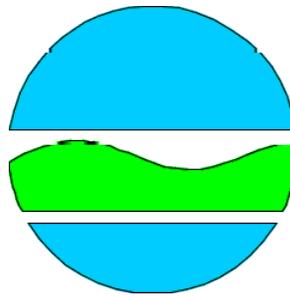


Appendix B

Area Source Methodology

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**THE NEW YORK STATE
AREA SOURCE METHODOLOGIES
MANUAL**



NYSDEC

Division of Air Resources

Bureau of Air Quality Planning

2005

NEW YORK STATE AREA SOURCE METHODOLOGIES

Area Sources are sources that are considered too small to be included in the Annual Point Source Inventory Survey. They are not required to obtain a Title V permit pursuant to 6 NYCRR 201-6. Some of the Area Source categories must have point source emissions subtracted out to avoid double counting depending on the SIC code. For example: Graphic Arts is an area source category, but there are Graphic Arts facilities that are large enough (emissions wise) that required them to obtain a Title V permit and other different types of Title V facilities that may have a Graphic Arts process. An activity like structure fires will not have point sources and therefore will not be subjected to double counting.

The New York State (NYS) Area Source Inventory is part of the Periodic Inventory that is mandated by the 1990 Clean Air Act (§7502(c)(3) and §7511a(a)(3)(A)). The Periodic Inventory is mandated to be completed every third year beginning with 1990 as the base year. The Area Source Inventory currently consists of 27 categories with emissions calculated per county for each of the contaminants associated with the respective category. The contaminants include the criteria contaminants: Carbon Monoxide (CO), Sulfur Dioxide (SO₂), Particulate Matter (PM , PM-10 and PM-2.5), Oxides of Nitrogen (NO_x), Volatile Organic Compounds (VOCs) and Hazardous Air Pollutants (HAPs). The HAPs that are part of the NYS Area Source Inventory were the HAPs that were targeted by the Great Lakes Commission (GLC), which NYS is a member. A listing of the targeted HAPs can be accessed at www.glc.org/air.

Emission factors utilized to calculate emissions from the various categories were derived or taken directly from Federal (United States Environmental Protection Agency, EPA) and various State references (For Example: Ohio's EPA was referenced for Agricultural Pesticides). Federal references included EPA's AP-42, Fire Information Retrieval (FIRE 6.25), Emission Inventory Improvement Program (EIIP), Landfill Air Emissions Estimation Model v2.01 (LAEEM) and the publication "Documentation For The 1996 Base Year National Toxics Inventory For Area Sources". The Federal references can be accessed at www.epa.gov/ttn/chief/. Each separate category will explain if the respective emission factor(s) depended on employment, per capita (population), fuel use, etc., and the respective reference(s) will be noted. If a category depended on a per capita emission factor then the New York State population per county for the respective Periodic Inventory Year can be downloaded from the New York Data Center located at the Empire State Development Department. The population per county data can be accessed at www.empire.state.ny.us/nysdc/popandhous/ESTIMATE.asp.

Please note that all the completed Area Source Categories can be found at the following address on the L drive: L:/dar/air3/apps1/baqp/baqp_ssps/areasources/.

TABLE OF CONTENTS

Page Number	Area Source Category
1	Agricultural Pesticides
2	Ammonia
3	Architectural Coatings
4	Asphalt Paving
5	Autobody Refinishing
6	Combustion (Commercial/Institutional, Electricity Generation, Industrial And Residential)
7	Commercial Bakeries
8	Consumer and Commercial Solvents
12	Chromium Electroplating
13	Dry Cleaning
14	Ethylene Oxide Sterilizers
15	Forest Fires
17	Forest Fires (Prescribed)
18	Portable Fuel Containers (Gas Can)
19	Gasoline Marketing (Stages I and II)
20	Graphic Arts
21	Human Cremation
22	Industrial Surface Coating
24	Marine Vessel Loading, Ballasting, and Transit
25	Mercury
26	Municipal Solid Waste (MSW) Landfills
28	Open Burning
29	PM
30	Public Owned Treatment Works (POTWs)
32	Solvent Cleaning
33	Structure Fires
34	Traffic Markings

1.) Agricultural Pesticides

Estimating emissions from the use of Atrazine and Trifluralin were based on actual pesticides use (gallons per county or pounds per county) that was calculated from data compiled by the New York State Department of Environmental Conservation's (NYSDEC) Division of Solid And Hazardous Materials, Bureau of Pesticide Management in conjunction with The Pesticide Management Education Program at Cornell University and EPA's Office of Pesticide Programs (Pesticide Product Label System (PPLS) - Search). The EPA's website for the Pesticide Programs is as follows: <http://oaspub.epa.gov/pestlabl/ppls.home>.

The data compiled by the NYSDEC represented only the counties that Atrazine and Trifluralin were sold in and the amount (gallons and/or pounds) that was sold. It was assumed that the amount sold in a county was used entirely (100%) in that respective county and was applied (100%) in that respective year that was a Periodic Inventory Year. Each pesticide has a Product Label associated with it and has to be registered at the EPA's Office of Pesticide Programs. The Product Label would list all the ingredients and the percentage of each ingredient in the pesticide. For example: A Product Label for a **Pesticide A** has Atrazine or Trifluralin listed as an ingredient with a percentage of 25%. Every county this pesticide was sold in would have this Product Label listed along with the amount sold either in gallons and/or pounds and the percentage would be used to calculate the amount of Atrazine or Trifluralin in the respective pesticide. For Example: 100 lbs. of Pesticide X was sold in County Y and Atrazine was listed on the Product Label as one of the ingredients with a percentage of 25%. Total amount of Atrazine in the pesticide: $100.0 \text{ lbs.} * 0.25 \text{ (25\% Atrazine)} = 25.0 \text{ lbs. of Atrazine}$. The conversion from gallons to pounds for either Atrazine or Trifluralin is as follows: $(\text{Weight of water (8.34 lbs./gallon)}) * (\text{Density of the contaminant (Atrazine (1.187) or Trifluralin (1.294)}) * (\text{amount of Atrazine or Trifluralin in gallons})$.

