Indiana Department of Environmental Management

2017 Fine Particles (PM$_{2.5}$) Summary Report

Office of Air Quality
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www.IN.gov/idem/airquality/2391.htm
About This Report

The Indiana Department of Environmental Management (IDEM) collects and analyzes air samples to monitor for regulated pollutants, including fine particles referred to as PM$_{2.5}$. Monitoring and reporting of PM$_{2.5}$ occurs on a year-round basis, as mandated by the U.S. Environmental Protection Agency (U.S. EPA). This 2017 Fine Particles (PM$_{2.5}$) Summary Report provides an overview of PM$_{2.5}$, including 2017 data and air quality trends over the past 10 years (2008-2017).

The following information is included in this report:

• General information about PM$_{2.5}$ (slides 3-5)
• Overview of PM$_{2.5}$ air health standards and requirements (slides 6-8)
• Overview of Indiana’s PM$_{2.5}$ monitoring network (slides 9-11)
• Summary of 2017 PM$_{2.5}$ monitoring data (slides 12-14)
• PM$_{2.5}$ air quality trends over the last 10 years (slides 15-19)
• Status of PM$_{2.5}$ designations (slides 20-22)
• Links for additional information (slide 23)
• Contact information (slide 24)
Particulate matter is a complex mixture of small particles found in the air, including dust, dirt, smoke, and liquid droplets. PM$_{10}$ refers to very small particles that are 10 micrometers, or microns, in diameter or smaller. PM$_{2.5}$ refers to small particles that are 2.5 microns or smaller.
Sources of particulate matter (PM) include all types of combustion activities:

- Motor vehicles, coal-fired power plants, open burning, etc.
- Certain industrial processes.
What are the Health Effects of PM?

Small enough to be inhaled deep into the lungs, these tiny airborne particles have been linked to:

• Increased respiratory symptoms:
  - Irritation of the airways.
  - Coughing or difficulty breathing.
  - Decreased lung function.
  - Aggravated asthma.
  - Development of chronic bronchitis.

• Irregular heartbeats.

• Nonfatal heart attacks.

• Premature death in people with heart or lung disease.
National Ambient Air Quality Standards (NAAQS) for PM$_{2.5}$

The federal Clean Air Act requires U.S. EPA to establish National Ambient Air Quality Standards (NAAQS) for certain pollutants, including particulate matter (PM). NAAQS are also known as air health standards.

Primary and secondary NAAQS established in 1971 set the first limits for total suspended particles (TSP). Since then, the NAAQS for fine particles have been reviewed periodically and revised. Standards for particles 10 microns in diameter and smaller, referred to as PM$_{10}$, were established in 1987. Standards for PM$_{2.5}$ were first established in 1997.

**Primary Standards** - Primary NAAQS set limits to protect public health, including the health of “sensitive” populations such as individuals with asthma, children and the elderly.

**Secondary Standards** - Secondary NAAQS set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.
History of the PM$_{2.5}$ NAAQS

- **1971**: U.S. EPA issued first NAAQS for Total Suspended Particles (TSP) with annual limit of 15 µg/m$^3$ and 24-hour limit of 65 µg/m$^3$.
- **1977**: Industry and state governments challenged NAAQS.
- **1987**: U.S. EPA revised the NAAQS and replaced TSP with PM$_{10}$.
- **1997**: D.C. Circuit Court rejected all remaining legal challenges to the 1997 NAAQS.
- **2001**: U.S. Supreme Court upheld U.S. EPA's authority to enforce the Clean Air Act and rules, U.S. EPA not allowed to consider cost.
- **2002**: D.C. Circuit Court remanded the 2006 PM$_{2.5}$ NAAQS to U.S. EPA for reconsideration, but did not vacate the standards.
- **2006**: U.S. EPA strengthened the annual primary PM$_{2.5}$ NAAQS to 12 µg/m$^3$ and retained the existing secondary standard at 15 µg/m$^3$ and the existing 24-hour NAAQS at 35 µg/m$^3$.
- **2009**: U.S. EPA strengthened the 24-hour NAAQS to 35 µg/m$^3$ and retained the existing annual standard at 15 µg/m$^3$.
- **2012**: U.S. EPA strengthened the 24-hour NAAQS to 35 µg/m$^3$ and retained the existing annual standard at 15 µg/m$^3$.

