



Indiana Department of Environmental Management

*Protecting Hoosiers and Our Environment Since 1986*

*Office of Air Quality*



# Indiana Department of Environmental Management

## 2017 Fine Particles (PM<sub>2.5</sub>) Summary Report

*Office of Air Quality*

*(800) 451-6027*

[www.IN.gov/idem/airquality/2391.htm](http://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<sub>2.5</sub>. Monitoring and reporting of PM<sub>2.5</sub> occurs on a year-round basis, as mandated by the U.S. Environmental Protection Agency (U.S. EPA). This **2017 Fine Particles (PM<sub>2.5</sub>) Summary Report** provides an overview of PM<sub>2.5</sub>, 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<sub>2.5</sub> (*slides 3-5*)
- Overview of PM<sub>2.5</sub> air health standards and requirements (*slides 6-8*)
- Overview of Indiana's PM<sub>2.5</sub> monitoring network (*slides 9-11*)
- Summary of 2017 PM<sub>2.5</sub> monitoring data (*slides 12-14*)
- PM<sub>2.5</sub> air quality trends over the last 10 years (*slides 15-19*)
- Status of PM<sub>2.5</sub> designations (*slides 20-22*)
- Links for additional information (*slide 23*)
- Contact information (*slide 24*)



# What Is Particulate Matter (PM)?

Particulate matter is a complex mixture of small particles found in the air, including dust, dirt, smoke, and liquid droplets. PM<sub>10</sub> refers to very small particles that are 10 micrometers, or microns, in diameter or smaller. PM<sub>2.5</sub> refers to small particles that are 2.5 microns or smaller.

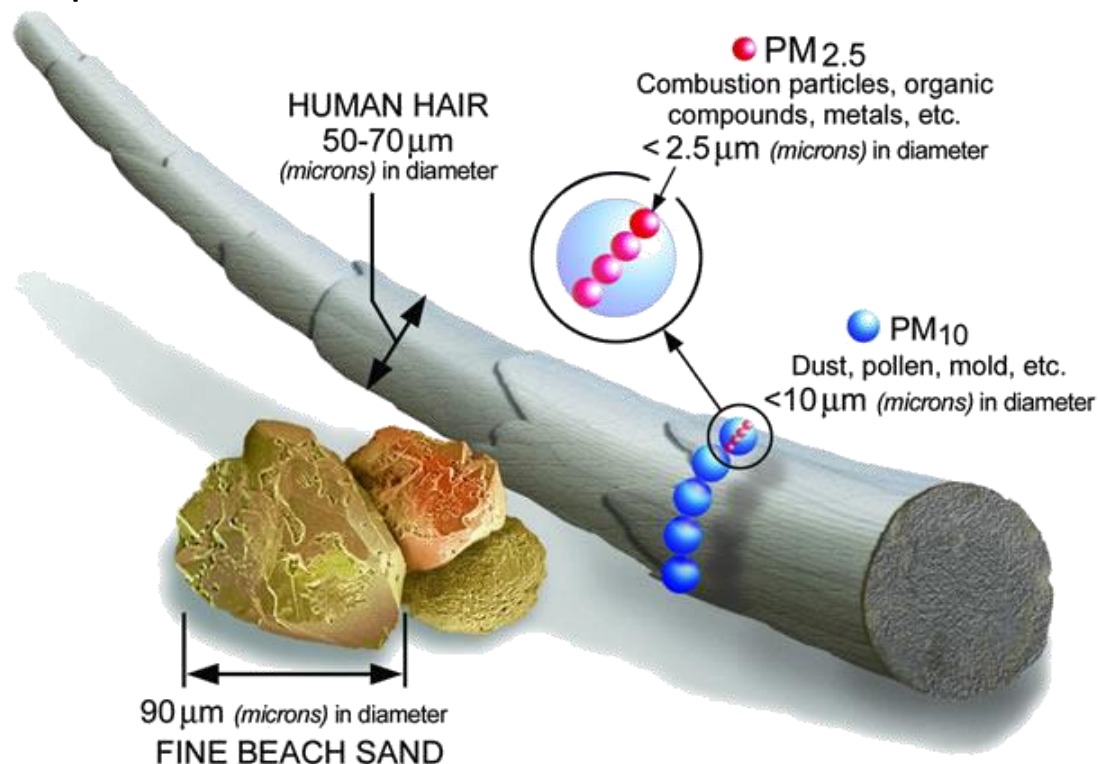


Image courtesy of the U.S. EPA



# Where Does PM Come From?

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<sub>2.5</sub>

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.