The emission factor for Atrazine is the volatility rate of 18 percent per unit of pesticide applied (in this case pounds) while the emission factor for Trifluralin is the volatility rate of 82 percent per unit of pesticide applied (again in pounds). The emissions factors were given in an email from Tom Velatis of Ohio's EPA dated June 21, 2000. ASC Code: 2461800000

A point source adjustment is not required for this area source category.

2.) Ammonia

The 2002 New York State Ammonia Area Source Inventory was generated by utilizing the Carnegie Mellon University's (CMU) Ammonia Model latest available version. Using the model's input and output files, ammonia emissions for the various processes in New York State were estimated to the county level. The input and output files are detailed in the model's user manual. The CMU Ammonia Model and user manual can be accessed and downloaded at www.marama.org/ under the Regional Technical Center. ASC: There are 33 different ASC codes associated with the Ammonia category and they all can be referenced to the CMU's Ammonia Model.

A point source adjustment is not required for this area source category.

3.) Architectural Coatings

Two types of paint are used to categorize architectural surface coating. They are water-based and solvent-based paints. Solvent-based paint typically contains substantially higher volatile solvent contents than water-based paint.

The emission factors (per capita) used in calculating VOC emissions were derived from the EIIP's Volume III, Chapter 3, Section 5. For each type of paint, VOC emission factors (lb/gal) and Usage factors, (gal/person) were given. Multiplying the factors we obtain 1.8189 lb of VOC/person for solvent-based paint and 1.4282 lb of VOC/person for water-based one. Adding the last two we obtain 3.2471 lb of VOC/person for architectural coating.

Paint Type	VOC Emission Factor (Lb/gal)	Usage Factor (Gal/person)	VOC / Person (Lb/person)
Solvent-based	3.87	0.47	1.8189
Water-based	0.74	1.93	1.4282

The VOC speciation profiles were obtained from the California Air Resources Board (CARB). CARB can be accessed at: <http://www.arb.ca.gov>. The targeted compounds for solvent-based paint are Acetone, Ethylbenzene, Xylenes, and Toluene. For water-based paint are Benzene, Methylene Chloride, and Methyl Chloride

Air Toxin (TOX)	Speciation (TOX/VOC), % by wt
Solvent-based paints: Acetone	3.2
Ethylbenzene	4.3
Isomers of Xylene	2.6
Toluene	5.2
Water-based paints: Benzene	0.3
Methylene Chloride	5.5
Methyl Chloride	0.5

Architectural surface coating is categorized under NAICS code 325510: Paint and coating manufacturing. It's categorized by the following ASC codes under FIRE

A24	Solvent Utilization
A2401	Surface Coating
A2401001	Architectural Surface Coating
A2401001000	Total: All Solvent Types

This activity is higher in the Summer, (EPA's default adjustment: 1.3). A point source adjustment is not required for this area source category.

4.) Asphalt Paving

Estimating VOCs (Volatile Organic Compounds) emissions from Asphalt Paving are based on actual data obtained from the New York State (NYS) Department of Transportation's Environmental Analysis Bureau, Air Quality Section for each county in the state. The data included the total amount of Asphalt Concrete, Crack Fill, and Emulsions that was applied in each county during 2002. The emission factor (0.219 lbs / gallons of asphalt) was derived from the emission factor for Emulsified Asphalt listed in EIIP's Asphalt Paving (Page 17.5-8, Table 17.5-2, Volume III: Chapter 17). Since Cutback Asphalt is prohibited in New York State (See 6NYCRR Part 211.4(a)) there are no Hazardous Air Pollutants (HAPs) associated with this process. ASC Code: 2461022000

A point source adjustment is not required for this area source category.

5.) Autobody Refinishing

Estimating VOCs (Volatile Organic Compounds) emissions from Autobody Refinishing in 1999 was based on per capita (population) and an emission factor of 2.3 lbs VOC /per capita/yr (EPA's document: Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone, Volume 1: General Guidance for Stationary Sources;1991). VOC emissions for 2002 incorporate the National Rule promulgated in 1998. EPA estimated a 37% reduction for the National Rule. Because this rule affects manufacturers, a 100 percent Rule Effectiveness (RE) is used, which assumes that instructions on how to apply the coatings are followed. Rule penetration (RP) is also 100 percent, because the rule affects all sources within the category. Ozone season daily emissions are estimated by dividing annual emissions estimates by 365, and assuming 5 days per week of operation. The 5 days per week assumption is applied by multiplying average daily emissions by 7/5. ACS: 2401005000

The equation for computing the VOC emission factor is described:

$$\begin{aligned}\text{Post-control emission factor} &= \text{Pre-control emission factor} * [1.0 - (\text{CE} * \text{RP} * \text{RE})] \\ &= 2.3 \text{ lbs/capita} * [1.0 - (0.37 * 1.00 * 1.00)] \\ &= 1.45 \text{ lbs/capita}\end{aligned}$$

VOC's speciation for this area source is provided by EIIP as follows:

Benzene (Cas No: 71432)	0.0151 lb/lb VOC
Di-n-butylbutyl Phthalate (Cas No: 84742)	0.0001 lb/lb VOC
Napthalene (Cas No: 91203)	0.0146 lb/lb VOC
Toluene (Cas No: 108883)	0.0865 lb/lb VOC
Xylene (m, o, & p mixture/Cas No: 1330207)	0.2067 lb/lb VOC

A point source adjustment is not required for this area source category.

