Question:
How does Ohio EPA, DAPC address condensable and non-condensable particulate matter when specifying permit emission limitations; conducting compliance demonstrations; and reporting emission fees?

Background:
In 1987, USEPA established new National Ambient Air Quality Standards (NAAQS) for PM10 which replaced the NAAQS for PM. In 1997, USEPA replaced the existing PM10 standard with a health based PM2.5 standard and retained the PM10 standard as a “coarse” standard protecting welfare. In 2006, U.S. EPA revised the 24-hour PM2.5 standard from 65 micrograms of particles per cubic meter (µg/m³) of air to 35 µg/m³. In 2012, U.S. EPA revised the primary annual PM2.5 standard from 15.0 µg/m³ to 12.0 µg/m³, retained the existing 24-hour PM2.5 standard at 35 µg/m³, retained the existing 24-hour PM10 standard at 150 µg/m³, and retained the current suite of secondary PM standards.

In 2005, U.S. EPA promulgated the initial PM2.5 nonattainment areas for the PM2.5 standards across the country, and in 2015, promulgated the nonattainment areas for the 2012 annual PM2.5 NAAQS.

Much of what constitutes PM2.5 is not directly emitted to the atmosphere, but is formed in the atmosphere by a chemical reaction between sulfur dioxide, oxides of nitrogen and organic and elemental carbon. Consequently, in order to reduce PM2.5 concentrations, regulators need to bring about reductions of SO2, NOx, and primary particulates until it can be demonstrated that the PM2.5 standards will be met.

In developing the State’s revised Implementation Plan to meet the PM2.5 standards, predictive modeling is performed, in part, to determine if the PM2.5 standards will be met. The modeling data considers the impact of primary PM2.5 emissions (the combination of filterable PM2.5 and condensable particulate matter).

While compliance with the applicable PM2.5 and PM10 NAAQS may consider the impact of primary PM2.5 and PM10 emissions, most of the USEPA’s NSPS and NESHAPS only regulate filterable particulate matter. This is also true for many of DAPC’s historic BAT determinations under OAC rule 3745-31-05. Since 2011, DAPC has only established primary PM2.5 and/or PM10 emission limitations for “significant” PSD or nonattainment NSR PM10 or PM2.5 sources and “significant” synthetic minor sources that are avoiding major NSR.

The following guidance attempts to clarify how DAPC will address the various forms of particulate matter when specifying permit emission limitations; conducting compliance demonstrations; and reporting emission fees.

Answer:
Please see the definitions included in Attachment A of this guidance.

Permitting/Compliance Demonstrations:
With respect to permit emission limitations and corresponding compliance demonstrations, Ohio EPA, DAPC addresses condensable and non-condensable particulate matter based upon the regulations applicable to the affected emissions unit.

Through OAC Chapter 3745-17, DAPC regulates particulate emissions, visible particulate emissions, and emissions of fugitive dust.

Particulate emissions are a subset of particulate matter emissions.

As collected and measured, particulate emissions would be classified as non-condensable particulate matter.

Particulate emissions are the filterable particulates (from heated sampling probe and filter) collected and measured by the procedures in USEPA Method 5. Please note that the filterable particulate also includes any material that condenses at or above the filtration temperature.

The particulate matter standards in OAC Chapter 3745-17 were developed, in part, based upon emission tests conducted in accordance with USEPA Method 5 and/or Method 17 (40 CFR Part 60, Appendix A). As such, any demonstration of compliance with the OAC Chapter 3745-17 particulate emission limitations is conducted using USEPA Method 5 (or approved alternative method – e.g., USEPA Method 17) where only the filterable particulate from the sampling train’s probe and filter is collected and measured.
In a similar manner, OAC Chapter 3745-17 only regulates a subset of visible emissions - visible particulate emissions. USEPA Method 9 is one of the approved methods that can be used to determine compliance with the OAC Chapter 3745-17 visible particulate emission limitations. While USEPA Method 9 can be used to determine the opacity of any visible emissions, it would not be appropriate to use the observed opacity of condensing organic emissions to assess compliance with a standard established solely for visible particulate emissions.

