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 1999 for point and area sources. Illinois did not perform the emission calculations in RAPIDS. Rather, Illinois used the data from the Factor Information Retrieval System (FIRE version 6.23) 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 1999. 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 January 2001. 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(99)-1 – Paint and Allied Products", September 2000 (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

Employment data was obtained from the Census Bureau report "1999 County Business Patterns", April 2001 (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 USEPA's 1999 NTI methodology document 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 "1999 County Business Patterns", April 2001 (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 1999 (Federal Highway Administration Highway Statistics, Table MF-33SF, May 2000) . 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 1999 NTI.

Vehicle Refueling (Stage II) – Multiplied monthly gasoline use times the monthly emission factor obtained from MOBILE 5b in combination with the speciation profile for gasoline from USEPA's 1999 NTI

Underground Tank Breathing – Used EIIP calculation methodology in combination with the speciation profile for gasoline from USEPA's 1999 NTI.

Gasoline Trucks in Transit – Used EIIP calculation methodology in combination with the speciation profile for gasoline from USEPA's 1999 NTI.

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 "1999 County Business Patterns", April 2001 (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.

Lamp Breakage and Lamp Recycling

Data from USEPA's 1999 NTI inventory was used.

Landfills

Inventoried as a point source.

Pesticides

Obtained pesticide use and application by county from Illinois Agricultural Statistics 2000 Annual Summary (www.agstats.state.il.us/website/reports.htm). Emission factors from EIIP were then used to calculate emissions.

Publicly Owned Treatment Works (POTWs)

Data from USEPA's 1999 NTI inventory was used.

Residential Fuel Combustion

The amount of fuel burned in Illinois was obtained from the State Energy Data Report 1999 (Department of Energy, Energy Information Administration, DOE/EIA-0214(99), May 2001). 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 1999 (Department of Energy, Energy Information Administration, DOE/EIA-0214(99), May 2001).

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 "1999 County Business Patterns", April 2001 (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

Emissions calculated for 1998 were used for 1999

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 1998 as it was in 1993. Emissions were speciated using profile 2438.

MERCURY

Part of the 1999 inventory was to perform more detailed analysis of mercury emissions. As had been done in previous years, the list of SCCs in FIRE that had mercury emission factors were matched against SCCs used in ISSIS. For categories having emission factors for mercury (e.g., coal combustion, natural gas combustion), SCCs that fell under the same category that did not have mercury emission factors were assumed to have the same emission factor as the SCCs that had a defined emission factor. For Illinois, this meant that an additional 11 SCCs had emissions of mercury calculated. This resulted in an additional 1376 pounds of mercury for coal combustion (327 pounds for residential coal combustion alone) and less than one pound each for natural gas and oil combustion

Table A-1: Mercury Emissions by Category (lb/yr)

Category	**1997**	**1998**	**1999**
Coal Combustion	2,635.89	2,635.86	13,147.16
Incineration	931.70	878.95	776.99
Natural Gas Combustion	382.55	377.22	449.24
Residential Coal Combustion			327.60
Lime manufacturing	1,946.54	1,946.54	194.65
Residential natural gas combustion	129.21	106.60	115.70
Asphaltic concrete	1,058.24	979.96	90.65
Lamp breakage			68.33
Oil combustion	96.99	99.72	45.89
Gray iron foundry	54.64	54.64	45.54
Cement manufacturing	2,488.30	2,495.16	36.48
Crematories	121.13	125.51	26.48
Kerosene combustion	1.92	2.12	9.17
Residential oil combustion	13.23	7.25	8.15
Landfills	3.68	3.68	3.68
Brick manufacturing	0.12	0.12	0.12
Wood combustion	0.14	0.14	0.09
Other	0.01	0.01	0.01
Total	**9,864.31**	**9,713.47**	**15,345.91**

The table above shows historical mercury emissions as calculated for RAPIDS. Differences fell into three categories. These are revised methodology, new categories being inventoried and better data.

Emissions changing based upon revised methodologies include asphaltic concrete, lime manufacturing and cement manufacturing. Older versions of the inventory assumed some control efficiency for the emission factors. The more detailed analysis of mercury for the 1999

inventory deemed the mercury emissions factors given in FIRE should be used as uncontrolled factors, not controlled.

Lamp recycling and lamp breakage emissions were not inventoried in the 1997 and 1998 inventories but were added for the 1999 inventory. Mercury emissions from residential coal combustion appear to not have been calculated in 1997 and 1998. This is correct, but the SCC used for residential coal combustion did not have a mercury emission factor. Emissions were calculated based upon other similar SCCs that did have mercury emission factors.

The largest emission difference was in coal combustion. The emissions calculated for 1999 are based upon data reported in the annual emission report. Prior to 1999, it was the Permit Section's responsibility to update the inventory. A review of criteria emissions for past years indicated that emissions for utilities were rarely updated. Annual emission reports submitted by utilities were used to correct this error.