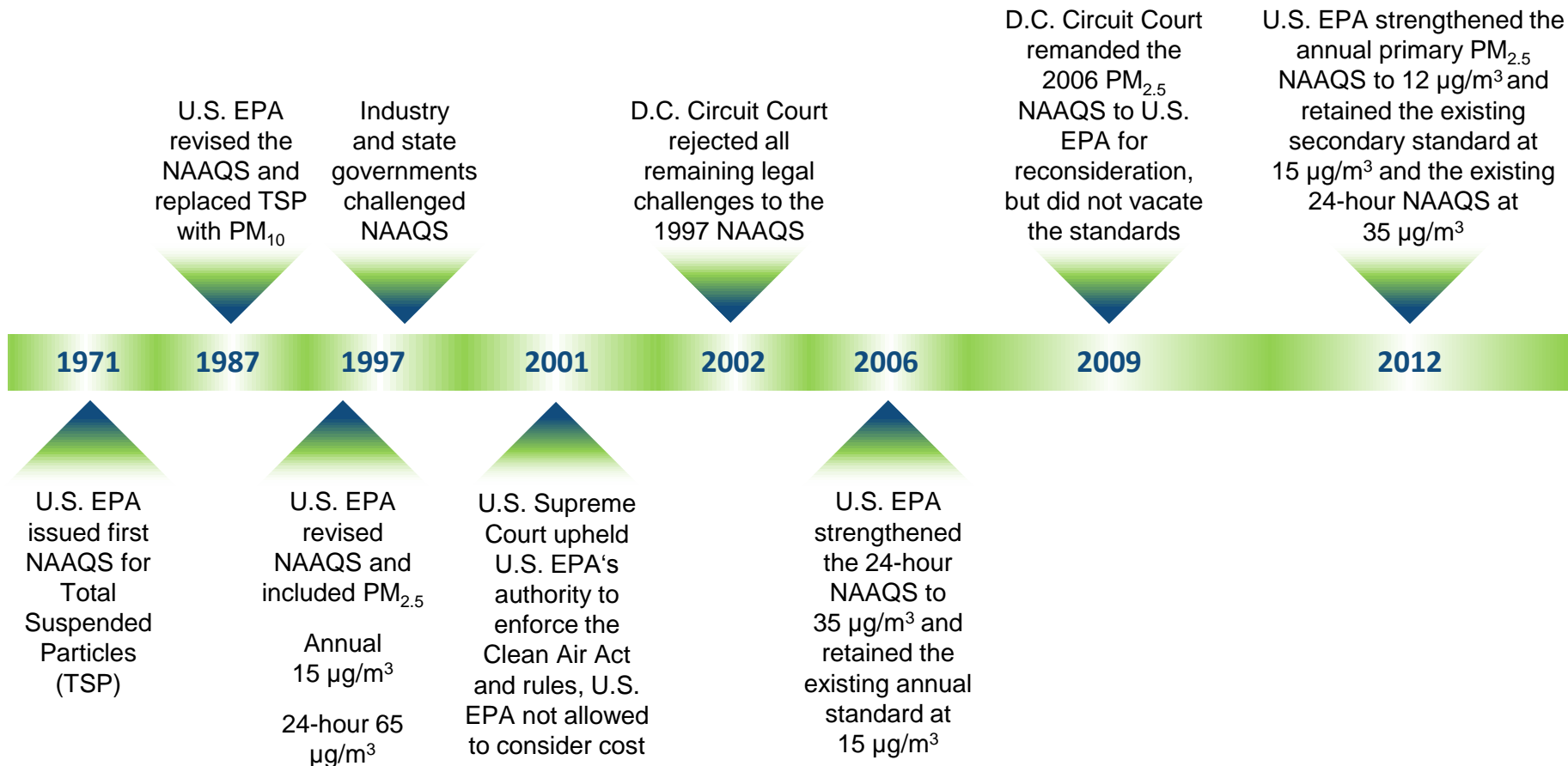
Primary and secondary NAAQS established in 1971 set the first limits for total suspended particles (TSP). Since then, the NAAQS for fine particles have been reviewed periodically and revised. Standards for particles 10 microns in diameter and smaller, referred to as PM<sub>10</sub>, were established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





# Attaining the PM<sub>2.5</sub> NAAQS

Air quality must meet both an annual standard and a 24-hour, or daily, standard for PM<sub>2.5</sub>. 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 ( $\mu\text{g}/\text{m}^3$ ). 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<sup>th</sup> percentile of measured concentrations does not exceed 35  $\mu\text{g}/\text{m}^3$ . 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<sub>2.5</sub> 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<sub>2.5</sub> concentrations.
  - 24-Hour Design Value: three-year average of the 98<sup>th</sup> 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.



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## Legend

 PM<sub>2.5</sub> Annual Design Value Monitor

 County



0 25 50 mi  
0 25 50 km

### Notes:

Map shows active PM<sub>2.5</sub> monitors, not those that were discontinued or are pending installation.