6.) Combustion (Commercial/Institutional, Electrical Generation, Industrial And Residential)

The NYSDEC estimated emissions from fuel combustion for four area source sectors: commercial/institutional, electrical generation, industrial, and residential. The emission estimates were developed on a county-basis for eight fuels per sector (Area Source Codes (ASCs)) for a total of 32 ASCs. The ASCs begin with 2101 for electrical generation, 2102 for industrial, 2103 for commercial/institutional, and 2104 for residential.

State-wide fuel use estimates for calendar year 2002 were obtained from the New York State Energy Research and Development Authority (NYSERDA) for each sector except residential wood use where the statewide estimate developed by MANE-VU was used. Fuel usage at major facilities in the State was determined from a NYSDEC database. The difference between the fuel usage reported by NYSERDA and by major facilities for each sector/fuel combination was allocated on a county-basis. The allocation was based upon census records or employment data and heating degree data (residential and commercial/institutional sectors only).

The emission estimates for each county were calculated by multiplying the fuel allocation by the appropriate emission factor for each ASC. Emission factors were obtained from EPA (AP-42 and FIRE 6.25 databases), the Great Lakes Commission and the MANE-VU Residential Wood Combustion Emission Inventory dated June 22, 2004.

There is no point source adjustment for the sector residential but point source adjustments have to be made for the sectors commercial/institutional, electrical generation and industrial.

7.) Commercial Bakeries

An emission factor of 0.35 lb VOC/capita/year (Emission Inventory Improvement Program (EIIP), Volume III, Area Source Method Abstracts, Baked Goods at Commercial/Retail Bakeries, July 1999), was derived, based on a per capita consumption of 70 pounds per person and emissions for the sponge-dough method of 5 pounds VOC per 1,000 pounds baked. Activity is assumed to occur five days per week, 52 weeks per year. ASC: 2302050000

A point source adjustment is required for this area source category.

8.) Consumer and Commercial Solvents

Overview:

All emission factors and information contained within are from the following source: EPA's Emission Inventory Improvement Program (EIIP), Volume III, 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 1 (See Page 9 of this document). 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 that are recommended by the EIIP and are as follows: 1.) Use of national average per capita emission factors (population based method) adjusted for state or local emission limits; 2.) Surveying consumer and commercial product use or sales in the inventory area. 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 population based method was the method used to calculate the emissions per county for this category in 2002. The procedure for the population based method is outlined below:

- 1.) Identify applicable state and local regulations.
- 2.) Create a database (See Table 1: (EIIP, Volume III, Chapter 5, Section 4, Page 5.4-3, Table 5.4-1)) or spreadsheet with per capita emission factors for the source categories of interest.
- 3.) Obtain population data for the base year of interest and allocate it to county level.
- 4.) Multiply per capita emission factors by the population per county to obtain overall emissions estimates.
- 5.) Adjust estimated emissions for applicable regulations as needed.

Estimating VOCs:

Example: To estimate VOC emissions from personal care products:

$$\text{VOCs Emissions} = (\text{Population}) * (\text{Per Capita Emission Factor})$$

Given a population of 1 million persons for a particular area, the VOC emissions from personal care products would be: $(1,000,000 \text{ persons}) * (2.32 \text{ lbs VOC's/person/year}) = (2,320,000 \text{ lb VOC/year}) / (2000 \text{ lb/ton}) = 1,160 \text{ tons VOC/year}$

Table 1:

Consumer and Commercial Solvent Product Categories and Emission Factors

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

a.) FIFRA: Federal Insecticide, Fungicide, and Rodenticide Act

Estimating HAPs:

The population based method is again the preferred method with adjustments made for state and local regulations on this industry but only for those HAPs that are targeted by The Great Lakes Commission (GLC). The per capita emission factors for the targeted HAPs (EIIP, Volume III, Chapter 5, Section 4, Pages 5.4-4 thru 5.4-6, table 5.4-2) are listed in Table 2.

Data Needed:

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

Population-based method:

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

Table 2:
Per Capita Consumer and Commercial Solvent HAPs (GLC) Emission Factors
(lb/yr/person)

Toxic Compounds:	Per Capita Emission Factor (lb /yr/Person)	CAS No:
Ethyl Benzene	2.07E-03	100-41-4
Ethylene Oxide	1.51E-02	75-21-8
Formaldehyde	1.26E-03	50-00-0
Glycol Ethers	4.04E-02	111-76-2
Methylene Chloride (Dichloromethane)	3.64E-02	75-09-2
Naphthalene	4.61E-02	91-20-3
Tetrachloroethylene (Perchloroethylene)	2.82E-02	127-18-4
Toluene	4.29E-01	108-88-3
Methylene Chloride (1,1,1-Trichloroethane)	3.87E-01	71-55-6
Xylenes, m,o, & p	2.03E-01	1330-20-7

When estimating emissions using emission factors, each state will need to use the latest published emission factors available. Additional work may need to be performed, as demonstrated below, in order to account for regulations and controls on the industry in each respective state.

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.

