tetrachloride (56-23-5)	6269			3857	10,130
Carbonyl sulfide (463-58-1)	5.222			1362	1367
Catechol (120-80-9)				350	350
Chlordane (57-74-9)				0.61	0.61

Pollutant Name (CAS)	Area Source Emissions	Non-road Emissions	On-road Emissions	Point Source Emissions	Total Emissions
Chlorine (7782-50-5)				530,500	530,500
Chlorobenzene (108-90-7)	859,200			51,160	910,300
Chloroethane (75-00-3)	86,470			81,910	168,400
Chloroform (67-66-3)	47,170			5533	52,710
2-Chloro-1,3-butadiene (126-99-8)	128.1				128.1
Chromium (7440-47-3)	11.41			37,950	37,960
Chromium VI (18540-29-9)		37.3	436	3793	4266
Chrysene (218-01-9)	3189	225.5	310.4	7347	11,070
2-Chloroacetophenone (532-27-4)				288	288
Cobalt (7440-48-4)	2.54			3600	3603
Coke oven emissions				501,800	501,800
Copper (7440-50-8)				90,830	90,830
Cresol (mixed isomers) (1319-77-3)	8.645			609	617.6
O-Cresol (95-48-7)	296.7			2516	2813
P-Cresol (106-44-5)	599.7				599.7
Cumene (98-82-8)	3685			45,170	48,850
Cyanide (57-12-5)	9440			104,800	114,200
2,4-D (2,4-Dichlorophenoxyacetic acid) (94-75-7)	3,369,000			10	3,369,000
Dibenz(a,h)anthracene (53-70-3)	51.67	4.976	0.1922	0.9067	57.74
Dibenzofuran (132-64-9)	93.25				93.25
1,2-Dibromoethane (106-93-4)				73.9	73.9
Di-N-butyl phthalate (84-74-2)	337.9			5332	5670
1,2-Dichloroethane (107-06-2)	2355			6592	8947
1,4-Dichlorobenzene (106-46-7)	2,452,000			50,820	2,503,000
1,1-Dichloroethane (75-34-3)				9074	9074
1,3-Dichloropropene (542-75-6)	421,000			13.99	421,000
Diethyl sulfate (64-67-5)				4500	4500
Diethanolamine (111-42-2)				4107	4107
Diethylhexyl phthalate (117-81-7)	1.854			7585	7587
1,1-Dimethylhydrazine (57-14-7)				10	10
Dimethyl phthalate (131-11-3)				1500	1500
Dimethyl sulfate (77-78-1)	7.073			6475	6482
N,N-Dimethylformamide (68-12-2)	82,030			1072	83,100
2,4-Dinitrophenol (51-28-5)				0.0526	0.0526
2,4-Dinitrotoluene (121-14-2)	259.3			11.52	270.9
1,4-Dioxane (123-91-1)	222.6			509	731.6

Pollutant Name (CAS)	Area Source Emissions	Non-road Emissions	On-road Emissions	Point Source Emissions	Total Emissions
Epichlorohydrin (106-89-8)				69,140	69,140
Ethyl acrylate (140-88-5)	9.431			2296	2305
Ethyl benzene (100-41-4)	1,181,000	2,132,000	3,880,000	493,500	7,687,000
Ethylene glycol (107-21-1)	1,975,000			81,600	2,057,000
Ethylene oxide (75-21-8)	1196			100,400	101,600
Ethylenethiourea (96-45-7)				10.02	10.02
Fluoranthene (206-44-0)	5866	2139	2455	10,890	21,350
Fluorene (86-73-7)	6530	3897	4119	69.24	14,620
Formaldehyde (50-00-0)	169,000	3,904,000	4,049,000	1,250,000	9,372,000
Glycol ethers	4,902,000			2,496,000	7,398,000
Hydrochloric acid (7647-01-0)	230,200			29,930,000	30,160,000
Heptachlor (76-44-8)				0.17	0.17
Hexachlorocyclopentadiene (77-47-4)	3.144				3.144
Hexane (110-54-3)	4,928,000	1,669,000	3,227,000	5,214,000	15,040,000
Hexachloro-1,3-butadiene (87-68-3)	3.929				3.929
Hexachlorobenzene (118-74-1)	1.171			0.17	1.341
Hydrogen fluoride (7664-39-3)	162.7			4,593,000	4,594,000
Hydrazine (302-01-2)				5	5
Hydrogen cyanide (74-90-8)	527,100				527,100
Hydrogen sulfide (7783-06-4)				111,700	111,700
Hydroquinone (123-31-9)				11	11
Indeno(1,2,3-c,d)pyrene (193-39-5)	266.9	206.9	198.4	1.008	673.3
Isophorone (78-59-1)	11,340			24,410	35,750
Lead (7439-92-1)	25.04	324.7		121,100	121,500
Maleic anhydride (108-31-6)				165,700	165,700
Manganese (7439-96-5)	91.09	126.5	372.8	141,600	142,200
Mercury (7439-97-6)	32.91		1779	8133	9945
Methyl ethyl ketone (78-93-3)	3,891,000			3,465,000	7,356,000
Methyl hydrazine (60-34-4)				6995	6995
Methyl iodide (74-88-4)				7.454	7.454
Methyl isobutyl ketone (108-10-1)	939,900			1,539,000	2,479,000
Methyl methacrylate (80-62-6)	2621			54,030	56,650
Methyl tert-butyl ether (1634-04-4)	614.1			20,700	21,320
Methanol (67-56-1)	8,104,000			1,495,000	9,599,000
4,4'-Methylenediphenyl diisocyanate (101-68-8)				2507	2507
Methoxychlor (72-43-5)				0.64	0.64