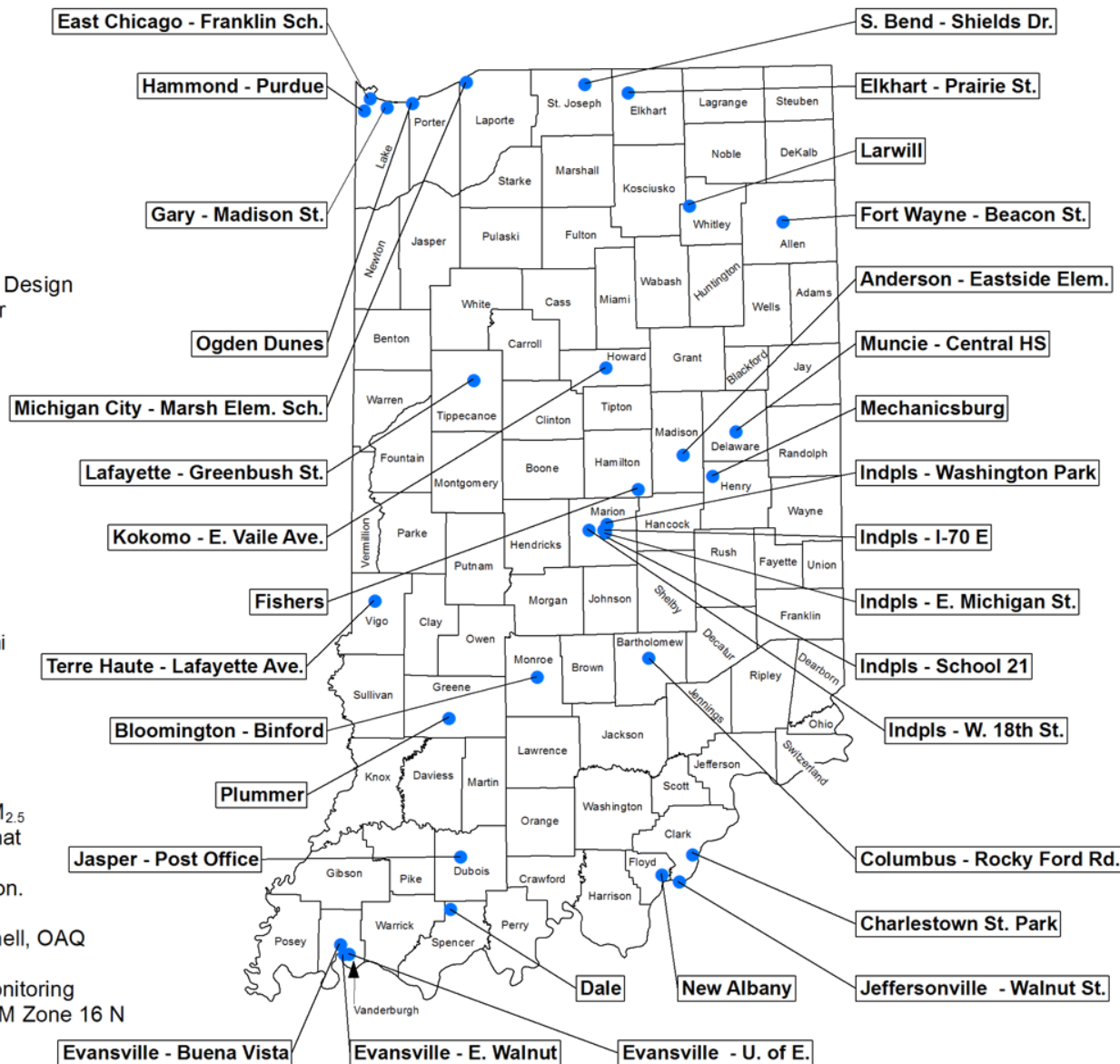
Mapped By: C. Mitchell, OAQ

Date: 04/16/2018

Source: IDEM Air Monitoring

Map Projection: UTM Zone 16 N

Map Datum: NAD83





## 2017 PM<sub>2.5</sub> Annual Ambient Air Monitoring Network



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**Legend**

 PM<sub>2.5</sub> 24-Hour Monitor

 County



0 25 50 mi  
0 25 50 km

**Notes:**

Map shows active PM<sub>2.5</sub> monitors, not those that were discontinued or are pending installation.