PM10 and PM2.5 definitions are referenced in OAC Chapter 3745-17; however, these definitions were related to the requirements for ambient air monitoring of particulates under OAC rule 3745-17-02 which was rescinded. Ambient monitoring for the appropriate forms of particulate matter is now addressed in OAC Chapter 3745-25.

Through OAC Chapter 3745-31, DAPC currently regulates particulate emissions, visible particulate emissions, emissions of fugitive dust, filterable particulate matter, primary particulate matter, primary PM10, and primary PM2.5.

Primary particulate matter emissions (the combination of filterable particulate matter and condensable particulate matter, as collected and measured by the appropriate USEPA Methods) represents the total particulate matter emissions released from a source to the atmosphere.

Primary PM10 emissions (the combination of filterable PM10 and condensable particulate matter); and primary PM2.5 emissions (the combination of filterable PM2.5 and condensable particulate matter) are subsets of particulate matter emissions.

Some of the older BAT determinations still regulate particulate emissions, visible particulate emissions, and emissions of fugitive dust based upon the timeframe the permits containing the BAT determinations were issued. The emission limitations/control measures tables cited BAT determinations under OAC rule 3745-31-05 and those determinations included the statement that BAT also included compliance with OAC rules 3745-17-07, 3745-17-11, etc. For these determinations, DAPC was still regulating particulate emissions. For the sources affected by these types of BAT determinations, the particulate compliance demonstrations should be conducted using the same methods that were used to establish the applicable emission limitations (i.e., USEPA Method 5 or 17).

Permits may also contain NSPS and NESHAPS (40 CFR Parts 60, and 61 and 63, respectively) particulate emission limitations. NSPS particulate emission limitations may be based upon only filterable particulate matter or could be based upon the summation of filterable particulate matter and condensable particulate matter. The NSPS for the asphalt roofing industry specifies that Method 5A be used for demonstrating compliance with the specified particulate emission limitation. This method only collects and measures filterable particulate matter. The NSPS for the fiberglass industry specifies that Method 5E be used for demonstrating compliance with the specified particulate emission limitation. This method collects and measures filterable particulate matter and condensable particulate matter. The NESHAPS for primary aluminum reduction plants specifies that Method 5 be used for demonstrating compliance with the applicable particulate emission limitation and that Method 315 be used for determining the polycyclic organic matter (organic matter extractable by methylene chloride as determined by Method 315).

To demonstrate compliance with NSPS or NESHAPS particulate emission limitations, the applicable subpart will specify the USEPA reference method(s) to be used (i.e., Methods 5, 5A, 5B, 5E, 5F, 5G, 5H, 5I, 17, 19, 29, 201, 201A, and/or 315) and the methods will collect and measure only filterable particulate matter or primary particulate matter, as appropriate.

Because the NAAQS regulate PM2.5 and PM10, any new source permit, in theory, must consider primary PM10 and/or PM2.5 for the purpose of applicability determinations, establishing permit limitations and/or restrictions, and for the purpose of demonstrating compliance with the established limitations and/or restrictions.

In addition, for any major stationary source and any major modification as defined by OAC Chapter 3745-31 with respect to each regulated NSR pollutant, except as otherwise allowed in the chapter, on or after January 1, 2011, all affected DAPC permits must consider primary PM10 and PM2.5 for the purpose of applicability determinations, establishing permit limitations and/or restrictions, and for the purpose of demonstrating compliance with the established limitations and/or restrictions in either attainment or nonattainment areas (OAC rules 3745-31-10 to 3745-31-20 and 3745-31-21 to 3745-31-27, respectively).

To demonstrate compliance with primary PM10 or primary PM2.5 emission limitations established under OAC Chapter 3745-31, USEPA Methods 201 or 201A and 202 would be the appropriate methods to use for the determination of primary PM10 or primary PM2.5 emissions from stationary sources.

For Method 201 (exhaust gas recycle procedure), a gas sample is isokinetically extracted from the source. An in-stack cyclone is used to separate PM greater than PM10, and an in-stack glass fiber filter is used to collect the PM10. To maintain isokinetic flow rate conditions at the tip of the probe and a constant flow rate through the cyclone, a clean, dried
portion of the sample gas at stack temperature is recycled into the nozzle. The particulate mass is determined gravimetrically after removal of uncombined water.