Example:

New York has a regulation in place affecting various product subcategories of the categories listed in Table 1. Hair spray, antiperspirants, deodorants, and all purpose cleaners had limits on the % VOC by weight of the products in these subcategories pursuant to 6 NYCRR Part 235 (Consumer Products). The products regulated make up only parts of several categories listed in Table 1. Therefore, when estimating emissions, CE and RP need to be calculated per affected category (see Table 1) as follows:

$$RP = (\text{per capita emissions of regulated portion of category} / \text{per capita emissions of all})$$

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.

A point source adjustment is not required for this area source category.

9.) Chromium Electroplating

Chrome Electroplating emissions were calculated from actual data, involving a survey of known Chrome Electroplating facilities listed in the New York State Department of Environmental Conservation's Source Management System. Chromium compounds emissions were converted to Chromium emissions. All the facilities surveyed had emission controls, with fume suppressants being the most common one. ASC: 2309100010

Point Source emissions (SIC 3471) will have to be subtracted from the Area Source emissions.

10.) Dry Cleaning

Actual facility data was used. The facility data was furnished by the NYSDEC's Division of Air Resources' Bureau of Stationary Sources. PERC machines (transfer and dry-to-dry), are the main concern. Coin Operated and Petroleum Solvents machines are negligible in the inventory. A point source (SIC 7216) adjustment by county is necessary for this area source category. ASC: 2420000055

11.) Ethylene Oxide Sterilizers

An EPA (2001) report based on validated distributor sales data in 15 metropolitan areas referenced an emission factor of 0.16 lbs./bed/yr of Ethylene Oxide blend for the two metropolitan areas in New York State: New York City and Buffalo. These two areas represent 70 percent of the total number of beds in the State, and by extrapolation the emission factor was used for the whole state. (No reports were available for 2002 apart from the statement that “National sales of ETO sterilants to hospitals declined somewhat in 2002”; therefore, the 2001 figures are conservative). The number of beds per county were determined from the “Health Facilities Directory 2002”, provided by the New York Department of Health (NYSDOH). ASC: 2850000010

A point source adjustment by county is necessary for this area source category.

12.) Forest Fires

Emissions from Forest Fires were based on actual acres burned per county and the number of actual forest fires in 2002. The actual acres burned per county was supplied by the NYS Department of Environmental Conservation's (NYSDEC) Division of Lands And Forests and the number of actual forest fires per county was furnished by the NYS Department of State's (NYSDOS) Office of Fire Prevention and Control. Since both the NYSDEC database and the NYSDOS database included the municipality's name for each forest fire listed we were able to avoid double counting the amount of acres burned. In order to convert the number of actual forest fires per county (NYSDOS's data) into acres burned per county the following two default values were used: 1.) 1.0 acre per forest fire in an urbanized county; 2.) 4.54 acres per forest fire in a rural county. The two default values can be referenced to the Great Lakes Commission 1998 Area Source Methodology and are based on data supplied by the State of Michigan's Department of Natural Resources, Forest Management Division. The default values can be accessed at www.glc.org/air/inventory/1998. The fuel loading factor (11.68 tons/acre burned), also known as biomass consumed was based on EPA's AP-42 (Section 13.1.1, Table 13.1-1, Page 13.1-2; Fig. 13.1-1, Page 13.1-3) and the NYSDEC's Division of Lands and Forests. The Criteria Pollutant emissions factors (lbs/ton burned) were forwarded to the Department's Division of Air Resources in an email from Randy Strait of E. H. Pechan & Associates, Inc. on 08/02/2004 (Total Particulate = 34.1 lbs/ton, PM10 = 28.1 lbs/ton, PM2.5 = 24.1 lbs/ton, Carbon Monoxide = 289.0 lbs/ton, NOx = 6.2 lbs/ton, SO2 = 1.7 lbs/ton and VOC = 13.6 lbs/ton) while the emissions factors for the Hazardous Air Pollutants (HAPs) were from EPA's Documentation For The 1996 Base Year National Toxics Inventory for Area Sources dated May 31, 2001 (Appendix A; Page A-30). The actual HAPs are listed below with their respective emission factors for both flaming and smoldering conditions.

Using the actual acres burned per county, the calculated fuel loading factor (biomass consumed) and the appropriate emission factors for Total Particulate, PM10, PM2.5 Carbon Monoxide, NOx, SO2, VOC and HAPs (Flaming and Smoldering Fuel Types) the emissions from Forest Fires were calculated. It was assumed that during forest fires, 75 per cent of biomass is burned under flaming conditions and 25 per cent of biomass is burned under smoldering conditions (See EPA's Documentation For The 1996 Base Year National Toxics Inventory For Area Sources dated May 31, 2001 (Appendix A; Page A-29)). ASC Code: 2810001000

A point source adjustment is not required for this area source category.

FOREST FIRES			
HAP	CAS No:	Flaming Fuel Emission Factor (lb/ton)	Smoldering Fuel Emission Factor (lb/ton)
1,3-butadiene	106-99-0	2.40E-01	9.00E-01
2,3,7,8-TCDD TEQ	1746-01-6	2.00E-09	2.00E-09
Acetaldehyde	75-07-0	4.73E-01	2.14E-01
Acrolein	107-02-8	4.68E-01	2.92E-01
Benz(a)anthracene	56-55-3	6.20E-03	6.20E-03
Benzene	71-43-2	6.60E-01	2.52E+00
Benzo(a)pyrene	50-32-8	1.48E-03	1.48E-03
Chrysene	218-01-9	6.20E-03	6.20E-03
Fluoranthene	206-44-0	6.73E-03	6.73E-03
Formaldehyde	50-00-0	1.50E+00	5.80E+00
Toluene	108-88-3	6.55E-01	3.08E-01
Xylenes, m, o, & p	1330-20-7	2.79E-01	1.31E-01