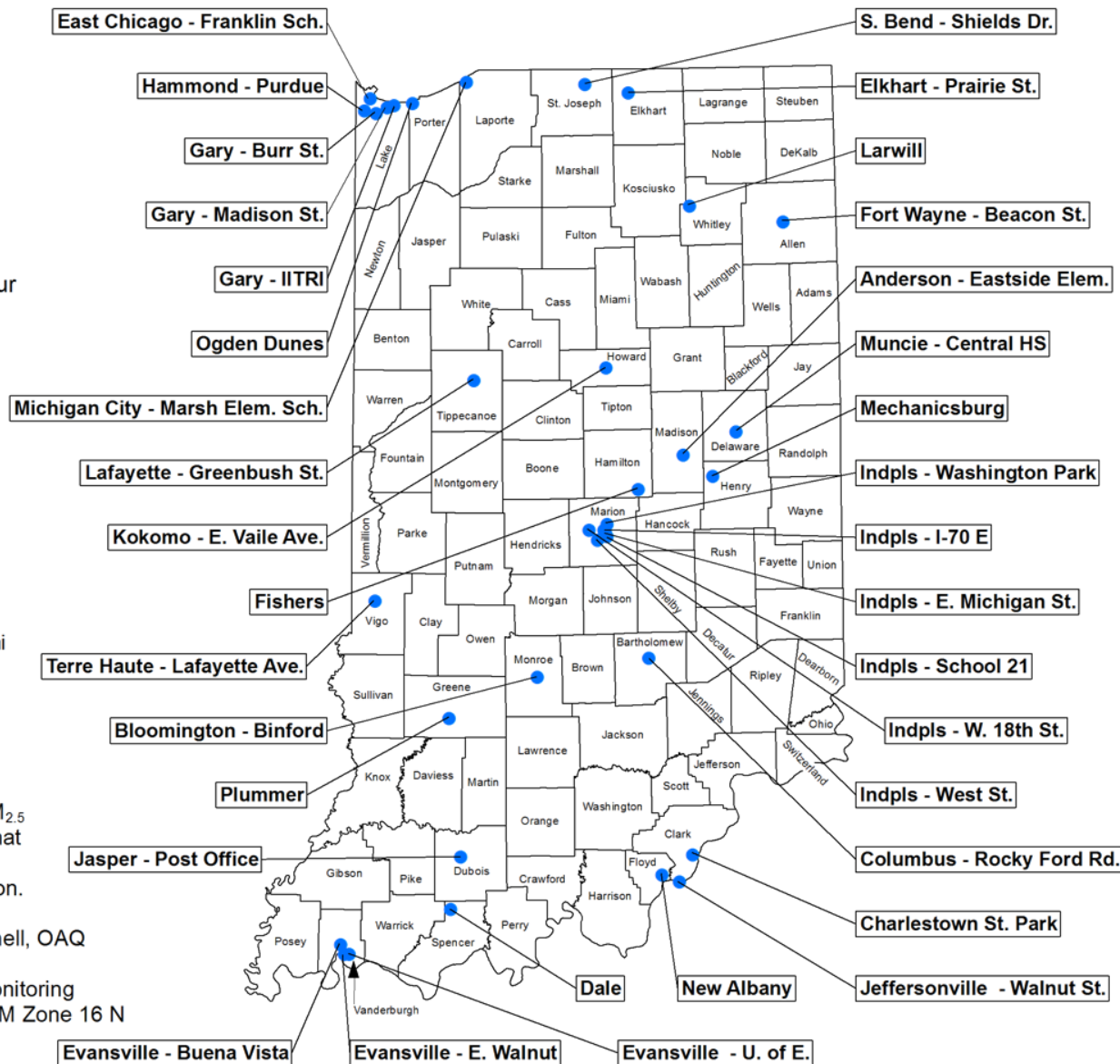
**Mapped By:** C. Mitchell, OAQ

**Date:** 04/16/2018

**Source:** IDEM Air Monitoring

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**2017  
PM<sub>2.5</sub>  
24-Hour  
Ambient Air  
Monitoring  
Network**



# 2017 PM<sub>2.5</sub> Monitoring Data Summary

## Air Quality Action Days:

No Air Quality Action Days were issued for PM<sub>2.5</sub>. *(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<sub>2.5</sub> concentrations above the current primary annual standard of 12 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ).
- No monitor had a daily 98<sup>th</sup> percentile of 24-hour PM<sub>2.5</sub> concentrations above the current primary 24-hour standard of 35  $\mu\text{g}/\text{m}^3$ .

## Quality Assured Monitoring Data for the 2015–2017 Three-Year Timeframe:

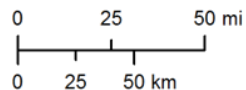
- No monitor had an annual Design Value *(the average of the annual mean of PM<sub>2.5</sub> concentrations over a three year period)* above 12  $\mu\text{g}/\text{m}^3$ .
- No monitor had a 24-hour Design Value *(the average of the 98<sup>th</sup> percentile of 24-hour PM<sub>2.5</sub> concentrations over a three year period)* above 35  $\mu\text{g}/\text{m}^3$ .
- More monitoring data is found on slides 13 and 14.



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## Legend

- PM<sub>2.5</sub> 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 monitoring data.
- Posted data are in units of micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ )

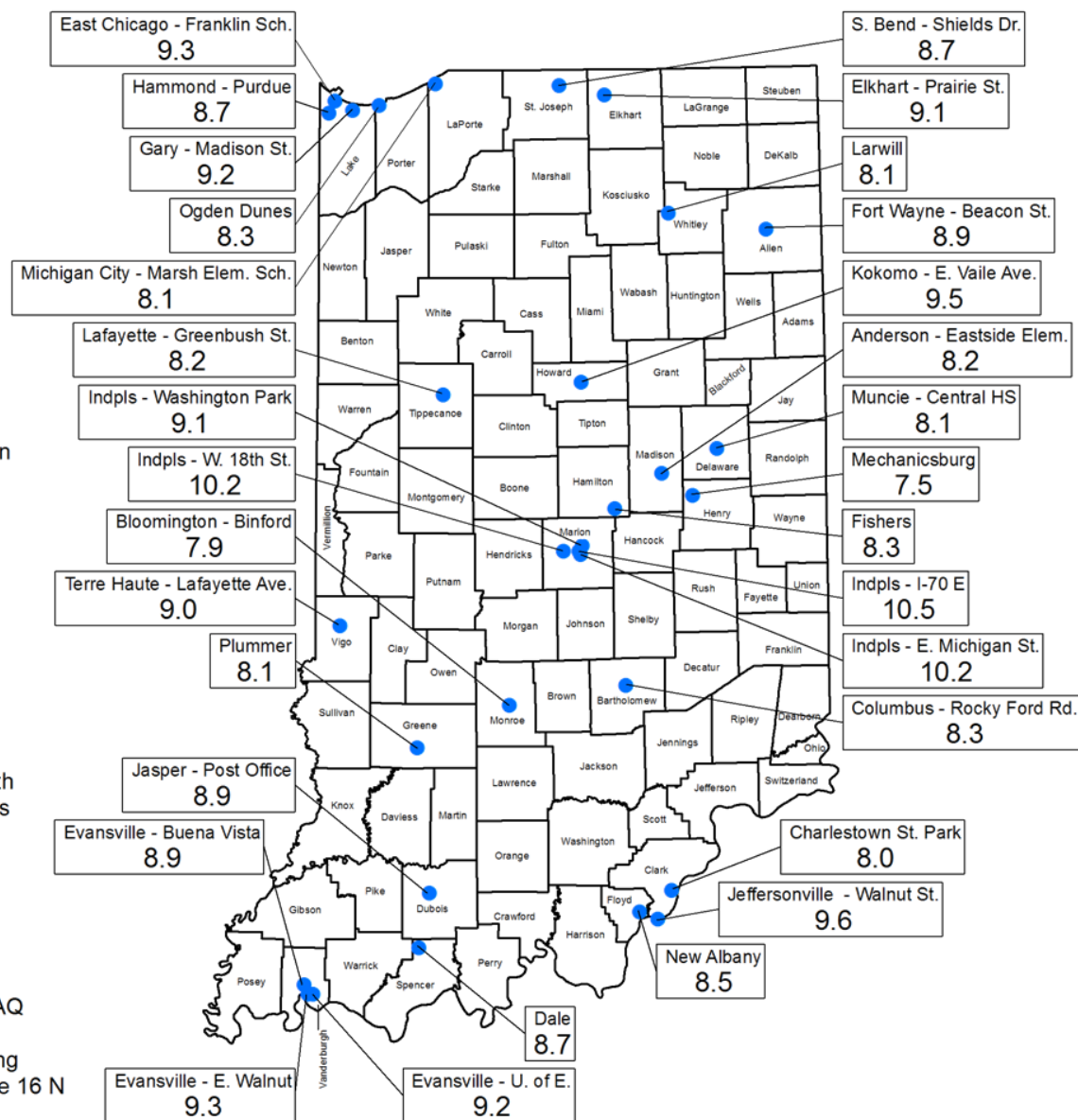
Mapped By: C. Mitchell, OAQ

Date: 04/30/2018

Source: IDEM, Air Monitoring

Map Projection: UTM Zone 16 N

Map Datum: NAD83

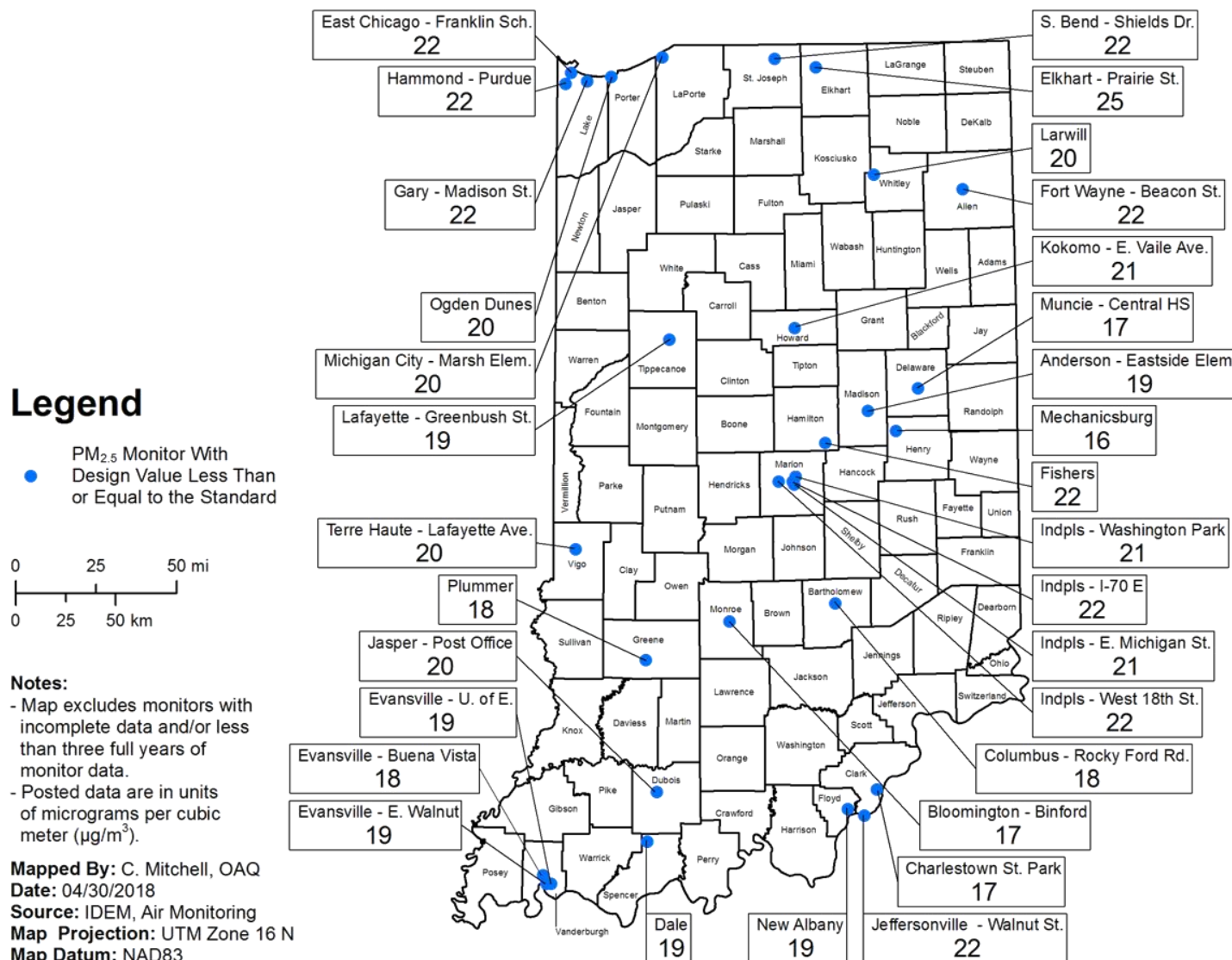


## PM<sub>2.5</sub> Annual Design Values 2015 - 2017

Standard set at  $12.0 \mu\text{g}/\text{m}^3$







