Chapter 5: Point Source Inventory Development

LESSON GOAL

Demonstrate, through successful completion of the chapter review exercises, a general understanding of the issues associated with identifying point sources for inclusion in an emissions inventory, including the form of the particulate matter and the particle size. You should be able to describe the methods for estimating emissions and be able to articulate the overlap issues associated with point and nonpoint source emission inventories.

STUDENT OBJECTIVES

When you have mastered the material in this chapter, you should be able to:

1. Explain the difference between filterable and condensable particles.
2. Explain the difference between primary and secondary particulate matter.
3. Identify the form of particulate matter that States must report to EPA.
4. Describe the approach for calculating the particle size of particulate matter from specific source categories.
5. Identify the available tools for estimating particulate matter emissions.
6. Identify and explain the overlap issues that exist between point and nonpoint source emission inventories.

Chapter 5: Point Source Inventory Development

5.1 IDENTIFYING POINT SOURCES

Point sources are stationary sources that are included in a point source inventory. Total plant or facility emissions for a given pollutant is usually the criterion for deciding if a specific source should be included in a point source inventory or an nonpoint source inventory. These criteria are defined by either state, local or tribal regulations or policy, or the reporting thresholds contained in the Consolidated Emissions Reporting Rule (CERR).

5.1.1 Filterable versus Condensable PM

Filterable PM is particles that are directly emitted as a solid or liquid at stack or release conditions and captured on the filter of a stack test train. Filterable PM may be PM_{10} or $PM_{2.5}$. Condensable PM is material that is in the vapor phase at stack conditions but condenses and/or reacts upon cooling and dilution in the ambient air to form a solid or a liquid particulate immediately after discharge from the stack. Condensable PM is almost always $PM_{2.5}$ or less.

Combustion sources typically emit both filterable and condensable emissions. Examples include boilers, furnaces and kilns, and both reciprocating internal combustion engines and turbines. Fugitive dust sources emit filterable emissions only. Examples of fugitive dust sources include storage piles and unpaved roads at industrial sites.

5.1.2 Primary versus Secondary PM

Primary PM is the sum of the filterable and the condensable PM. All primary particles are emitted directly from a stack. Secondary PM is particles that form through chemical reactions in the ambient air after dilution and condensation has occurred. Secondary PM is formed downwind of the source. Precursors of secondary PM include SO_2, NO_x, ammonia and VOC. The secondary PM should **not** be reported in the emission inventory, just the precursor emissions.

5.1.3 Ammonia Sources

Sources of ammonia emissions fall into three broad categories: industrial processes, use of ammonia as a reagent in NO_x control (e.g., selective catalytic reduction or selective non-catalytic reduction), and refrigeration losses. Examples of industrial

processes that emit ammonia include combustion sources, ammonium nitrate and phosphate production, petroleum refining, pulp and paper production, and beet sugar production. These industrial processes represent the more significant contributors of ammonia emissions from industrial processes as reported in the 2000 Toxics Release Inventory (TRI).

5.1.4 Resources

Resources for identifying point sources of fine PM and ammonia include Volume II of the Emissions Inventory Improvement Program (EIIP) guidance document for point sources, AP-42 emission factors document, and existing inventories such as the NEI and the TRI (for ammonia).

5.2 REPORTING PM

When States report their $PM_{2.5}$ primary (PM2.5-PRI) emissions to the EPA, either $PM_{2.5}$ primary or the $PM_{2.5}$ filterable and PM condensable components individually can be reported. All PM condensable is assumed to be in the $PM_{2.5}$ size. When States report their PM_{10} primary emissions to the EPA, either PM_{10} primary or the PM_{10} filterable and PM condensable components individually can be reported.

Reporting should be done by using the NIF 3.0 PM pollutant code extensions that identify the forms of the PM. This includes PRI for primary filterable, FIL for filterable, and CON for condensable. The database management system will need to be updated to record these pollutant code extensions.

The form of the PM should be verified to ensure that PM emissions that are recorded as PM_{10} or $PM_{2.5}$ are correctly identified as filterable, condensable, or primary emissions. This verification may require an examination of the emission factors on which the emissions are based. If the emissions were reported by facilities, the verification will require that States contact the facilities to ask them what emission factors were used to calculate the emissions. Alternatively, if the emissions estimates provided by the sources are based on stack test data, the States will need to ask them what method was used to measure the emissions in order to determine the form of PM.

