

Massachusetts  
2011 Periodic Emissions Inventory of  
VOC, NO<sub>x</sub>, CO, SO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub> and NH<sub>3</sub>

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# SECTION 3

## STATIONARY AREA SOURCES

### 3.0 DESCRIPTION OF STATIONARY AREA SOURCES

The Stationary Area Source section inventories stationary emissions sources that are too small and numerous and to be inventoried as point sources and are not, mobile, or biogenic sources. Whereas point sources are inventoried individually, area sources are inventoried collectively. These small sources are grouped with other like sources into area source categories whose emissions can then be estimated collectively using one methodology. They are not treated as individual point sources largely because the effort required to gather data and estimate emissions for each individual facility is great while the emissions per facility are usually small. Gasoline stations and dry cleaning establishments are examples of numerous small facilities that are generally treated as area sources.

There are also categories of area sources, such as pesticide use and commercial/consumer product use, which are not emitted from a stationary emission unit. These types of non-unit specific sources are also included within the stationary area source categories of this inventory.

The Stationary Area Source section is comprised of the following six subsections that address specific categories of sources. These are presented as separate files of text and tables (spreadsheets).

1. Waste Treatment Emissions
2. Gasoline Distribution
3. Solvent Use
4. Combustion Processes
5. Agricultural Activities
6. Fugitive Dust from Construction and Paved/Unpaved Roads

Area sources are inventoried based on an estimated level of activity related to a particular type of area source. The activity factors for these area sources include material sales records, state registration records, fuel/material usage, default employment, and per capita data. Several source categories were estimated based on state employment and population data. Area source emissions were apportioned to counties based on available fuel/material used, employment, state registration, and population data.

MassDEP estimated emissions with emission factors from EPA's *Compilation of Air Pollution Emission Factors AP-42 Vol. 1 Stationary Point and Area Sources*<sup>1</sup> and the Emissions Inventory Improvement Project (EIIP) guidance documents<sup>2</sup>. MassDEP applied a rule effectiveness formula to those area source categories which are subject to state regulatory controls (e.g., gasoline station Stage I tank truck unloading).

Double counting of emissions from area sources can occur if the category also includes point sources. For example, dry cleaners are an area source, but there are also large dry cleaners that are included in the point source inventory. In order to avoid double counting MassDEP subtracts point source emissions from the area source emissions (except for fuel combustion, where point source fuel use is subtracted to state-wide fuel use data to improve accuracy of the resulting emissions estimates).

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<sup>1</sup> *Compilation of Air Pollutant Emission Factors, AP-42 Vol. 1 Stationary Point and Area Sources*, EPA, OAQPS RTP. N.C.; See <http://www.epa.gov/ttn/chief/ap42/index.html>.

<sup>2</sup> *Emission Inventory Improvement Program Technical Report Series, Volume 2 Point Sources*. See: <http://www.epa.gov/ttn/chief/eiip/techreport/volume02/index.html>

MassDEP adopted EPA's emission estimates for the area source categories listed below that can be found at EPA's websites<sup>3</sup>

- Publicly Owned Treatment Works (POTWs)
- hazardous waste transportation, storage and disposal facilities (TSDFs)
- portable fuel containers
- graphic arts
- industrial coating appliances
- industrial coating other transport equipment - aircraft
- industrial coating – other transport equipment - rail
- miscellaneous solvents – emulsified asphalt
- miscellaneous solvents – agricultural pesticide use
- miscellaneous solvents – non-agricultural pesticide use
- wood-burning
- open burning
- wildfires
- food prep - commercial-all
- agricultural, human, pets, wildlife, soils (except agricultural tilling)
- fugitive dust (all: construction activities, mining/quarrying, and paved/unpaved roads)

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<sup>3</sup> <ftp://ftp.epa.gov/EmisInventory/2011nei/doc/>

### 3.1 WASTE TREATMENT EMISSIONS

This section provides a description of the methodologies for estimating VOC emissions from the treatment of wastewater and solid waste at landfills. Ammonia (NH<sub>3</sub>) is also estimated from wastewater treatment. In addition to wastewater generated at the municipal level, many industries generate large quantities of contaminated water as a byproduct of production processes. Wastewater collection and treatment units are generally uncovered and allow for volatilization of VOC and NH<sub>3</sub> to the atmosphere. Municipal solid waste landfills receive household, commercial, and non-hazardous industrial solid wastes that are significant sources of VOC. Landfills that accept hazardous wastes are classified as treatment, storage and disposal facilities (TSDF). This section includes the following three categories:

1. Publicly Owned Treatment Works (POTWs) (adopted EPA emissions)
2. Industrial Wastewater and Hazardous Waste Treatment, Storage and Disposal Facilities (IWW/TSDFs)
3. Municipal Solid Waste Landfills

*EIIP Volume II (Point Sources), Chapter 5 Preferred and Alternative Methods for Estimating Air Emissions from Wastewater Collection and Treatment and Volume III (Area Sources) Chapter 15 Municipal Solid Waste Landfills*<sup>4</sup> was consulted in order to estimate the 2011 emissions. VOC emissions from waste treatment management practices were divided into three subcategories as outlined in Table 4.10-1 of EPA's *Procedures for the Preparation of Emission Inventories, Volume I*.<sup>5</sup>

#### 3.1-1 PUBLICLY OWNED TREATMENT WORKS (POTWs)

MassDEP adopted EPA's emissions estimate for POTWs because it is based on EPA's NPDES national wastewater discharge data. MassDEP has used this same NPDES data for past previous inventories. The national emissions by county and the methodology are presented in EPA's FTP website.<sup>6</sup>

Publicly Owned Treatment Works (POTW) means a treatment works that is owned by a state, municipality, city, town, special sewer district, or other publicly owned and financed entity as opposed to a privately (industrial) owned treatment facility. The definition includes intercepting sewers, outfall sewers, sewage collection systems, pumping, power, and other equipment. The wastewater treated by these POTWs is generated by industrial, commercial, and domestic sources.

The general approach to calculating emissions for POTWs is to estimate the 2011 national POTW flow rate using methods described in 3.1-2 below and then multiply the estimated flow

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<sup>4</sup> EPA Emission Inventory Improvement Program (EIIP) Volume II Chapter 5 "Point Sources Preferred and Alternative Methods for Estimating Air Emissions from Wastewater Collection and Treatment", March 1997; Volume III Chapter 15 Area Sources "Municipal Solid Waste Landfills," OAQPS MD-14, April 2001. See: <http://www.epa.gov/ttn/chiep/eiip/techreport/index.html>

<sup>5</sup> *Procedures for the Preparation of Emission Inventories for CO and Precursors of Ozone*. Volume I. General Guidance for Stationary Sources. EPA OAQPS RTP NC. EPA.450/4-91-016, May 1991.

<sup>6</sup> <ftp://ftp.epa.gov/EmisInventory/2011nei/doc/>

rate by the emission factors for VOCs and ammonia. The emissions are allocated to each county based on population.

EPA's guidance documents state that the wastewater treatment operations at POTWs are significant sources of VOC. The concentration of VOC found in POTW wastewater is, according to EPA guidance, known to be directly proportional to the industrial component of POTW wastewater flow. This implies that VOC emission estimates can be allocated to the county level based upon the total industrial flow per county.

POTW emissions from EPA are presented in Table 3.1.

### **3.1-2 INDUSTRIAL WASTEWATER AND HAZARDOUS WASTE TREATMENT, STORAGE AND DISPOSAL FACILITIES (IWW/TSDF)**

#### **Description**

EPA Region I NPDES Programs Operation Branch also provided IWW/TSDF wastewater flow data for 2011. Table 3.2 lists the average daily flow rates by facility for each month. MassDEP used EPA's 1991 Volume I guidance<sup>7</sup> that stated that IWW/TSDF wastewater consists mainly of industrial discharge, whereas POTW wastewater consists of a combination of residential sewage, commercial and industrial wastewater. The industrial portion of the wastewater is considered to be the source of VOC emissions. The Volume 1 guidance provided a national average industrial wastewater composition of the total effluent for POTWs at 16 percent, compared to 100 percent for IWW/TSDFs.

#### **Methodology**

MassDEP excluded the EPA-NPDES wastewater flow data from electric utilities because most of their wastewater operations are generally used in their boiler cooling systems and hence, are not involved in any VOC emitting manufacturing or industrial process. Also excluded were fisheries/hatcheries and stone crushing facilities.

MassDEP did not use the EPA-EIIP recommended WATER9 computer model because the required detailed input data are not readily available to run the model for the numerous IWW/TSDFs. MassDEP used instead the EPA's Volume I emissions factor method for estimating VOC emissions from all IWW/TSDFs.

