PM Testing Methods – Methods 5, 17, 201A and 202

Dan Deatsch – Thompson Environmental Consulting
Overview

- Three methods for testing particulate matter emissions
  - **Method 5 and 17** – Particulate Matter Emissions
  - **Method 201A** – PM10 and PM2.5 Emissions
  - **Method 202** – Condensable Particulate Matter
Method 5

- This method is used for the measurement of particulate emissions that are condensable above the filter temperature.

- Filter Temperature in Method 5 is 250°F (±25°C)

- This method is generally paired with Method 202 to collect all particulate emissions from the source.
Method 5 Summary

- Sample is extracted isokinetically from the stack – at the same rate as the stack flow
- Samples are taken on a traverse across the stack with airflow being measured simultaneously
- Sample is drawn through a heated probe then through a heated filter into an impinger train
- The impinger train collects moisture to determine water content of stack gas
Method 5 Sample Train
Method 5 Sampling

- Sample is extracted from the stack exhaust over a period long enough to collect 50 mg of sample material
- EPA Method 2 is used to determine airflow from the stack
- EPA Method 3 or 3A is used to determine O2 and CO2 content of the stack gas
- EPA Method 4 is used to determine moisture content of the gas
Method 5 Recovery

- Filters are recovered from the train
- Probe, nozzle, and filter housing are washed to collect PM residue
- Impinger water is measured and silica gel weighed to determine moisture content
Method 5 Lab Analysis

- Filters are dried and weighed gravimetrically to determine PM weight.
- Probe, nozzle, and filter rinse is dried to determine PM weight
- Weight of PM, airflow and gas density are used to calculate the grains per scf and lb/hr of PM emissions
Method 17

- Method 17 is comparable to Method 5 except that in this method, the filter housing is kept in stack to keep the filter at stack temperature.

- This method is generally used on low moisture sources as higher moisture in the sample gas can cause issues with filter blockage and damage.
Method 201A – PM10 and PM2.5

- Method 201A is similar in concept to Method 5 in that it draws air through the sample train to collect particulate matter.
- Sample is drawn through either one or both of the PM10 and PM2.5 cyclones dependent on which size particulate matter is being sampled.
Method 201A Train Diagram
PM10 Cyclone
PM10 and PM2.5 Cyclones in Series
PM10 and PM2.5 Collection

- The first cyclone in the series is designed to cut particulate at the level of PM10 sizing. Particulate collected from this cyclone after sampling is >10 microns.

- The second cyclone cuts the particulate at the level of PM2.5 sizing. Particulate collected from this cyclone after sampling is > 2.5 microns but <10 microns.

- Particulate on the filter, filter housing wash, and in the impinger train is classified as ≤ to PM2.5 emissions.
Method 201A Notes

- Sampling time for M201A is longer than that of Method 5 or 201A because the sampling rate is lower to maintain cyclone efficiency.
- Sample rate is constant during the sampling to maintain cyclone efficiency.
- This method is not to be used with sample gas that includes entrained water droplets. These water droplets can be larger than the cut sizes for the cyclones but contain particulate less than the cut sizes.
Method 201A Notes

- Small diameter ducts (generally less than 18 inches for PM10 testing and less than 26.5 inches for combined PM10 and PM2.5 testing) should not be tested with these methods due to blockage of the exhaust stream by the sampling equipment.
Method 202

- Method 202 is used to determine condensable particulate matter emissions after the sample gas has been drawn through filters and/or cyclones in the previous methods.

- Water is collected from an impinger train, separated into organic and aqueous fractions, dried and weighed to determine particulate emissions.

- A CPM filter is also used in the train and is weighed after being dried.
Method 202 Diagram

Figure 1. Schematic of Condensable Particulate Sampling Train
Method 202 Recent Revisions

- Eliminates the use of water as a collection agent in the impingers
- Adds a condenser after the probe and filter from the sampling train before the gas enters the water dropout impinger
- A condensable particulate matter (CPM) filter has been added after the water dropout impinger and first modified Greenburg Smith impinger
Method 202 Notes

- The water from the method is also weighed to determine moisture content of the stack gas.
- The method requires that the CPM filter temperature is maintained between 65° F and 85° F during the test.
General Testing Notes

- Testing on sources must be done at 90% or greater of the rated capacity of the source according to IDNR policy.

- Sample ports for particulate testing should be 6 inches in diameter. They are ideally positioned at 8 stack diameter equivalents upstream of any disturbance and 2 diameter downstream of any disturbance. The minimum allowed distance upstream is 2 diameters and $\frac{1}{2}$ diameter downstream. Port locations are determined by EPA Method 1.
Questions?