13.) **Forest Fires (Prescribed)**

Emissions from Prescribed Forest Fires were based on actual acres burned per county in 2002. The data was supplied by the Department's Division of Lands And Forests. The fuel loading factor (8.2 tons/acre), also know as biomass consumed was from EPA's Documentation For The 1996 Base Year National Toxics Inventory For Area Sources dated May 31, 2001 (Appendix A; Page A-31). The Criteria Pollutant emissions factors (lbs/ton burned) were forwarded to the Department's Division of Air Resources in an email from Randy Strait of E.H. Pechan & Associates, Inc. on 08/02/2004 (Total Particulate, PM10, PM2.5, Carbon Monoxide, NOx, SO2 and VOC) while the emissions factors for the Hazardous Air Pollutants (HAPs) were from EPA's Documentation For The 1996 Base Year National Toxics Inventory For Area Sources dated May 31, 2001 (Appendix A; Page A-32). The Criteria Pollutant emissions factors and actual HAPs are the same as for the category **Forest Fires** and are listed under that category.

Using the actual acres burned per county, the calculated fuel loading factor (biomass consumed) and the appropriate emission factors for Total Particulate, PM10, PM2.5 Carbon Monoxide, NOx, SO2, VOC and HAPs (Flaming and Smoldering Fuel Types) the emissions from Forest Fires were calculated. It was assumed that during prescribed forest fires, 75 percent of biomass is burned under flaming conditions and 25 percent of biomass is burned under smoldering conditions (See EPA's Documentation For The 1996 Base Year National Toxics Inventory For Area Sources dated May 31, 2001 (Appendix A; Page A-31). AMS Code: 2810015000

A point source adjustment is not required for this area source category.

14.) Portable Fuel Containers (Gas Can)

Emissions estimated by this inventory come from residential and commercial containers. These emissions are generated in permeation, diurnal (storage), and transport-spillage (can filling). Emissions from equipment refueling spillage and refueling vapor displacement were estimated by our Mobile Source Program.

To estimate the emissions from residential containers we used a California Air Resources Board (CARB) survey, EPA emission factors and New York State household data from “New York State 2002 Residential Housing Units”. To estimate emissions from commercial containers we used the CARB survey, EPA emission factors and number of business, (establishments), from “County Business Patterns”, US Census Bureau. ASC: 2501011011

A point source adjustment is not required for this area source category.

15.) Gasoline Marketing (Stages I and II)

The calculation methodology followed for estimating area source emissions for this category was taken from the Emission Inventory Improvement Program (EIIP), Volume 3, Chapter 11, Gasoline Marketing (Stage I and II), April 2001. This methodology involves employing an emission factor relating emissions to the volume of gasoline distributed.

There are four sources of information that contain emission factors regarding gasoline service operations.

They are:

- i) AP-42, Chapter 5, Section 2,
- ii) EIIP, Volume III, Chapter 11,
- iii) FIRE 6.22, and
- iv) other technical documents.

These sources offer factors which are applied to gasoline consumption rates for each county in order to estimate emissions of toxic substances from tank filling, tank breathing, tank emptying, and vehicle fueling operations. Tank filling operations are further broken out to include splash filling, submerged filling without controls, and balanced submerged filling. Due to the lack of information concerning gas filling distribution in New York State, it is assumed that gasoline consumption is evenly distributed among these three filling operations.

Emission factors for toluene (submerged filling and balanced submerged filling operations) and xylenes (each of the filling operations) are expressed in units of mg/L, while factors for each of the other contaminants are given in units of lb/1000 gal. Emission factors with units of mg/L were converted to lb/1000 gallons to achieve a consistent format among factors. The units for each of the toxic contaminants also varied from gallons of gas transferred, stored, pumped, and processed. In order to apply each factor to gasoline usage, it is assumed that all units can be equated simply to lb/1000 gallon.

VOC emissions for tank breathing, tank emptying, and vehicle fueling operations were speciated according to *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. Toxic emission estimates are provided for each county according to appropriate area source code (ASC). ASC: 2501060000

A point source adjustment is not required for this area source category.

16.) Graphic Arts

Volatile Organic Compounds (VOCs) emissions for the area source category Graphic Arts were calculated using an emission factor based on per capita (population) which was 1.3 lbs. VOC/person/year (0.00065 tons VOC/person/year). The emission factor was taken from EPA's Emission Inventory Improvement Program (EIIP), Volume III, Chapter 7, pages 7.5-10 thru 7.5-11.

6 NYCRR Part 234 (Graphic Arts) establishes rules on materials' VOC contents and controls on processes. Adding the gains brought by the required materials' VOC content plus the post controls on the different processes, we can conservatively state an 80% Control Efficiency (CE) for calculating VOC emissions for the Graphic Arts category. Since the rule applies to every process the Rule Penetration (RP) is 100% and the Rule Effectiveness (RE) is 80%, which is based on good engineering judgement. The equation to calculate VOC emission per county for Graphic Arts is as follows: Emissions per County = (county population*per capita emission factor)*((1.0-(CE*RP*RE)))

VOC's speciation was accomplished using EPA's program SPECIATE (version 3.2). The program can be downloaded from: www.epa.gov/ttn/chief/emch/speciation/.
ASC: 2425000000

A point source adjustment is required for this area source category.