Pollutant Name (CAS)	Area Source Emissions	Non-road Emissions	On-road Emissions	Point Source Emissions	Total Emissions
Methyl chloride (74-87-3)	73,320			22,490	95,810
Methylene chloride (dichloromethane) (75-09-2)	1,282,000			810,800	2,093,000
Naphthalene (91-20-3)	654,700	55,940	272,600	237,600	1,221,000
Nickel (7440-02-0)	17.74	1796	824.6	47,020	49,660
Nitrobenzene (98-95-3)	35.36				35.36
4-Nitrophenol (100-02-7)	729			0.03693	729.1
2-Nitropropane (79-46-9)	26.07			20	46.07
Polychlorinated biphenyls (PCBs) (1336-36-3)	57.69			0.2264	57.91
Polychlorinated dibenzodioxins, total	0.04158	0.1118		2.296	2.449
Polychlorinated dibenzofurans, total	0.02923	0.02027		0.9247	0.9742
Pentachlorophenol (87-86-5)	1.069				1.069
Tetrachloroethylene (Perc) (127-18-4)	4,593,000			771,800	5,365,000
Phenanthrene (85-01-8)	22,560	7821	6759	900.3	38,040
Phenol (108-95-2)	7842	8932		615,700	632,400
Phosgene (75-44-5)				0.00048	0.00048
Phosphorus (7723-14-0)				11,840	11,840
Phthalic anhydride (85-44-9)				127,300	127,300
Propionaldehyde (123-38-6)	14,620	360,600	223,600	16,340	615,200
Propoxur (114-26-1)				10	10
Propylene dichloride (78-87-5)	62.08			883.2	945.3
Propylene oxide (75-56-9)	6127			2277	8405
Pyrene (129-00-0)	7107	2347	3417	17.28	12,890
Quinone (106-51-4)				863.4	863.4
Selenium (7782-49-2)	57.09	15.89		40,830	40,900
Styrene (100-42-5)	72,650	173,300	784,400	1,790,000	2,820,000
2,3,7,8-Tetrachlorodibenzo-p-dioxin (1746-01-6)	0.0002501	0.0006785		0.0004625	0.001391
2,3,7,8-Tetrachlorodibenzofuran (51207-31-9)	0.001997	0.001719		0.02766	0.03138
1,1,1-Trichloroethane (71-55-6)	4,495,000			70,220	4,566,000
1,1,2,2-Tetrachloroethane (79-34-5)	9.431			7291	7300
Toluene (108-88-3)	33,450,000	13,110,000	26,030,000	6,748,000	79,340,000
Toluene-2,4-diisocyanate (584-84-9)				244.6	244.6
O-Toluidine (95-53-4)	9.431			10	19.43
Trichloroethylene (79-01-6)	7373			1,267,000	1,274,000
1,2,4-Trichlorobenzene (120-82-1)	467.4			10	477.4
1,1,2-Trichloroethane (79-00-5)	6.287			26.86	33.14
2,4,5-Trichlorophenol (95-95-4)				10	10

Pollutant Name (CAS)	Area Source Emissions	Non-road Emissions	On-road Emissions	Point Source Emissions	Total Emissions
Triethylamine (121-44-8)	10,370			37,730	48,100
Trifluralin (1582-09-8)	607,700			29.86	607,700
2,2,4-Trimethylpentane (540-84-1)	245,200	5,704,000	9,894,000	4456	15,850,000
Vinylidene chloride (75-35-4)	2280			759.5	3039
Vinyl acetate (108-05-4)	413.2			122,200	122,600
Vinyl chloride (75-01-4)	36.15			127,300	127,300
M-Xylene (108-38-3)				12,270	12,270
O-Xylene (95-47-6)	2,971,000	7124		524,200	3,502,000
P-Xylene (106-42-3)				5628	5628
Xylene (mixed isomers) (1330-20-7)	8,211,000	10,660,000	14,720,000	2,983,000	36,570,000