## PM<sub>2.5</sub> 24-Hour Design Values 2015 - 2017

Standard set at  
35.0  $\mu\text{g}/\text{m}^3$







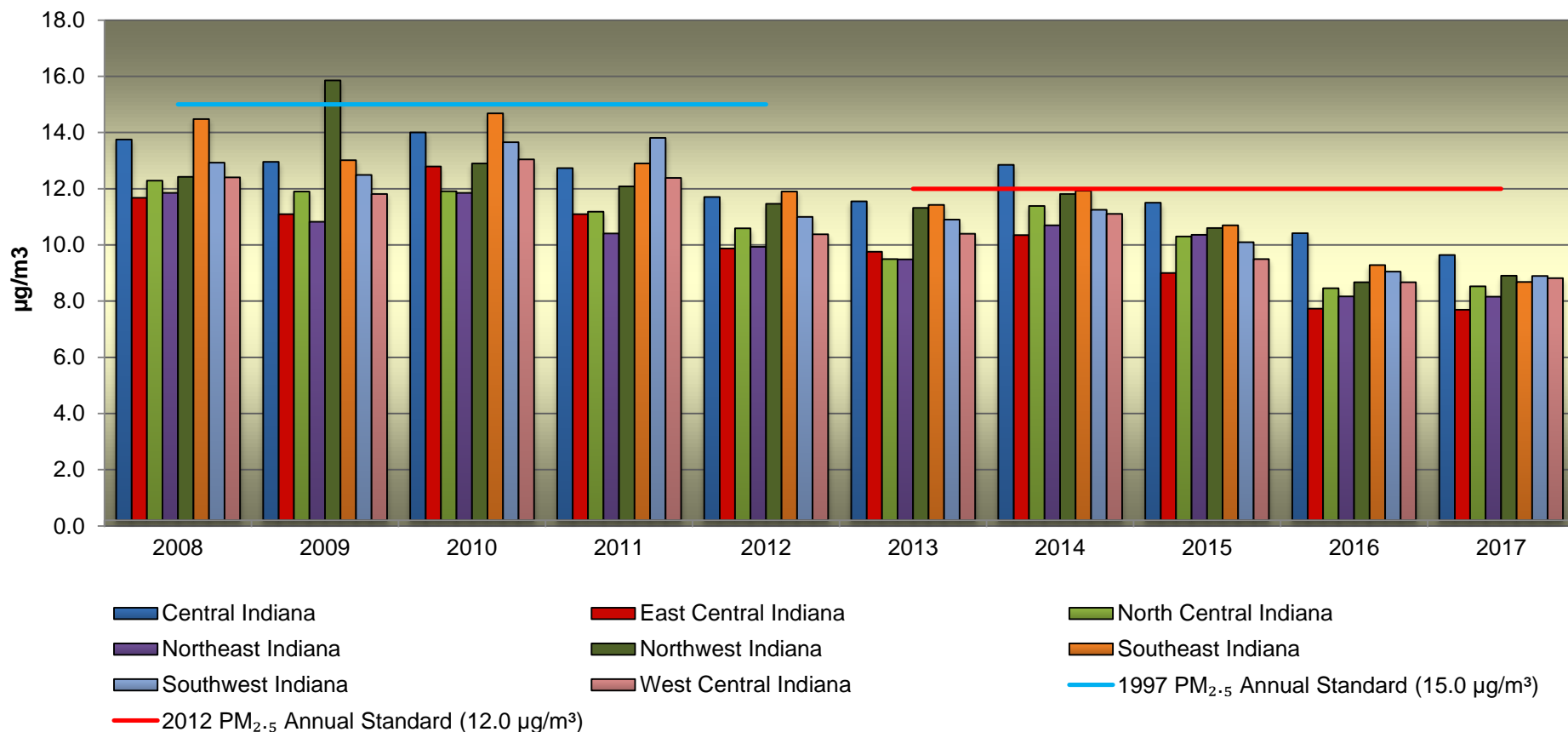
## **PM<sub>2.5</sub> Air Quality Trends**

Monitoring data shows significant improvements in Indiana's air quality over the past 10 years. The following four slides provide illustrations.