Examining the test method used to collect the data can identify the form of the PM. EPA's Reference Method 5 series is used to measure total PM filterable emissions. Most of the AP-42 emission factors are based on Method 5 and, therefore, represent PM-filterable. Method 17 is similar to the Method 5, however it is infrequently used. Method 201/201A is designed for PM_{10} filterable. In order to calculate or measure the PM_{10} filterable or the $PM_{2.5}$ filterable, a particle size analysis of the total PM must be conducted to develop the size fractions or cut points for PM_{10} or $PM_{2.5}$. This information is used to develop particle size specific emission factors in AP-42. However, most of the emission factors in AP-42 are for filterable emissions, although there are some condensable emission factors for combustion sources. The filterable

and condensable emission factors need to be summed to obtain a PM primary emission factor. There are some exemptions so it is important to always understand the form of the PM that the emission factor represents.

For condensable, Preliminary Method 4 is being developed by the EPA to measure both $PM_{2.5}$ filterable and condensable. Method 202 is a method for condensable PM, but it is not used frequently, mainly because regulations do not require sources to measure condensable emissions.

5.3 PARTICLE SIZE

AP-42 provides particle size distribution data and particle size specific emission factors. Some of the source categories (e.g., combustion) in AP-42 have particle size specific emission factors for PM and, for those categories, that data should be used first. Appendix B1 should be used for source categories that do not have particle size specific emission factors. Appendix B1 contains particle size distribution data and particle size emission factors for selected sources. It is based on documented emissions data available for specific processes. In the event that Appendix B1 does not have particle size data for the source category of interest, Appendix B2 should be used. Appendix B2 contains generalized particle size distributions that are based on data for similar processes. These distributions are approximations and should only be used in the absence of source specific particle size distribution data.

Prior to consulting AP-42, any source specific data at the local or state level should be examined. Any information reported by a source is going to be the best data. If source provided information does not exist, the hierarchy of resources from AP-42 discussed above should be used. AP-42 chapters are not always clear on what source test methods were used to develop the particle size data, so the background information documents that were used to develop the chapters for AP-42 may need to be consulted. AP-42 is available in EPA's Clearinghouse for Inventories and Emission Factors (CHIEF) website at www.epa.gov/ttn/chief/.

5.4 EMISSION ESTIMATION TOOLS

5.4.1 Factor Information Retrieval System (FIRE)

The Factor Information Retrieval System (FIRE) is a compilation of emission factors from AP-42 and other documents. It is an electronic database that is available on the CHIEF web site. EPA is in the process of developing a more complete set of PM_{10} and $PM_{2.5}$ filterable and PM condensable emission factors that will be incorporated into FIRE.

5.4.2 The PM Calculator

The PM Calculator is a tool developed by EPA to calculate uncontrolled and controlled filterable $PM_{2.5}$ and PM_{10} emissions using AP-42 particle size data. For example, it can be used to calculate the $PM_{2.5}$ filterable emissions based on the PM_{10} filterable emissions contained in an inventory. It can also be used to calculate PM_{10} and $PM_{2.5}$ from the total PM filterable emissions. The calculator only deals with the filterable emissions (i.e., it does not address the condensable portion) and is for point sources only. Although it contains over 2300 SCCs, it is limited in that it is based on AP-42 particle size data that is not available for many sources. As a result, many times it uses the generic particle size data that is contained in Appendix B2 of AP-42 or other sources. It is also available on the CHIEF web site.

5.5 POINT AND NONPOINT SOURCE OVERLAP ISSUES

For categories included in the point and nonpoint source emission inventories, the total point activity must be subtracted from the total state activity to obtain a total nonpoint source activity. Using the fuel combustion category as an example, the point source activity is the fuel throughput from the point source inventory. Total activity is the statewide fuel throughput obtained from the state or local government agency or from the state energy data reports published by the Interior Energy Administration in the U.S. Department of Energy.

Ideally, the point source subtraction is based on activity data. For example, the point source fuel throughput for a given year (e.g., 2002) is subtracted from the total statewide fuel consumption for the same year. However, in a lot of cases, the activity data for performing that calculation may not be available. In this case, an emissions based calculation is acceptable. Under the emissions based approach, the total source category activity and the point activity need to be on the same control level. This control level should be an uncontrolled emissions basis because the total statewide activity represents uncontrolled sources. In this case, it is important to ensure that the point source emissions represent uncontrolled levels. It is also important to check the uncontrolled emissions to make sure that they seem reasonable.