17.) Human Cremation

Emissions for the area source category Human Cremation in New York State (NYS) were calculated using the following equation: $\text{Emissions} = (\text{Bodies Cremated} * \text{Average Weight/Corpse (lb)} * \text{Emission Factor (lb/ton)}) * \text{ton}/2000 \text{ lb}$. The number of Bodies Cremated in NYS was calculated based on the number of deaths in NYS for 2002, which was provided by the New York State Department of Health and the NYS Cremation Rate (22%), which was provided by the Cremation Society (United States Cremation Statistics) and the equation is as follows: $\text{Number of Bodies Cremated} = (2002 \text{ Deaths in NYS}) * (\text{NYS Cremation Rate})$. The Average Weight per Corpse is 150 lbs. ASC: 2601020000

Emission Factors were based on the California Air Resources Board's (CARB) test report no. C-90-004. Listed below are the emission factors in lbs/ton for the respective contaminants which were inventoried for this category.

Contaminant	CAS No:	Emission Factor
PCDD		7.74*10E-8
PCDF		1.43*10E-7
POM		9.63*10E-4
Formaldehyde	5000	2.89*10E-9
Lead	7439921	9.39*10E-3
Mercury	7439976	5.32*10E-1
Nickel	7440020	5.09*10E-4
Arsenic	7440382	4.0*10E-4
Beryllium	7440417	1.84*10E-5
Cadmium	7440439	1.46*10E-3
Chromium	7440473	3.99*10E-4
Hydrogen Chloride	7647010	1.97

A point source adjustment is not required for this area source category.

18.) Industrial Surface Coating

Emissions estimated from the various Industrial Surface Coating processes (10 processes) were based on employment (EIIP, Volume III, Chapter 8, Industrial Surface Coating, Table 8.5-1 (See below), Page 8.5-2, September 1997). Throughput for the per employee emission factors was provided by the New York State Department of Labor (NYDOL), Division of Research and Statistics and was compiled based on the North American Industry Classification System (NAICS) which has replaced the SIC system of codes. The respective SIC Codes listed in Table 8.5-1 were matched with the equivalent NAICS code provided by the United States Census and forwarded to the NYSDOL for compilation. The NAICS codes can be accessed at the following website: www.census.gov/epcd/. Then using the appropriate emission factor (lbs/year/employee) for the respective process (EIIP, Volume III, Chapter 8, Industrial Surface Coating, Table 8.5-1, Page 8.5-2, September 1997), control efficiency if any existed for a process, the Volatile Organic Compounds (VOCs) emissions for each process under Industrial Surface Coating were calculated per county in NYS. The processes that had control efficiencies are as follows: 1.) Electrical Insulation, 2.) Furniture And Fixtures, 3.) Metal Containers, 4.) Machinery And Equipment and 5.) Sheet, Strip And Coil.

The control efficiencies were calculated by using Table 8.5-1 (dividing the Per Employee VOC Emission Factor (lb/yr) by the Per Employee Coating Usage Factor (gal/yr)) and the maximum permitted pounds of VOCs per gallon (lbs/gal) of coating at application (See 6NYCRR Part 228.7, Table1) for each respective process which had control. Rule effectiveness (RE) was assumed to be 80% for all control processes which was based on good engineering judgement. Rule Penetration (RP) for each control process depended on the geographical area of NYS. The New York City Metropolitan Area (NYMA) had a RP of 100% (See 6NYCRR Part 228.1(b)) for each control process. The Lower Orange County Metropolitan Area (LOCMA) and the rest of NYS had a different RP for each control process because not all Surface Coating Facilities located in these two areas would be effected by Part 228 (See Part 228.1(c)(3) for LOCMA and Part 228.1(d)(3) for the rest of NYS). A review of the NYS database was used to determined the appropriate RP for each of the respective control processes in these two areas.

Point source emissions have to be subtracted out of the Area Source Inventory per county. They can be identified by referencing EIIP, Volume III, Chapter 8, Industrial Surface Coating, Table 8.5-1, Page 8.5-2, September 1997.

TABLE 8.5-1**NATIONAL DEFAULT PER EMPLOYEE EMISSION FACTORS (EPA. 1991)**

ASC:	Category:	SIC Code:	Per Employee VOC Emission Factor (lb/yr):	Per Employee Coating Usage Factor (gal/yr):
2401020000	Furniture and Fixtures	25	944.0	175.0
2401040000	Metal Containers	341	6,029.0	1,218.0
2401070000	Automobiles (new)	3711	794.0	131.0
240155000	Machinery and Equipment	35	77.0	17.0
2401060000	Appliances	363	463.0	181.0
2401075000	Other Transportation Equipment	37, except 3711 and 373	35.0	14.0
2401045000	Sheet, Strip and Coil	3479	2,877.0	474.0
240105000	Factory Finished Wood	2426-9, 243-245, 2493, 2499	131.0	40.0
2401065000	Electrical Insulation	3357, 3612	290.0	114.0
2401080000	Marine Coatings	373	308.0	47.0

19.) Marine Vessel Loading, Ballasting, and Transit

The calculation methodology followed for estimating area source emissions for this category was taken from the Emission Inventory Improvement Program (EIIP), Volume 3, Chapter 12, Marine Vessel Loading, Ballasting, and Transit, May 1998 document.