# PM<sub>2.5</sub> Air Quality Trends – Annual NAAQS

## Annual Average Mean Values (2008-2017)





# PM<sub>2.5</sub> Air Quality Trends – Annual NAAQS Three-Year Design Values (2008-2017)

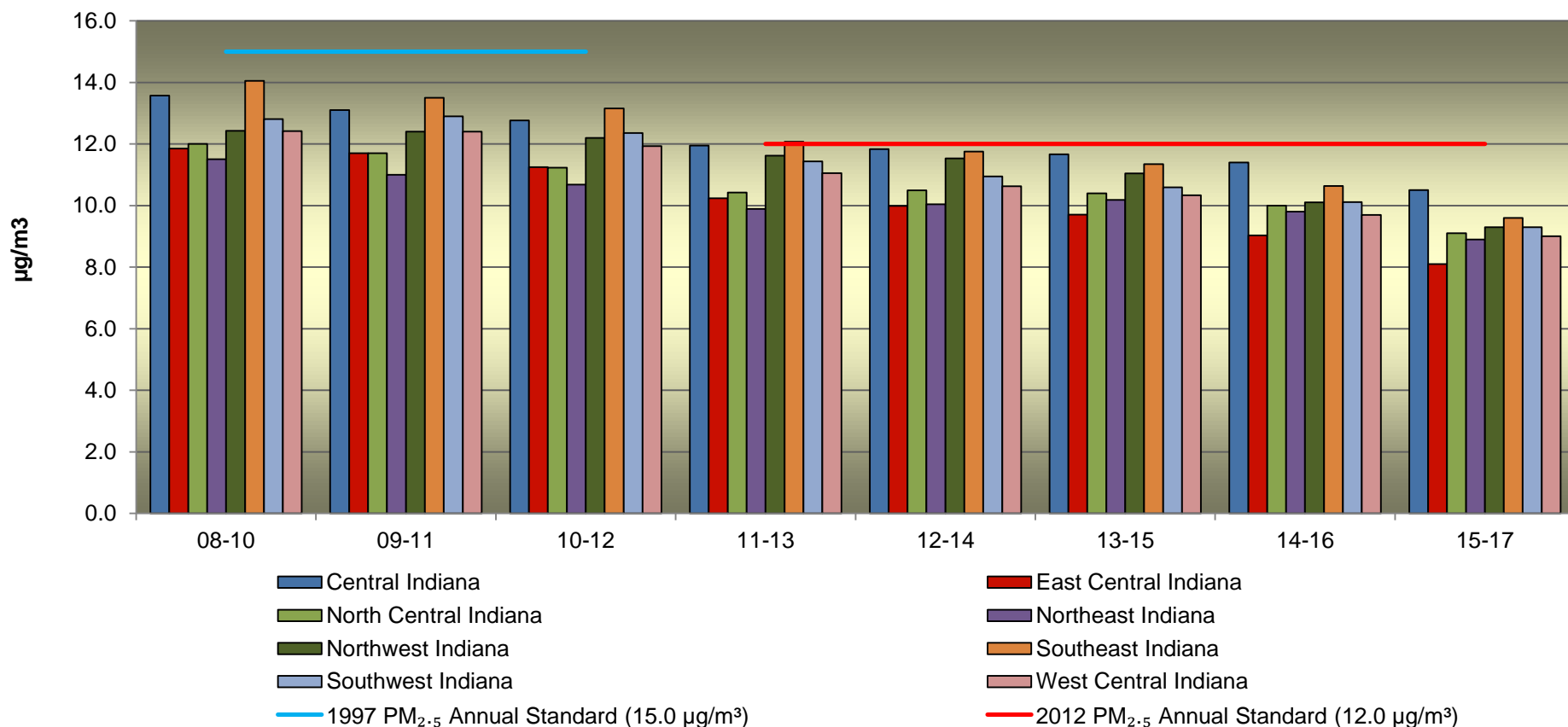
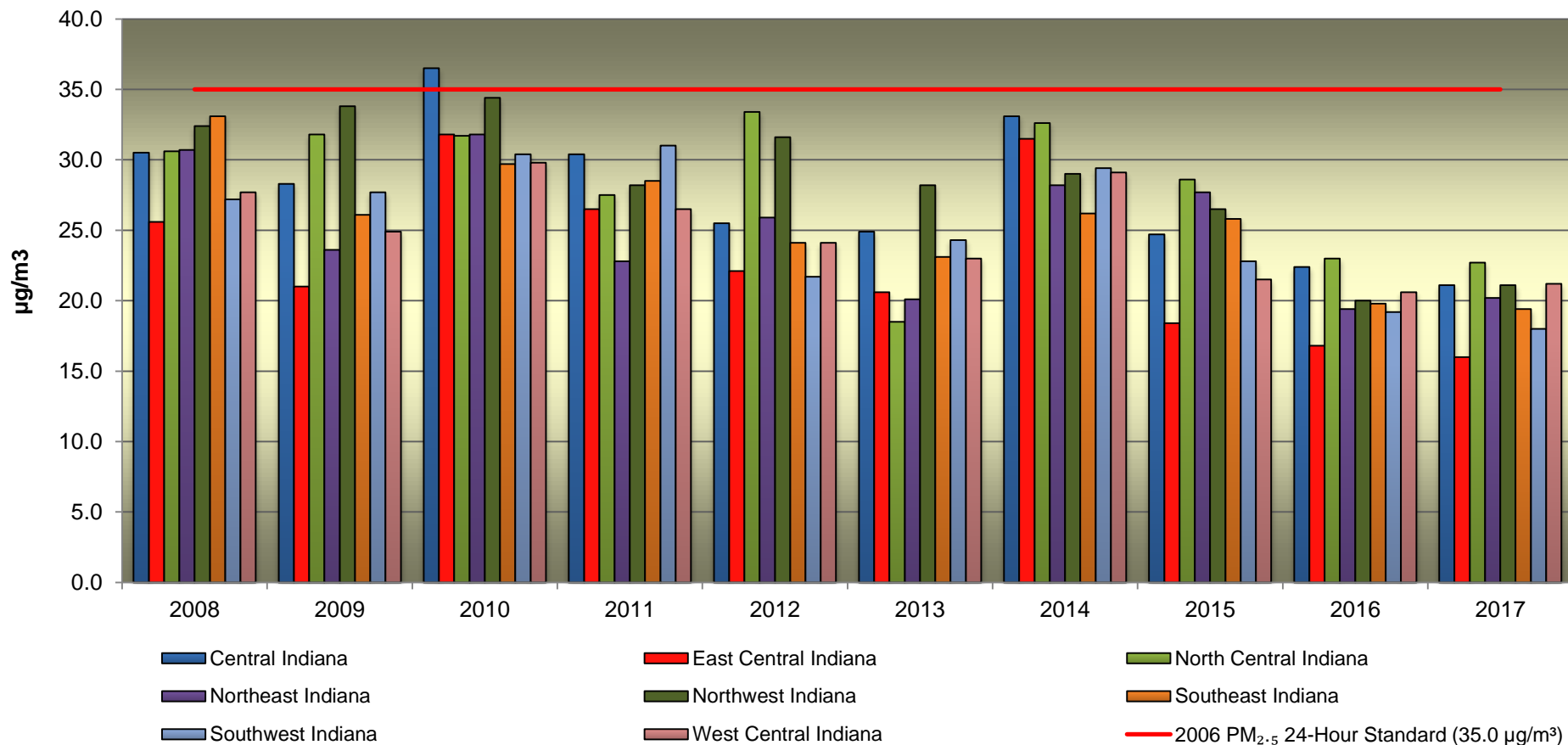


