Appendix F: Ohio Toxic Emissions Inventory

BACKGROUND

The State of Ohio compiled a comprehensive air toxic emission inventory for the Great Lakes Air Toxic Emission Inventory Project for calendar year 2002. Ohio followed the Air Toxic Emissions Inventory Protocol for the Great Lakes Commission in developing its contribution to the regional inventory.

CALCULATION METHODS

Point Sources

The point source inventory was compiled from two sources. The first source consists of major Title V facilities. Those 240 major facilities are subject to a state reporting requirement for criteria pollutant every three years. The information was uploaded from the state criteria inventory into RAPIDS. The RAPIDs emission estimator was employed to estimate a toxic inventory utilizing the facility process provided data and the RAPIDS emission factors and toxic profiles. The second source is the Toxic Release Inventory (TRI). The TRI inventory is considered of high confidence and it has been quality assured. There are roughly 1600 TRI facilities in the state and around 1200 facilities have air releases. In order to avoid duplication of facilities with the Title V inventory, the inventories were compared and removed the duplicated facilities. The TRI records and values were converted to valid RAPIDS codes and the information was uploaded in RAPIDS.

Area sources

Agricultural Pesticides

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.

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 population and the EIIP recommended factor of 1.3 lbs VOC/person were used to estimate VOC emissions. Toxic emissions were speciated using profile 1194 and NEI emission factors.

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 NAICs codes 81231 and 81232. 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 2001 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.n the underground tank. In the emission calculation of Stage II operations, 16 counties are subjected to a stage II vapor control system. The Stage II emission estimate is a considerably higher from reality because the emission factor is not providing us with a credit for cars that are built with ORVR after 2000. Mobile 6.2 or NMIM will provide a better emission estimate. 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 1.3 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.

Hospital Sterilizers
Hospital beds per county data were collected and they were multiplied to ethylene oxide emission factors to estimate emissions by county.

Human Cremation
The total number of cremated bodies in counties with crematories were multiplied with toxic emission factors to produce a county estimate of emission.

Industrial Surface Coatings
Employment data for available NAICS codes were obtained from the "2001 County Business Patterns " publication and county population data from the State's population projection center. The per employee EIIP emission factors or the per capita emission factors were used to estimate VOC emissions and the regional protocol speciation profiles were applied to estimate toxic emissions.

Lamp Breakage
The NEI national lamp breakage was apportioned to the state and county level using the population surrogate.

Lamp Recycling
Surveyed the three major lamp recycling facilities and obtained number of recycled lamps. The NEI factor for mercury was applied to the number of recycled lamps to calculate the county mercury release.

Landfills
Activity data were provided by the Ohio EPA's Division of Solid Waste. Assumptions 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.

Publicly Owned Treatment Works
Activity data were provided by the Division of Surface Water. RAPIDS protocol was used to estimate waste flow and toxic pollutants.

Residential/Industrial/Commercial Fuel Combustion
These three source categories of air emissions cover the combustion of coal, natural gas, distillate fuel oil, liquified petroleum gas, natural gas and wood. The county fuel usage was multiplied with the toxic emission factors to calculate emissions.

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.

Structure Fires
Residential and commercial structure fires at the county level were multiplies with FIRE toxic emission factors to produce a county estimate

Traffic Marking
County highway miles of road was assumed one traffic marking application per year and the calculated paint usage was multiplied with toxic emission factors to produce a county estimate of toxic pollutants. The Traffic Marking

Mobile Source Inventory
USEPA developed a comprehensive mobile on-road and off-road toxics inventory for calendar year 2002 using the Mobile 6.2 model and EPA's new NMIM model. Prior to running those models, Ohio EPA provided VMT, speed and vehicle distribution profiles to EPA. The results of those runs are stored on EPA's ftp site in NEI NIF3.0 format. The files were downloaded and uploaded in RAPIDS.