Beginning in March 1999, the Bureau of Air removed the responsibility of coding the inventory from the Permit Section and placed with the staff responsible for annual emission reports (now known as the Inventory and Data Support Unit in the Air Quality Planning Section). The inventory coding by this unit is reviewed for consistency and accuracy before that company's inventory has been deemed to have been calculated. The work of this unit will greatly improve the accuracy of the inventory in years to come.

INFORMATION

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Table A-2: Illinois - Statewide Emissions (lb/yr)

Pollutant	Point Sources	Area Sources	Total
ACENAPHTHEN	14.60	11,044.73	11,059.33
ACENAPHTHYL	32.09	35,341.38	35,373.46
ACETALDEHYDE	42,035.55	8,662.23	5,6997.78
ACETAMIDE		1.43	1.43
ACETONITRILE	122,068.00	2,084.57	124,152.57
ACETOPHENONE	14,472.91	101.04	14,573.95
ACROLEIN	29,391.24	153,307.01	182,698.25
ACRYLAMIDE	154.00		154.00
ACRYLIC ACID	40,667.00	0.04	40,667.04
ACRYLONITRIL	308,592.43	2,313.78	310,906.21
ALLYL CHLORI		111.22	111.22
ANILINE	1,736.00		1,736.00
ANTHRACENE	8.71	9,940.61	9,949.31
ANTIMONY	3,079.44		3,079.44
ARSENIC	24,296.98	112.10	24,409.07
ASBESTOS	499.00		499.00
ATRAZINE	287.00	1,347,840.00	1,348,127.00
BENZ(A)ANTHR	10,411.57	1,505.55	11,917.12
BENZ(GHI)PE	2.13	22,088.39	22,090.53
BENZENE	639,694.26	572,986.47	1,212,680.72
BENZO(A)PYRE	1,849.72	6,626.95	8,476.66
BENZO(B)FLUO	2.15	4,418.37	4,420.52
BENZO(K)FLUO	1.23	1,105.19	1,106.42
BENZYL CHLOR	27,976.44	50.01	28,026.46
BERYLLIUM	4,382.53	22.66	4,405.19
BIPHENYL	1,813.77	24,753.12	26,566.89
BROMOFORM	5,085.78		5,085.78
BROMOMETH	108,623.59	2,629,731.19	2,738,354.78
BUTADIENE,13	117,067.37	152.08	117,219.45
CADMIUM	29,494.41	528.91	30,023.32
CALCIUM CYAN	499.00		499.00
CARBON DISUL	3,509,529.64	26,774.00	3,536,303.64
CARBON TETRA	4,933.52	8,819.81	13,753.33
CARBONYL SUL	1,848.37		1,848.37
CATECHOL	237.00		237.00
CHLORINE	237,609.49		237,609.49
CHLOROBENZ	123,345.10	851,091.80	974,436.90
CHLOROETHANE	183,128.23	102,252.38	285,380.61
CHLOROFORM	5,352.88	52,172.44	57,525.33
CHLOROPRENE		147.50	147.50
CHROMIUM	36,799.02	641.43	37,440.44
CHROMIUM VI	3,610.33		3,610.33
CHRYSENE	8,629.69	11,044.79	19,674.48
CLACETOPHE,2	15.82		15.82
COBALT	7,417.33	37.38	7,454.71
COKE OVEN GS	447,895.74		447,895.74
COPPER	83,622.03	1,020.86	84,642.89
CRESOL MX IS	16,790.00	10.67	16,800.67
CRESOL,M	86.00		86.00

Table A-2: Illinois - Statewide Emissions (lb/yr)