Chart excludes monitors with incomplete data and/or less than three full years of monitoring data.

µg/m³ = micrograms per cubic meter



# PM<sub>2.5</sub> Air Quality Trends – 24-hour NAAQS 98<sup>th</sup> Percentile Values (2008-2017)





# PM<sub>2.5</sub> Air Quality Trends – 24-hour NAAQS

## Three-Year Design Values (2008-2017)

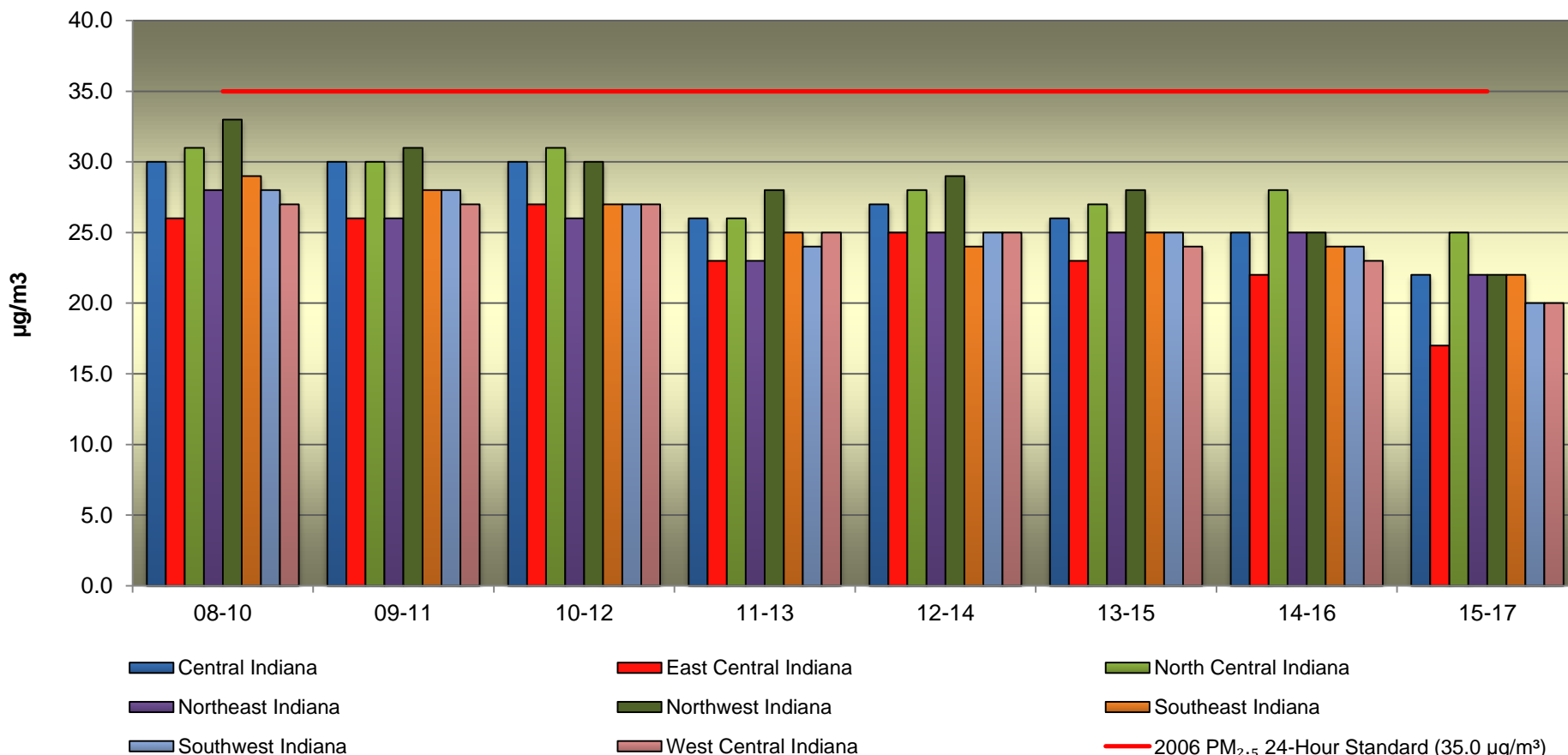


Chart excludes monitors with incomplete data and/or less than three full years of monitoring data.

µg/m³ = micrograms per cubic meter



# PM<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> 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<sub>2.5</sub> Designations (Cont.)

- Lake and Porter counties - When U.S. EPA designated areas for the revised PM<sub>2.5</sub> 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<sub>2.5</sub> monitoring information, visit IDEM's website:  
[www.IN.gov/idem/airquality/2346.htm](http://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](http://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](mailto:cmitchel@idem.IN.gov).