RESULTS
Ohio's Great Lakes Toxic Inventory for inventory year 2002 is a comprehensive inventory of the region's 188 air toxic pollutants. The methodologies for each one of the categories were dictated by the availability of activity data. We continue to strive for better methodologies, better emission factors and more accurate activity data so as to ensure the accuracy of the

information. Each future inventory should be an improvement over the previous inventories and also account for more sources and pollutants.

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Ohio - Statewide Emissions (lb/yr)

Pollutant Name (CAS)	Area Source Emissions	Point Source Emissions	On-road Emissions	Non-road Emissions	Total Emissions
Acenaphthene (83-32-9)	3621	32.82	2134	4078	9866
Acenaphthylene (208-96-8)	73,910	18.49	11,350	8502	93,780
Acetaldehyde (75-07-0)	1990	343,600	2,366,000	1,396,000	4,108,000
Acetamide (60-35-5)	1.38	5			6.38
Acetonitrile (75-05-8)	2198	13,170			15,360
Acetophenone (98-86-2)	97.81	5714			5812
Acrolein (107-02-8)	114,600	18,070	236,900	118,200	487,800
Acrylamide (79-06-1)		1315			1315
Acrylic acid (79-10-7)	0.04	4247			4247
Acrylonitrile (107-13-1)	13,730	64,280			78,020
Allyl chloride (107-05-1)	123.5	250			373.5
Aniline (62-53-3)		33,560			33,560
Anthracene (120-12-7)	4988	146.1	2548	4258	11,940
Antimony (7440-36-0)	1386	2280			3666
Arsenic (7440-38-2)	509.1	47,550	12.56		48,070
Asbestos (1332-21-4)		542			542
Atrazine (1912-24-9)	4,747,000	584			4,747,000
Benz(a)anthracene (56-55-3)	7030	437.2	573.1	3663	11,700
Benzo(g,h,i)perylene (191-24-2)	1664	326.8	755.6	4046	6792
Benzene (71-43-2)	1,860,000	255,400	12,990,000	4,325,000	19,430,000
Benzo(a)pyrene (50-32-8)	1483	15,070	373.9	3606	20,530
Benzo(b)fluoranthene (205-99-2)	2148	0.61	414.3	3495	6057
Benzo(k)fluoranthene (207-08-9)	701	0.25	414.3	3588	4703
Benzyl chloride (100-44-7)	51.99	42,680			42,730
Beryllium (7440-41-7)	88.41	4549		0.71	4638
Bis(2-chloroethyl)ether (111-44-4)		5			5
Bromoform (75-25-2)		2378			2378
1,3-Butadiene (106-99-0)	159.7	37,690	1,423,000	638,700	2,100,000
Cadmium (7440-43-9)	924.6	6291		11.32	7227
Captan (133-06-2)		935			935
Carbaryl (63-25-2)		479			479
Carbon disulfide (75-15-0)	29,010	312,500			341,500
Carbon tetrachloride (56-23-5)	8649	4531			13,180
Carbonyl sulfide (463-58-1)	987.9	5,906,000			5,907,000
Chlordane (57-74-9)		1			1