Method 201A (constant sampling rate procedure) is used to measure filterable particulate matter emissions equal to or less than a nominal aerodynamic diameter of 10 micrometers (PM10) and 2.5 micrometers (PM2.5). This method can be used to measure coarse particles (i.e., the difference between the measured PM10 concentration and the measured PM2.5 concentration). To measure PM10 and PM2.5, a sample of gas is extracted at a predetermined constant flow rate through an in-stack sizing device. The particle-sizing device separates particles with nominal aerodynamic diameters of 10 micrometers and 2.5 micrometers. After a sample is obtained, uncombined water is removed from the particulate, then a gravimetric analysis is used to determine the particulate mass for each size fraction.

Method 202 is used to measure condensable particulate matter emissions from stationary sources. This method includes procedures for measuring both organic and inorganic condensable particulate matter. For Method 202, the condensable particulate matter is collected in dry impingers after filterable PM has been collected on a filter maintained as specified in either Method 5, Method 17, or Method 201A. The organic and aqueous fractions of the impingers and an out-of-stack condensable particulate matter filter are then taken to dryness and weighed. The total of the impinger fractions and the condensable particulate matter filter represents the condensable particulate matter.

Method 202 can be used to measure emissions in stacks that have entrained droplets only when this method is combined with a filterable PM test method that operates at high enough temperatures to cause water droplets sampled through the probe to become vaporous.

The combined results from Methods 201 or 201A and 202 would yield primary PM10 or primary PM2.5.

There are some exceptions. If the stack gas temperature does not exceed 85 degrees F, Method 201 alone may be used to determine primary PM10 or primary PM2.5.

Methods 201 and 201A cannot be used to measure emissions in stacks where water droplets are present because the size separation of the water droplets may not be representative of the dry particle size released into the air. These water droplets normally contain particles and dissolved solids that become PM10 and PM2.5 following evaporation of the water.

To measure filterable PM10 and PM2.5 emissions in stacks where water droplets are known to exist, we recommend that you use Method 5.

To measure primary PM10 and PM2.5 emissions in stacks where water droplets are known to exist, we recommend that you use Method 5 in combination with Method 202.

**Condensable and non-condensable particulate matter quantification for emission fees and emission inventory reporting:**

The preferred method for determining the filterable particulate matter and condensable particulate matter emissions is through emission testing. Where emission testing cannot or will not be performed, emission factors may be used to quantify the filterable particulate matter and condensable particulate matter emissions. Filterable particulate matter and condensable particulate emission factors are available for certain operations and may be obtained from the following locations:


WebFIRE: [https://www.epa.gov/electronic-reporting-air-emissions/webfire](https://www.epa.gov/electronic-reporting-air-emissions/webfire)

PM Augmentation: [https://www.epa.gov/air-emissions-inventories/pm-augmentation](https://www.epa.gov/air-emissions-inventories/pm-augmentation)
Attachment A:

Definitions:

"Particulate matter" means any material, except water in uncombined form, that is or has been airborne, and exists as a liquid or a solid at standard conditions.

"Particulate emissions" means particulate matter measurable by the applicable test methods in 40 CFR Part 60, Appendix A, "Standards of Performance for New Stationary Sources".

"PM10" means particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers.

"PM10 emissions" means finely divided solid or liquid material, with an aerodynamic diameter less than or equal to a nominal ten micrometers that is or has been emitted to the ambient air as measured by an applicable reference method, or an equivalent or alternative method, specified in 40 CFR Part 51, Appendix M.

"PM2.5" means particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers.

"PM2.5 emissions" means finely divided solid or liquid material, with an aerodynamic diameter less than or equal to nominal 2.5 micrometers that is or has been emitted to the ambient air as measured by an applicable reference method, or an equivalent or alternative method, specified in 40 CFR Part 51, Appendix M.

"Fugitive dust" means particulate matter which is emitted from any source by means other than a stack.

"Filterable particulate matter" means particles that are emitted directly by a source as a solid or liquid at stack or release conditions and captured in the probe and on the filter of a stack test train.

"Condensable particulate matter" (CPM) means material that is vapor phase at stack conditions, but condenses and/or reacts upon cooling and dilution in the ambient air to form solid or liquid particulate matter immediately after discharge from the stack. Note that all condensable particulate matter is assumed to be in the PM2.5 size fraction.