5.5.1 Geographic Adjustment

The geographic level of the point source adjustment that is used to calculate the nonpoint source activity is an issue when surrogate activity data (e.g., employment and housing populations) is used to allocate total state activity to the county level. For example, the EIIP method recommends using employment for specific SIC codes to allocate total statewide natural gas combustion to the county level for fuel combustion at industrial and commercial institutions. However, summing the point source throughput for a given county and subtracting it from the total activity for the

county may produce negative results, indicating the point source consumption fuel use is higher than that calculated for the nonpoint sources. This can be an artifact of the allocation data that was used. The preferred approach is to sum up the point source fuel throughput consumption on the state level and subtract it from the total consumption for the state prior to doing the county-level allocation. It is also preferable to obtain activity data such as employment data for the point sources included in the inventory. In this way it is possible to make point source adjustments to the surrogate allocations to account for the amount of employment that is associated with the point sources.

5.5.2 QA/QC

It is also recommended that the county level nonpoint source estimates be reviewed for reasonableness after the adjustment has been made. Adjustments should be based on the experience of the agency personnel. For example, if the allocation method places nonpoint source activity in a county for which it is known that there is no activity, that county should be excluded from the allocation. Also, if all of a county's activity is covered by the point source emission inventory, the nonpoint source emissions should be zero.

5.5.3 CERR Reporting

If the point emission inventory includes sources with emissions below the CERR point emission inventory reporting thresholds, the emissions for these small sources can be included in the nonpoint source emissions. However, in this case it is important to avoid double counting in the nonpoint source inventory. This can be done by subtracting the total point source activity from the total state activity before rolling up the small point source data to add to the inventory. In this way the emissions for the small point sources in the area are not double counted.

5.6 ADDITIONAL MATERIALS

A suggested reading list for preparing point source inventories for fine PM is listed in Table 5-1.

Table 5-1. Reading List

Stationary Source Control Techniques Document for Fine Particulate Matter, EPA/OAQPS, Oct. 1998 (http://www.epa.gov/ttn/oarpg/t1/meta/m32050.html)
Emission Inventory Guidance for Implementation of Ozone and Particulate Matter National Ambient Air Quality Standards (NAAQS) AND Regional Haze Regulations, EPA, OAQPS (http://www.epa.gov/ttn/chief/eidocs/publications.html)
Introduction to Stationary Point Source Emission Inventory Development, EIIP Vol. 2, Chapter 1, May 2001
How to Incorporate Effects of Air Pollution Control Device Efficiencies and Malfunctions into Emission Inventory Estimates, EIIP Vol. 2, Chapter 12, July 2000

Review Exercises

1. _____ particulate matter is particles that are directly emitted as a solid or liquid at stack or release conditions and captured on the filter of a stack test train.
   a. Condensable
   b. Primary
   c. Secondary
   d. Filterable

2. Which of the following should **not** be reported in a particulate matter emission inventory?
   a. Primary PM
   b. Secondary PM
   c. Secondary PM precursors
   d. Filterable PM

3. What should be reported if it cannot be determined whether the emissions represent the $PM_{2.5}$ or PM_{10} size fraction?
   a. total primary PM
   b. filterable total primary PM and condensable PM, individually.
   c. both a and b
   d. None of the above

4. Which EPA test method is designed for measuring PM_{10} filterable?
   a. Method 5
   b. Method 201/201A
   c. Method 17
   d. Preliminary Method 4

5. In estimating particle size, which of the following sources of particle size data should be consulted first?
   a. AP-42
   b. Appendix B-1
   c. Appendix B-2
   d. State and local data

6. Which of the following can be used to estimate $PM_{2.5}$ emissions based on the PM_{10} emissions?
   a. AP-42
   b. FIRE
   c. The PM Calculator
   d. CHIEF

7. The best approach to calculating a total nonpoint source activity level is to base it on _____.
   a. activity data
   b. emissions data
   c. geographical location
   d. population data

8. The geographical level of the point source adjustment is important when _____ data is used to allocate total state activity to the county level.
   a. employment
   b. population
   c. square mileage
   d. All of the above

9. Adjustments made to the county level nonpoint source estimates should be based on _____.
   a. data obtained from the sources
   b. the experience of the agency personnel
   c. data obtained from surveys
   d. All of the above

10. What is he appropriate action when the point source inventory includes sources with emissions below the CERR reporting thresholds?
   a. Nothing
   b. Include those sources in the nonpoint source inventory
   c. Include those sources in both the nonpoint source and pint source inventories
   d. Create a special category for these sources in the point source inventory

Review Answers

1. d. Filterable

2. c. Secondary PM precursors.

3. c. both a and b.

4. b. Method 201/201A

5. d. State and local data

6. c. The PM Calculator

7. a. activity data

8. d. All of the above

9. b. the experience of the agency personnel

10. b. Include those sources in the nonpoint source inventory