Pollutant	Point Sources	Area Sources	Total
CRESOL,O	2,330.00		2,330.00
CRESOL,P	11,933.00		11,933.00
CUMENE	155,766.63	4,413.76	160,180.39
CYANIDE	88,802.41		88,802.41
D,2,4		3,295,100.00	3,295,100.00
DIBENZAHAN	2.15	4,418.11	4,420.26
DIBENZOFURAN	423.00		423.00
DIBROMOET,12	150.94		150.94
DIBUTYL PHTH	3872.67		3872.67
DICHLORETH12	14,123.19	0.37	14,123.56
DICLBENZ,14	80,939.27	924,072.89	1,005,012.16
DICLETH,11-	14,672.05		14,672.05
DICLPROPE,13	171.17	1,895,301.76	1,895,472.93
DIETH SULFAT	8.00		8.00
DIETHANOLAMI	8,176.00		8,176.00
DIEYLHEX PHT	1,240.97		1,240.97
DIMETH PHTHA	2,841.00		2,841.00
DIMETH SULFA	4,658.51	8.01	4,666.51
DIMETHFORMAM	1,998.00	373.14	2,371.14
DIMETHYLANIL		1,974.66	1,974.66
DINITROPH,24	0.03		0.03
DINITRTOL,24	0.63	294.25	294.88
DIOXANE	10,903.00	224.59	11,127.59
EPICLHYDRIN	75,851.39	29.35	75,880.74
ETH ACRYLATE	4,885.00	11.56	4,896.56
ETHYLBENZENE	804,377.87	620,312.78	1,424,690.65
ETHYLENE GLY	159,975.35	2,877,601.82	3,037,577.17
ETHYLENE OXI	136,850.89	1,377.18	138,228.08
FLUORANTHENE	15,232.79	8,836.61	24,069.40
FLUORENE	76.89	15,462.75	15,539.63
FORMALDEHYDE	1,512,986.75	83,468.70	1,596,455.46
GLYCOL ETHRS	3,246,006.36	7,541,860.75	10,787,867.11
HCL	35,469,672.86	490,001.03	35,959,673.88
HEXACL-1,3-C		3.56	3.56
HEXANE	6,666,821.12	2,336,013.54	9,002,834.67
HEXCL-13-BUT		4.45	4.45
HEXCLBENZENE		0.70	0.70
HF	2,399,117.80	152.57	2,399,270.37
HYDRAZINE	4.00		4.00
HYDROGEN SUL	76,181.66		76,181.66
HYDROQUINONE	644.00		644.00
INDN(123CDPY	2.21	22,088.66	22,090.88
ISOPHORONE	1,311.12	11,217.82	12,528.95
LEAD	113,614.98	274.47	113,889.45
MALEIC ANHYD	221,763.00		221,763.00
MANGANESE	235,368.72	358.36	235,727.08
MERCURY	14,816.96	528.96	15,345.91
METH ETH KET	4,693,338.50	4,287,499.12	8,980,837.63
METH HYDRAZI	6,522.77		6,522.77

Table A-2: Illinois - Statewide Emissions (lb/yr)

Pollutant	Point Sources	Area Sources	Total
METH IODIDE	1.44		1.44
METH ISOBUT	1,765,692.49	1,153,923.67	2,919,616.15
METH METHACR	45,910.38	7,772.77	53,683.16
METH TERT BU	25,392.92	637.73	26,030.65
METHANOL	2,354,423.76	7,648,808.79	10,003,232.55
METHENE DIAN	499.00		499.00
METHYL CHLOR	183,600.95	85,210.31	268,811.26
METHYLENE CL	1,327,102.17	2,280,999.68	3,608,101.85
NAPHTHALENE	185,598.02	743,959.61	929,557.62
NICKEL	51,122.99	973.91	52,096.90
NITROBENZ		41.81	41.81
NITROPHENL,4	0.02		0.02
NITROPROPA,2		24.76	24.76
PCBS	1.17		1.17
PCDD	4.05		4.05
PCDF	1.65		1.65
PERC	1,325,433.22	3,986,801.60	5,312,234.82
PHENANTHRENE	161.24	130,325.94	130,487.18
PHENOL	590,673.75	1,104.39	591,778.15
PHOSGENE	negl		negl
PHOSPHORUS	1,117.04		1,117.04
PHTHALIC ANH	144,970.00		144,970.00
PROPIONALDEH	14,580.30	22.24	14,602.54
PRPLENE DICH	1,845.96	62.22	1,908.18
PRPLENE OXID	1,647.85	18,290.51	19,938.36
PYRENE	49.49	8,837.37	8,886.86
QUINOLINE	192.00		192.00
SELENIUM	62,257.19	97.29	62,354.48
STYRENE	2,247,734.66	53,642.98	2,301,377.64
TCDD,2378	0.0009	0.0003	0.0012
TCDF,2378	0.0520	0.0079	0.0599
TCE,111	232,309.09	9,356,476.22	9,588,785.32
TETCLET,1122	11,852.42	11.56	11,863.98
TOLUENE	10,359,724.74	47,340,116.01	57,699,840.76
TOLUENE24DII	1,055.00		1,055.00
TOLUENE24DII		11.56	11.56
TRICHLORETHY	1,450,099.43	3,677,623.46	5,127,722.89
TRICLBNZ,124	11.18	526.41	537.59
TRICLETH,112	122.98	7.12	130.10
TRIETHAMINE	110,005.00	9,938.49	119,943.49
TRIFLURALIN		610,560.00	610,560.00
TRIME-PENTAN	1,108.27	291,589.57	292,697.84
VINLIDENE CL	19,293.37	2,557.39	21,850.76
VINYL ACETAT	127,909.61	460.59	128,370.20
VINYL CHLOR	192,620.08	42.70	192,662.77
XYLENE,M	20,795.46		20,795.46
XYLENE,O	675,870.47	4,230,797.73	4,906,668.20
XYLENE,P	86.21		86.21
XYLENES ISO	4,965,572.64	13,631,934.09	18,597,506.72