The Waterborne Commerce of the United States publication was used to obtain data on the movements of commodities and vessels at individual ports and harbors on individual waterways and canals of New York for the 2002 calendar year. Upon following EIIP guidance, a table identifying New York State waterways, petroleum products by fuel type, emission points, and traffic classifications was created. These values were then summed and converted to appropriate units for application of EIIP emission factors for each classification. According to 6 NYCRR Part 229.3(f) facilities loading more than 15,000 gallons/day must operate a vapor control system which reduces total VOC emissions by 90 percent by weight. This control was applied to the Vessel Loading classification. The Waterborne Commerce of the United States publication indicates that zero values presented in the tables represent less than 500 tons but more than 0. New York's estimation replaces each zero found in the table with 0.25 or 250 tons (the average of 0-500). Upon calculating the total VOC value for each waterway, the emissions were distributed to the appropriate counties within the state according to the allocation breakdown identified in the 1990 stationary area sources report prepared by RADIANT Corp (revised July 1993). Once total VOC emission were distributed, they were speciated according to EPA AP-42 Chapter 5: *Petroleum Refining* speciation profiles in order to calculate the amount of relevant toxic substances contained in each. The ASC (SCC) used to classify total fuels was 2505020000 (marine vessel total: all products), as taken from FIRE 6.22. A further breakdown for each fuel type is possible, but is a much more in depth procedure and requires a tedious summation of each fuel from each waterway for each of the affected counties. This further breakdown creates room for error and does not appear to enhance these area source emission estimates.

No point source emissions adjustments have been made, but may be necessary.

20.) Mercury

Population and an emission factor of $2.5473 * 10^{-5}$ lbs Mercury per capita were used to calculate Mercury emissions for 2002. The emission factor was calculated based on EPA's Mercury Study Report to Congress / Volume II: An Inventory of Anthropogenic Mercury Emissions in the United States (EPA-452/R-97-004), Pages 5-1 and 5-2, Table 5-1. [Emission Factor calculation: (0.55 grams mercury per person per year)*(0.002204623 lbs/grams) = 0.001213 lbs mercury per person per year * 0.021 (Page 5-2, Table 5-1 of the above mentioned EPA Document) = $2.5473 * 10^{-5}$ lbs mercury per person per year]. ASC: 2861000000

A point source adjustment is not required for this area source category.

21.) Municipal Solid Waste (MSW) Landfills

Estimating emissions from MSW Landfills were based on actual MSW Landfill data compiled from the New York State Department of Environmental Conservation's (Department) Division of Solid And Hazardous Materials for the years 1988 through 2002. Utilizing the landfill data and the appropriate default values from Section 2.4, Pages 2.4-3 and 2.4-4 of EPA's AP-42 for C(Non-Methane Organic Compounds(NMOCs)), Lo (Methane generation potential = $100 \text{ m}^3/\text{kg}$), and k (Methane generation rate constant, yr^{-1}) the emissions for NMOCs and the associated Hazardous Air Pollutants (HAPs) were calculated using EPA's Landfill Air Emissions Estimation Model (LAEEM). It was assumed that the landfill data was for Co-Disposal, therefore the C(NMOC) value of 2,420 ppmv as Hexane was entered into the LAEEM. Since NYS receives 25 inches or more of rain per year the default value 0.04/yr was used for k and entered into the LAEEM. ASC Code: 2620030000

Point source emissions will have to be subtracted from Area Source emissions by county for MSW Landfills.

Toxic Compounds Emitted By MSW Landfills That Are Targeted by The Great Lakes Commission (GLC) For The 2002 Area Source Inventory:	
Toxic Compounds:	CAS No:
Non-Metal Compounds (Excluding PAHs):	
Acrylonitrile	107-13-1
Benzene	71-43-2
Carbon Tetrachloride	56-23-5
Chloroform	67-66-3
Ethylbenzene	100-41-4
Ethylene Dibromide (Dibromoethane)	106-93-4
Ethylene Dichloride (1,2-Dichloroethane)	107-06-2
Methyl Chloroform (1,1,1-Trichloroethane)	71-55-6
Methylene Chloride (Dichloromethane)	75-09-2
Tetrachloroethylene (Perchloroethylene)	127-18-4
Toluene	108-88-3
Vinyl Chloride	75-01-4
Xylenes (Iso)	1330-20-7
Metal Compounds	
Mercury	7439-97-6

22.) [reserved] Open Burning

23.)[reserved] PM-2.5

24.) Public Owned Treatment Works (POTW)

The Great Lakes Commissions issued a table of emission factors for estimation of HAPs generated through volatilization at the surface of the wastewater during treatment processes. 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 tank for disinfecting.

Good part of the work for the estimation of this inventory consists in editing the POTW report from the Department’s Division of Water, since the flows have different units (reported in gallons and/or million gallons) and our HAPs’ emission factors are given in lbs/million gallons.

EPA’s procedures document states that approximately 16 percent of all flow of wastewater effluent is waste, with a VOC content of 0.0011 lb/gallon. The emission factor for VOC was calculated to be 1.76×10^2 lbs/million gallons $((0.0011 \text{ lb/gallon} \times 10^6 \text{ gallons/million gallons}) \times 0.16 = 1.76 \times 10^2 \text{ lbs/million gallons})$. ASC: 2630020000

Contaminant	CAS No:	Emission Factor
Formadehyde	50000	2.29E-04
Carbon Tetra	56235	1.32E-02
Methanol	67561	1.33E-01
Chloroform	67663	7.53E-02
Benzene	71432	7.86E-02
TCE.111	71556	6.58E-03
Vinyl Chlor	75014	7.76E-05
Acetonitrile	75058	4.03E-03
Acetaldehyde	75070	3.62E-03
Methylene Cl	75092	1.07E-01
Carbon Disul	75150	5.05E-02
Ethylene Oxi	75218	2.59E-03
Vinlidene Cl	75354	4.94E-03
Prolene Oxid	75569	8.55E-03
Hexacl-1,3-c	77474	6.46E-06
Dimeth Sulfa	77781	1.45E-05
Prolene Dich	78875	1.34E-04
Meth Eth Ket	78933	3.32E-02
Tricleth.112	79005	1.29E-05
Trichlorethy	79016	3.57E-03
Tetclet.1122	79345	2.10E-05
Nitropropa.2	79469	3.23E-06
Meth Methacr	80626	3.63E-03
Hexcl-13-But	87683	8.08E-06
Naphthalene	91203	1.53E-02