$\mu g/m^3 = $ micrograms per cubic meter
Attaining the PM$_{2.5}$ NAAQS

Air quality must meet both an annual standard and a 24-hour, or daily, standard for PM$_{2.5}$. Three complete, consecutive years of monitoring data is used to make a determination about a given area. For example, an evaluation in 2018 will be based on data from 2015 to 2017.

**Primary Annual Standard** - For the primary annual standard, measured concentrations are averaged on an annual rolling basis. Air quality meets the 2012 standard when the three-year average of the annual mean does not exceed 12 micrograms per cubic meter ($\mu$g/m$^3$). The data from each monitor is evaluated.

**Primary 24-Hour Standard** - For the primary daily standard, measured concentrations are averaged on a 24-hour rolling basis. Air quality meets the standard when the three-year average of the 98$^{th}$ percentile of measured concentrations does not exceed 35 $\mu$g/m$^3$. The data from each monitor is evaluated.

**Design Values** - The three-year averages are referred to as Design Values.

**The Difference Between an Exceedance and a Violation** - When a monitor records a concentration above the limit established by the standard, it is referred to as an exceedance. A monitor can have an exceedance without being in violation of the standard. However, if a monitor’s three-year Design Value exceeds the standard, the monitor is in violation.
2017 PM$_{2.5}$ Monitoring Network

**Placement**
- U.S. EPA provides guidance on placement of monitors.
- Monitor placement is based on population density and manufacturing levels.
- Indiana conducts an annual review of its ambient air monitoring network plan.

**Monitors**
- IDEM operated 32 annual fine particle monitors in 23 counties across Indiana.
- IDEM operated 35* 24-hour fine particle monitors in 23 counties across Indiana.

**Calculating the Design Value**
- A monitor’s Design Value is calculated at the end of the year, once all of the data has been quality assured.
  - Annual Design Value: three-year average of the weighted annual mean PM$_{2.5}$ concentrations.
  - 24-Hour Design Value: three-year average of the 98$^{th}$ percentile of 24-hour concentrations.

* Three monitoring sites reflect air quality in a relatively small area, are directly influenced by a specific source, and are intended to be used for attainment status under the 24-hour standard only.
Air Quality Action Days:
No Air Quality Action Days were issued for PM$_{2.5}$. (Indiana and local, state and regional partners analyze data and issue air quality forecasts year-round. Air Quality Action Days are issued when poor air quality is forecasted.)

Exceedances:
Exceedances were recorded on three days. Exceedance is the term for a concentration that is recorded above the standard.

Quality Assured Monitoring Data:
• No monitor had an annual mean of PM$_{2.5}$ concentrations above the current primary annual standard of 12 micrograms per cubic meter (µg/m$^3$).
• No monitor had a daily 98$^{th}$ percentile of 24-hour PM$_{2.5}$ concentrations above the current primary 24-hour standard of 35 µg/m$^3$.

Quality Assured Monitoring Data for the 2015–2017 Three-Year Timeframe:
• No monitor had an annual Design Value (the average of the annual mean of PM$_{2.5}$ concentrations over a three year period) above 12 µg/m$^3$.
• No monitor had a 24-hour Design Value (the average of the 98$^{th}$ percentile of 24-hour PM$_{2.5}$ concentrations over a three year period) above 35 µg/m$^3$.
• More monitoring data is found on slides 13 and 14.
PM$_{2.5}$ 24-Hour Design Values 2015 - 2017

Standard set at 35.0 µg/m$^3$

Legend

- PM$_{2.5}$ Monitor With Design Value Less Than or Equal to the Standard

Notes:
- Map excludes monitors with incomplete data and/or less than three full years of monitor data.
- Posted data are in units of micrograms per cubic meter (µg/m$^3$).