Pollutant Name (CAS)	Area Source Emissions	Point Source Emissions	On-road Emissions	Non-road Emissions	Total Emissions
Chlorine (7782-50-5)		37,670	2224		39,900
Chlorobenzene (108-90-7)	821,800	117,800			939,600
Chloroethane (75-00-3)	101,300	4921			106,200
Chloroform (67-66-3)	52,430	41,510			93,940
2-Chloro-1,3-butadiene (126-99-8)	151.3				151.3
Chromium (7440-47-3)	1232	1,123,000	2191		1,127,000
Chromium VI (18540-29-9)	65.46	4820	442.7	3176	8504
Chrysene (218-01-9)	4330	80.05	331.2	3662	8404
2-Chloroacetophenone (532-27-4)		426.3			426.3
Chloromethyl methyl ether (107-30-2)		250			250
Cobalt (7440-48-4)	1652	7106			8757
Coke oven emissions		164,200			164,200
Copper (7440-50-8)	1072	55,910	740.1		57,720
Cresol (mixed isomers) (1319-77-3)	10.21	32,790			32,800
Cresol, M- (108-39-4)		1264			1264
Cresol, O- (95-48-7)		116			116
Cumene (98-82-8)	194	113,200			113,400
Cyanide (57-12-5)		152,500			152,500
2,4-D (2,4-Dichlorophenoxyacetic acid) (94-75-7)	101,500				101,500
Dibenz(a,h)anthracene (53-70-3)	70.96	0.27	0.19	920.1	991.5
Dibenzofuran (132-64-9)	84.52	130			214.5
1,2-Dibromoethane (106-93-4)		6957			6957
Di-N-butyl phthalate (84-74-2)	1,485,000	801.2			1,485,000
1,2-Dichloroethane (107-06-2)	11,460	360.6			11,820
1,4-Dichlorobenzene (106-46-7)	891,100	1697			892,800
1,1-Dichloroethane (75-34-3)		250			250
1,3-Dichloropropene (542-75-6)	1,827,000	735			1,828,000
Diethanolamine (111-42-2)		5590			5590
Diethylhexyl phthalate (117-81-7)		13,490			13,490
1,1-Dimethylhydrazine (57-14-7)		250			250
Dimethyl phthalate (131-11-3)		1215			1215
Dimethyl sulfate (77-78-1)	8.36	2962			2970
N,N-Dimethylformamide (68-12-2)	112,200	11,680			123,800
Dimethylanaline (121-69-7)	2052				2052
2,4-Dinitrotoluene (121-14-2)	306.4	20.74			327.1
1,4-Dioxane (123-91-1)	228.4	250			478.4

Pollutant Name (CAS)	Area Source Emissions	Point Source Emissions	On-road Emissions	Non-road Emissions	Total Emissions
Epichlorohydrin (106-89-8)	28.78	400			428.8
Ethyl acrylate (140-88-5)	11.14	7174			7185
Ethyl carbamate (51-79-6)		71			71
Ethyl benzene (100-41-4)	1,123,000	501,900	4,719,000	2,698,000	9,043,000
Ethylene glycol (107-21-1)	1,378,000	52,450			1,430,000
Ethylene oxide (75-21-8)	188,900	250			189,200
Fluoranthene (206-44-0)	7055	57.14	2648	4801	14,560
Fluorene (86-73-7)	1120	60.31	4435	6007	11,620
Formaldehyde (50-00-0)	97,380	6,368,000	4,746,000	3,085,000	14,300,000
Glycol ethers	671,800				671,800
Hydrochloric acid (7647-01-0)	418,300	144,900,000			145,300,000
Heptachlor (76-44-8)		1			1
Hexachlorocyclopentadiene (77-47-4)	3.71	1			4.71
Hexane (110-54-3)	5,563,000	1,754,000	4,020,000	2,021,000	13,360,000
Hexachloro-1,3-butadiene (87-68-3)	4.64				4.64
Hexachlorobenzene (118-74-1)		0.04			0.04
Hydrogen fluoride (7664-39-3)		17,150,000			17,150,000
Hydrazine (302-01-2)		94			94
Hydrogen cyanide (74-90-8)	902,800	10,350			913,100
Hydroquinone (123-31-9)		659			659
Indeno(1,2,3-c,d)pyrene (193-39-5)	306.9	3.74	214.6	3510	4035
Isophorone (78-59-1)	10,830	35,370			46,200
Lead (7439-92-1)	777	316,400	152.5	162.5	317,500
Maleic anhydride (108-31-6)		114			114
Manganese (7439-96-5)	1084	1,076,000	2574	3645	1,083,000
Mercury (7439-97-6)	315.2	23,810			24,130
Methyl ethyl ketone (78-93-3)	16,980,000	1,526,000			18,510,000
Methyl hydrazine (60-34-4)		10,370			10,370
Methyl iodide (74-88-4)		279.5			279.5
Methyl isobutyl ketone (108-10-1)	7,908,000	701,500			8,609,000
Methyl methacrylate (80-62-6)	6533	66,580			73,110
Methyl tert-butyl ether (1634-04-4)	405.7	9603	1,495,000		1,505,000
Methanol (67-56-1)	7,359,000	3,582,000			10,940,000
Methoxychlor (72-43-5)		1			1
Methyl chloride (74-87-3)	82,160				82,160
Methylene chloride (dichloromethane) (75-09-2)	2,868,000	348,900			3,217,000