"Primary particulate matter" (also known as direct particulate matter) means particles that enter the atmosphere as a direct emission from a stack or an open source. Primary particulate matter comprises two components: filterable particulate matter and condensable particulate matter. These two particulate matter components have no upper particle size limit.

"Primary PM10" (also known as direct PM10, total PM10, PM10, or the combination of filterable PM10 and condensable particulate matter) means particulate matter with an aerodynamic diameter equal to or less than 10 micrometers.

"Primary PM2.5" (also known as direct PM2.5, total PM2.5, PM2.5, or combined filterable PM2.5 and condensable particulate matter) means particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers. These solid particles are emitted directly from an air emissions source or activity, or are the gaseous emissions or liquid droplets from an air emissions source or activity that condense to form particulate matter at ambient temperatures. Direct PM2.5 emissions include elemental carbon, directly emitted organic carbon, directly emitted sulfate, directly emitted nitrate, and other inorganic particles (including but not limited to crustal material, metals, and sea salt).

"PM2.5 direct emissions" means solid particles, with an aerodynamic diameter less than or equal to nominal 2.5 micrometers, emitted directly from an air emissions source or activity, or gaseous emissions or liquid droplets from an air emissions source or activity which condense to form particulate matter at ambient temperatures. Direct PM2.5 emissions include elemental carbon, directly emitted organic carbon, directly emitted sulfate, directly emitted nitrate, and other inorganic particles (including but not limited to crustal material, metals).

"Criteria pollutant" means PM10, PM2.5, nitrogen oxides, VOCs, sulfur dioxide, carbon monoxide, lead or any other air pollutant for which a national ambient air quality standard has been promulgated under Section 109 of the Clean Air Act.

"Regulated NSR pollutant" means the following:

(1) For stationary sources located in a nonattainment area for a given regulated air pollutant:

(a) Nitrogen oxides or any VOCs.

(b) Any pollutant for which a national ambient air quality standard has been promulgated.

(c) Any pollutant that is identified under this paragraph as a constituent or precursor of a general pollutant listed under paragraph (NNNNN)(1)(a) or (NNNNN)(1)(b) of this rule, provided that such constituent or precursor pollutant may only
be regulated under NSR as part of regulation of the general pollutant. Precursors identified by the director for purposes of new source review are the following:

(i) VOCs and nitrogen oxides are precursors to ozone in all ozone nonattainment areas.
(ii) Sulfur dioxide is a precursor to PM2.5 in all PM2.5 nonattainment areas.
(iii) Nitrogen oxides are a precursor to PM2.5 in all PM2.5 nonattainment areas.

(d) PM2.5 emissions and PM10 emissions shall include gaseous emissions from a source or activity which condense to form particulate matter at ambient temperatures. On or after January 1, 2011, such condensable particulate matter shall be accounted for in all permit applications for PM2.5 and PM10 in nonattainment new source review permits. Compliance with emissions limitations for PM2.5 and PM10 issued prior to this date shall not be based on condensate particulate matter unless required by the terms and conditions of the permit or the applicable implementation plan. Applicability determinations made prior to this date without accounting for condensate particulate matter shall not be considered in violation of this section unless the applicable implementation plan required condensate particulate matter to be included.

(2) For stationary sources located in an attainment area for a given regulated air pollutant, the following:
(a) Any pollutant for which a national ambient air quality standard has been promulgated. This includes, but is not limited to, any of the following:
(i) PM2.5 emissions and PM10 emissions shall include gaseous emissions from a source or activity which condense to form particulate matter at ambient temperatures. On or after January 1, 2011, such condensable particulate matter shall be accounted for in all permit applications for PM2.5 and PM10 in PSD permits. Compliance with emissions limitations for PM2.5 and PM10 issued prior to this date shall not be based on condensable particulate matter unless required by the terms and conditions of the permit or the applicable implementation plan. Applicability determinations made prior to this date without accounting for condensable particulate matter shall not be considered in violation of this section unless the applicable implementation plan required condensable particulate matter to be included.
(ii) Sulfur dioxide is a precursor to PM2.5 in all attainment and unclassifiable areas.
(c) Nitrogen oxides are a precursor to PM2.5 in all attainment and unclassifiable areas.
(b) Any pollutant that is subject to any standard promulgated under Section 111 of the Clean Air Act;
(c) Any Class I or II substance subject to a standard promulgated under or established by Title VI of the Clean Air Act; or
(d) Any pollutant that otherwise is subject to regulation under the Clean Air Act; except that any or all HAPs either listed in Section 112 of the Clean Air Act or added to the list pursuant to Section 112(b)(2) of the Clean Air Act, which have not been delisted pursuant to Section 112(b)(3) of the Clean Air Act, are not regulated NSR pollutants unless the listed HAP is also regulated as a constituent or precursor of a general pollutant listed under Section 108 of the Clean Air Act.