Mapped By: C. Mitchell, OAQ
Date: 04/30/2018
Source: IDEM, Air Monitoring
Map Projection: UTM Zone 16 N
Map Datum: NAD83
PM$_{2.5}$ Air Quality Trends

Monitoring data shows significant improvements in Indiana’s air quality over the past 10 years. The following four slides provide illustrations.
PM$_{2.5}$ Air Quality Trends – Annual NAAQS
Annual Average Mean Values (2008-2017)

µg/m$^3$ = micrograms per cubic meter
PM$_{2.5}$ Air Quality Trends – Annual NAAQS

Chart excludes monitors with incomplete data and/or less than three full years of monitoring data.
$\mu g/m^3 = \text{micrograms per cubic meter}$
PM$_{2.5}$ Air Quality Trends – 24-hour NAAQS
98$^{th}$ Percentile Values (2008-2017)

µg/m$^3$ = micrograms per cubic meter
PM$_{2.5}$ Air Quality Trends – 24-hour NAAQS

Chart excludes monitors with incomplete data and/or less than three full years of monitoring data.
µg/m$^3$ = micrograms per cubic meter
PM$_{2.5}$ Designations

When a new NAAQS is issued, the implementation process begins. The first step is to identify any areas that do not meet the new standard. This is referred to as the designation process. U.S. EPA is responsible for designating areas that do not meet the standard. IDEM works to ensure that the designations are appropriate and that Indiana receives formal recognition for its achievements under the standards.

1997 Standards - PM$_{2.5}$ was regulated for the first time under standards issued in 1997. Designations were completed several years later, in April of 2005, following the resolution of legal challenges to the new standards. Although 12 counties and five townships in Indiana were initially designated as “nonattainment”, subsequent monitoring data showed compliance. Indiana submitted petitions for the redesignation of all 17 areas. All areas have since been reclassified to “attainment”.

2006 Standards - The 24-hour standard was strengthened in 2006. No areas of Indiana were designated as “nonattainment.” All areas were designated as unclassifiable/attainment and remain in compliance today.
PM$_{2.5}$ Designations (Cont.)

2012 Standards – U.S. EPA’s most recent revision in 2012 strengthened the annual primary standard. Data for the most recent three-year timeframe indicates that all measured air in Indiana meets the 2012 standards (see slide 13). At the time of this report, all Indiana counties are listed as “unclassifiable/attainment”, with the exception of the following two areas.

- Clark and Floyd counties - When U.S. EPA designated areas for the revised PM$_{2.5}$ standard, based on 2012 – 2014 data, Clark and Floyd counties were in attainment of the standard. However, due to uncertainties within the Louisville, KY monitoring network, U.S. EPA was unable to determine whether Clark and Floyd counties were contributing to a potential violation in the Louisville area. As such, U.S. EPA designated them as “unclassifiable”.

In 2013, Kentucky began collecting valid PM$_{2.5}$ data. Certified monitoring data for the years 2015 – 2017 demonstrated attainment of the 2012 standard. All monitors in the Louisville area demonstrate attainment of the standard. As such, IDEM is in the process of preparing a request to redesignate Clark and Floyd counties from “unclassifiable” to “unclassifiable/attainment”.

PM$_{2.5}$ Designations (Cont.)

- Lake and Porter counties - When U.S. EPA designated areas for the revised PM$_{2.5}$ standard, based on 2011 – 2013 data, Lake and Porter counties were in attainment of the standard. However, due to uncertainties within the Chicago, IL monitoring network, U.S. EPA was unable to determine whether Lake and Porter counties were contributing to a potential violation in the Chicago area. As such, U.S. EPA designated them as “unclassifiable”.

Indiana continues to demonstrate attainment of the standard for monitors in Lake and Porter counties. However, several monitors within the Chicago, IL monitoring network for the years 2015, 2016 and 2017 did not satisfy completeness criteria and are considered invalid. Therefore it is still undetermined whether Lake and Porter counties are contributing to a potential violation in the Chicago area.
Additional Information

• For additional PM$_{2.5}$ monitoring information, visit IDEM’s website: www.IN.gov/idem/airquality/2346.htm

• For additional information regarding the designation process or Indiana’s redesignation petitions and maintenance plans, visit www.IN.gov/idem/airquality/2342.htm

• For additional information regarding the NAAQS for fine particles, visit U.S. EPA’s Particulate Matter (PM) Standards website: https://www.epa.gov/naaqs
Contact

Please feel free to direct questions or comments to Ms. Catherine Mitchell with IDEM’s Office of Air Quality at (800) 451-6027 (toll free), (317) 234-6530 (direct), or cmitchel@idem.IN.gov.