The following is an example of the VOC emissions estimation methodology using the Crane & Co located in Berkshire County.

$$\begin{aligned} \text{Average daily flow rate for 2011} &= 3.16\text{MGD} * 365 \text{ days} \\ &= 1,153.4 \text{ MGY} * 0.85 \text{ lb VOC/MG.} = 980.4 \text{ lb VOC /2000 lbs} \\ &= 0.49 \text{ TPY VOC /365 days} * 1.2 \text{ (summer adjustment)} = 0.016 \text{ TPSD} \end{aligned}$$

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<sup>7</sup> EPA "Procedures for the Preparation of Emission Inventories for Carbon Monoxide and Precursors of Ozone" Volume I General Guidance for Stationary Sources. EPA OAQPS EPA-450/4-91-016 May 1991.

Table 3.1 summarizes the emissions by county and Table 3.2 lists TSDF wastewater and emissions by facility.

### 3.1-3 MUNICIPAL SOLID WASTE LANDFILLS

#### Description

The EIIP Volume III (Area Sources) guidance, Chapter 15 “*Municipal Landfills*”<sup>8</sup> and Volume I methods were used for this category. MSW landfills are regulated under Subtitle D of Resource Conservation and Recovery Act (RCRA). EIIP and Volume 1 guidances stated that landfills nationally consist of approximately 54 percent household waste and 28 percent commercial waste. Municipal solid waste landfills emit VOC emissions by three mechanisms: volatilization, chemical reaction and biological decomposition of liquid and solid compounds into other chemical species.

The guidance documents state that several factors affect the volatilization of gases at MSW landfills such as: partial pressure of the constituent, constituent concentration at the liquid-air-interface, temperature, and confining pressure. Chemical reactions are also affected by waste composition, moisture content, and the practice of separate disposal areas for different waste types. Factors affecting biological decomposition include nutrient and oxygen availability, refuse composition, age of landfill, moisture content, temperature, pH, and the toxicity of waste to bacteria.

#### Methodology

MassDEP used the EPA recommended Landfill Gas Estimation Model (LandGEM- Microsoft® Windows Version 1) developed by EPA's Control Technology Center.<sup>9</sup>

MassDEP Bureau of Waste Prevention, Division of Solid Waste Management<sup>10</sup> provided landfill refuse in-place data for 2011. Table 3.3 includes refuse data from landfills that operated during the last 45 years. LandGEM results show that landfill emissions peak between 5 to 10 years after placement of refuse and decline substantially after 30 years.

MassDEP replicated the LandGEM model equation in an Excel spreadsheet in Table 3.4 with the default parameters in order to perform a batch calculation for over four hundred landfills. The spreadsheet presents the emissions for all the landfills that operated as far back as 45 years in Massachusetts, including active, and capped and uncapped inactive landfills. Capped landfill gases are generally collected and combusted or vented to the atmosphere for safety measures. Emissions from the largest capped or partially capped landfills in the state are recorded through MassDEP's Source Registration program as stationary point sources. MassDEP estimated area source non-methane organic compounds (NMOC) from the LandGEM equation and applied the EPA recommended NMOC/VOC conversion factor of 0.923. Landfill-refuse tonnage, model input parameters, and VOC emissions by facility are included in Table 3.4.

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<sup>8</sup> EPA Emission Inventory Improvement Program (EIIP) Volume III Chapter 15 Area Sources “Municipal Landfills.” OAQPS MD-14, April 2001. See: <http://www.epa.gov/ttn/chiep/eiip/techreport/index.html>

<sup>9</sup> Landfill Gas Emissions Model (LandGEM) Version 3.02, May 2005. See: <http://www.epa.gov/ttn/catc/products.html#software>

<sup>10</sup> Department of Environmental Protection, Bureau of Waste Prevention, Division of Solid Waste Management 2011 [Solid Waste Facility listings](#).

MassDEP's Source Registration database was cross-checked (NAICS 562212-3) in order to avoid double counting of landfill emissions for the same facility reported in the point and area source categories. Landfills listed in the AQ\_ID column in Table 3.3 are the large landfill facilities reported that generally had collection and control devices and are already reported in the Point Source section.

For example, the Bourne landfill in Barnstable county (AQRS- ID120-614) using LandGEM has an estimated uncontrolled NMOC emissions of 48.1 TPY NMOC ( $\times 0.923 = 44.1$  TPY VOC). The point source section recorded Bourne landfill emitting 2.75 TPY in 2011. AQRS landfill facility emissions is preferred because they reflect the net VOC emissions after collection and combustion of landfill gas and are therefore more accurate than the area source methodology.

The guidance documents do not provide any seasonal variation in landfill emissions, so there is no summer seasonal adjustment. Table 3.1 summarizes the 2011 annual and summer day emissions for landfills by county.