"Significant air contaminant source" or "significant air contaminant source project" means any air contaminant source, or air contaminant source project, that emits the following:

(1) Greater than one hundred tons per year of any of the following air contaminants:
(a) PM10.
(b) PM2.5.
(c) Sulfur dioxide.
(d) Nitrogen oxides.
(e) OCs.

(2) Greater than one thousand tons per year of carbon monoxide.
(3) Greater than two tons per year of lead.

"Significant" means, in reference to a net emissions increase or the potential of a stationary source to emit any of the following air pollutants, a rate of emissions that would equal or exceed any of the following rates:

<table>
<thead>
<tr>
<th>Air Pollutant</th>
<th>Emission Rate (Ton(s)/Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon monoxide</td>
<td>100</td>
</tr>
<tr>
<td>Nitrogen oxides</td>
<td>40</td>
</tr>
<tr>
<td>Sulfur dioxide</td>
<td>40</td>
</tr>
<tr>
<td>Particulate matter</td>
<td>25</td>
</tr>
<tr>
<td>PM10</td>
<td>15</td>
</tr>
<tr>
<td>PM2.5</td>
<td>10 (of direct PM2.5 emissions); 40 (sulfur dioxide emissions); 40 (nitrogen oxides emissions)</td>
</tr>
<tr>
<td>Ozone (VOCs or nitrogen oxides)</td>
<td>40</td>
</tr>
<tr>
<td>Lead</td>
<td>0.6</td>
</tr>
<tr>
<td>Fluorides (excluding hydrogen fluoride)</td>
<td>3</td>
</tr>
<tr>
<td>Sulfuric acid mist</td>
<td>7</td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>10</td>
</tr>
<tr>
<td>TRS</td>
<td>10</td>
</tr>
<tr>
<td>RSCs</td>
<td>10</td>
</tr>
<tr>
<td>NMOCs from municipal waste landfills</td>
<td>50</td>
</tr>
</tbody>
</table>

(a) Municipal waste combustor organic (measured as total tetra- through octachlorinated dibenzo-p-dioxins and dibenzofurans): 3.2 grams per year (0.007055 pound per year).

(b) Municipal waste combustor metals (measured as particulate matter): 14 megagrams per year (15 tons per year).

(c) Municipal waste combustor acid gases (measured as sulfur dioxide and hydrogen chloride): 36 megagrams per year (40 tons per year).

"Significant", in reference to a net emissions increase or the potential of a stationary source to emit a regulated NSR pollutant that the air pollutant and emission rate table in paragraph (VVVVV)(1) of this rule does not list, any emission rate.

Notwithstanding paragraph (VVVVV)(1) of this rule ["Significant air contaminant source"... above], "significant" means any emission rate or any net emissions increase associated with a major stationary source or major modification that would be constructed within ten kilometers of a Class I area, and have an impact on such area equal to or greater than one microgram per cubic meter (24-hour average).

"Significant emissions increase" means, for a regulated NSR pollutant, an increase in emissions that is significant, as defined in this rule, for that pollutant.

Ambient Terms

"PM10" means particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers as measured either by a reference method that is based on 40 CFR Part 50, Appendix J and designated in accordance with 40 CFR Part 53 or by an equivalent method designated in accordance with 40 CFR Part 53.

"PM2.5" means particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers as measured by a reference method based on 40 CFR Part 50, Appendix L and designated in accordance with 40 CFR Part 53 or an equivalent method designated in 40 CFR Part 53.
Engineering Guide #74

Contact
For more information, contact Michael Hopkins at michael.hopkins@epa.ohio.gov or (614) 644-2270.