Contaminant	CAS No:	Emission Factor
Biphenyl	92524	8.79E-04
Toluidine, O-	95534	2.10E-05
Nitrobenz	98953	7.60E-05
Ethylbenzene	100414	8.95E-02
Styrene	100425	3.19E-02
Benzyl Chlor	100447	9.54E-05
Diclbz, 1,4	106467	2.51E-03
Epichlorhydrin	106898	5.33E-05
Butadiene, 1,3	106990	2.93E-04
Acrolein	107028	4.48E-03
Allyl, Chlori	107051	2.26E-04
Acrylonitril	107131	4.51E-03
Vinyl Acetat	108054	8.94E-04
Meth Isobut	108101	3.14E-02
Toluene	108883	1.43E-01
Chlorobenz	108907	5.64E-03
Glycol Ethrs	111762	1.34E-01
Triclbz, 1,2,4	120821	1.01E-03
Dinitrtol, 2,4	121142	5.62E-04
Dimethylanil	121697	3.76E-03
Pronionaldeh	123386	4.04E-05
Dioxane	123911	2.10E-04
Chloroprene	126998	2.78E-04
Perc	127184	4.98E-02
Cresol Mx Is	1319773	1.94E-05
Xylenes (Iso)	1330207	6.98E-01
Eth Acrylate	140885	2.10E-05
Meth Tert Bu	1634044	7.43E-04
VOC	NY998000	1.76E+02

A point source adjustment is required for this area source category.

25.) Solvent Cleaning

The method used to estimate VOC emissions from the category Solvent Cleaning was the method described in The Emission Inventory Improvement Program's (EIIP), Volume 3 (Area Sources and Area Source Method Abstracts), Solvent Cleaning Chapter (Chapter 6; Section 5.1.2; Pages 6.5-1 thru 6.5-4). The emission factors used were the Per Employee Emission Factors (lb/yr/employee) listed in Table 6.5-2 (Page 6.5-4). Throughput for the per employee emission factors was provided by the New York State Department of Labor (NYDOL), Division of Research and Statistics and was compiled based on the North American Industry Classification System (NAICS) which has replaced the SIC system of codes. The respective SIC Codes listed in Table 6.5-2 were matched with the equivalent NAICS code provided by the United States Census and forwarded to the NYSDOL for compilation. The NAICS codes can be accessed at the following website: www.census.gov/epcd/. ASC: 2460000000

**Table 6.5-2
Per Capita and Per Employee Solvent Cleaning Emission Factors
(EPA, 1991)**

Subcategory	SIC Codes	Per Capita Factor (lb/yr/person)		Per Employee Factor (lb/yr/person)	
		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, 553 552, 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

A point source adjustment is not required for this area source category.

26.) Structure Fires

Estimating 2002 emissions from Structure Fires were based on the actual number of structure fires per county upstate and Long Island which was provided by the NYS Department of State's (NYS DOS) Office of Fire Prevention And Control and the 5 counties (Bronx, Kings, New York, Queens and Richmond) of New York City (NYC) which was downloaded from the NYC Fire Department website which can be accessed at <http://nyc.gov/html/fdny/html/stats>. The fuel loading factor (1.15 tons/fire) and the appropriate emission factors (lbs./ton) were from EIIP, Volume III, Chapter 18, Structure Fires, Pages 18.4-2 and 18.4-5 (see table below), Revised Final January 2001. In an email from Randy Strait of E. H. Pechan & Associates, Inc. on 08/02/2004, it was determined that PM10 emissions equals Particulate Matter (PM) emissions (PM = PM10 = 10.8 lb./ton burned) and that PM2.5 emissions equals 91% of the PM10 emissions (PM2.5 = 0.91 * 10.8 lb./ton burned = 9.84 lb/ton burned). Using the above data the emissions from structure fires were calculated per county in NYS. ASC Code: 2810030000

A point source adjustment is not required for this area source category.

Pollutant:	Emission Factor (lb/ton burned):
Particulate Matter (PM)	10.8
Total Organic Compound (TOG)	13.9
Formaldehyde (Cas No: 50-00-0)	1.02
Acrolein (Cas No: 107-02-8)	4.41
Volatile Organic Compounds (VOCs)	11.0
Oxides Of Nitrogen (NOx)	1.4
Carbon Monoxide (CO)	60

27.) Traffic Markings

Estimating 2002 emissions from Traffic Markings were dependent on the number of miles for each type of roads, (federal, state, county, town) and the type of paint used. New York State Department of Transportation's (NYSDOT) used water-based paints for traffic markings in 2002 and the water based-paints were based on the NYSDOT's own formulation. The water-based paints had replaced solvent-based paints and the emission factors for other types of paint such as epoxy, thermoplastic, latex, were considered negligible.

The number of miles for each type of road is found in the "NYSDOT Highway Mileage Summary" and the type of paint used was found after calling each one of the interested parties. (Note: A survey of the counties and towns transportation offices revealed that they follow advice from DOT about type of paints used).

According to the NYSDOT the Volatile Organic Compounds (VOCs) Hazardous Air Pollutants (HAPS,) Glycol Ether (1%(w)), and Methanol (1%(w)) were speciated out of the Unspeciated VOCs total per county and the balance was reported as VOCs for each county in New York State. ASC:2401008000

A point source adjustment is not required for this area source category.

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