Pollutant Name (CAS)	Area Source Emissions	Point Source Emissions	On-road Emissions	Non-road Emissions	Total Emissions
Naphthalene (91-20-3)	377,000	50,130	300,300	127,800	855,300
N,N-Dimethyl carbamoyl chloride (79-44-7)		5			5
Nickel (7440-02-0)	20,050	83,480	1696	5857	111,100
Nitrobenzene (98-95-3)	41.78	8			49.78
2-Nitropropane (79-46-9)	24.13	5			29.13
Polychlorinated biphenyls (PCBs) (1336-36-3)		3.62			3.62
Polychlorinated dibenzodioxins, total			0.09		0.09
Polychlorinated dibenzofurans, total					
Pentachloronitrobenzene (82-68-8)		1097			1097
Tetrachloroethylene (Perc) (127-18-4)	3,312,000	217,300			3,530,000
Phenanthrene (85-01-8)	28,960	467.7	7295	9927	46,650
Phenol (108-95-2)	0.41	678,800		1250	680,100
P-Phenylenediamine (106-50-3)		42			42
Phosgene (75-44-5)	1.12	13			14.12
Phosphorus (7723-14-0)		23,760			23,760
Phthalic anhydride (85-44-9)		3652			3652
Propionaldehyde (123-38-6)	32.1	75,310	263,400	303,600	642,300
Propylene dichloride (78-87-5)	755.9				755.9
Propylene oxide (75-56-9)	15,190	629.7			15,820
Pyrene (129-00-0)	8423	21.69	3678	5672	17,800
Quinoline (91-22-5)		75			75
Selenium (7782-49-2)	33.61	79,420	36.29	19.91	79,510
Styrene (100-42-5)	45,000	1,555,000	946,200	181,700	2,728,000
2,3,7,8-Tetrachlorodibenzofuran (51207-31-9)		0.07		5.65	5.72
1,1,1-Trichloroethane (71-55-6)	12,080,000	3189			12,080,000
1,1,2,2-Tetrachloroethane (79-34-5)	6265	1091			7355
Titanium tetrachloride (7550-45-0)		561			561
Toluene (108-88-3)	31,380,000	1,871,000	31,680,000	13,090,000	78,020,000
*Toluene-2,4-diisocyanate (584-84-9)		206			206
O-Toluidine (95-53-4)	11.14				11.14
Trichloroethylene (79-01-6)	7,560,000	421,900			7,982,000
1,2,4-Trichlorobenzene (120-82-1)	549.6	8692			9242
11,1,2-Trichloroethane (79-00-5)	7.42	254			261.4
2,4,6-Trichlorophenol (88-06-2)		4			4
Triethylamine (121-44-8)	9582	173,200			182,800
Trifluralin (1582-09-8)		979.8			979.8

Pollutant Name (CAS)	Area Source Emissions	Point Source Emissions	On-road Emissions	Non-road Emissions	Total Emissions
2,2,4-Trimethylpentane (540-84-1)			11,890,000	5,615,000	17,510,000
Vinylidene chloride (75-35-4)	3344	255			3599
Vinyl acetate (108-05-4)	488	53,540			54,030
Vinyl chloride (75-01-4)	15,190	1259			16,450
M-Xylene (108-38-3)	714,000	5.21			714,000
O-Xylene (95-47-6)	234,000	16.47			234,000
P-Xylene (106-42-3)	141,100	0.02			141,100
Xylene (mixed isomers) (1330-20-7)	28,860,000	2,917,000	17,890,000	12,690,000	62,350,000