



# Indiana Department of Environmental Management

## 2016 Sulfur Dioxide (SO<sub>2</sub>) Summary Report

*Office of Air Quality*

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[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 sulfur dioxide referred to as SO<sub>2</sub>. Monitoring and reporting of SO<sub>2</sub> occurs on a year-round basis, as mandated by U.S. Environmental Protection Agency (U.S. EPA). This **2016 Sulfur Dioxide (SO<sub>2</sub>) Summary Report** provides an overview of SO<sub>2</sub>, including 2016 data and air quality trends over the past 10 years (2007-2016).

The following information is included in this report:

- General information about SO<sub>2</sub> (*slide 3*)
- Overview of SO<sub>2</sub> air health standards and requirements (*slides 4-6*)
- Overview of Indiana's SO<sub>2</sub> monitoring network (*slides 7-8*)
- Summary of 2016 SO<sub>2</sub> monitoring data (*slides 9-10*)
- SO<sub>2</sub> air quality trends over the last 10 years (*slides 11-13*)
- Status of SO<sub>2</sub> designations (*slides 14-17*)
- Links for additional information (*slide 18*)
- Contact information (*slide 19*)

# What Is SO<sub>2</sub>?

Sulfur dioxide (SO<sub>2</sub>) is one of a group of highly reactive gases known as sulfur oxides (SO<sub>x</sub>). Highly reactive gases are those that have a high potential to change in composition under certain conditions of pressure, temperature or light, or upon contact with another chemical. For example, SO<sub>2</sub> released into the atmosphere dissolves in water vapor to form acid rain.

## Where does SO<sub>2</sub> come from?

SO<sub>2</sub> can come from natural sources, like volcanic activity, but also from the following man-made sources:

- Fossil fuel combustion at power plants and other industrial facilities.
- Industrial processes such as extracting metal from ore.
- Burning of high sulfur containing fuels by locomotives, large ships, and non-road equipment.

## What are the health effects of exposure to SO<sub>2</sub>?

Breathing SO<sub>2</sub> has been linked to an array of adverse respiratory effects including:

- Narrowing of the airways leading to breathing difficulty (bronchoconstriction)
- Increased asthma symptoms, especially during exercise.
- Increased visits to emergency departments and hospital admissions for respiratory illnesses.

# National Ambient Air Quality Standards (NAAQS) for SO<sub>2</sub>

The federal Clean Air Act requires U.S. EPA to establish National Ambient Air Quality Standards (NAAQS) for certain pollutants, including sulfur dioxide (SO<sub>2</sub>). NAAQS are also known as air health standards.

Primary annual and 24-hour and secondary annual and 3-hour NAAQS, established in 1971, set the first limits for SO<sub>2</sub>. Since then, the NAAQS for SO<sub>2</sub> have been reviewed periodically and revised. In 1973, the secondary annual standard was revoked. In 2010, U.S. EPA revoked the annual and 24-hour primary SO<sub>2</sub> standards and established a 1-hour primary standard of 75 parts per billion (ppb). The secondary 3-hour SO<sub>2</sub> standard remains as originally set.

**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 SO<sub>2</sub> Standard

U.S. EPA first established a primary 24-hour standard of 0.14 parts per million (ppm) and an annual average standard at 0.03 ppm

After a scheduled review, U.S. EPA chose not to revise the SO<sub>2</sub> standards

U.S. EPA revoked the annual and 24-hour primary SO<sub>2</sub> standards and established a 1-hour standard of 75 ppb

1971

1973

1996

2010

2012

U.S. EPA set a 3-hour average secondary standard at 0.50 ppm and set an annual standard at 0.02 ppm

U.S. EPA retained the existing 3-hour secondary standard and revoked the annual secondary SO<sub>2</sub> standard

U.S. EPA retained the existing secondary 3-hour SO<sub>2</sub> standard without revision.

# Attaining the SO<sub>2</sub> Standard

Air quality monitoring data must measure at or below the 1-hour standard set by U.S. EPA for three complete, consecutive years to remain in attainment of the primary 1-hour SO<sub>2</sub> standard. For example, an evaluation in 2017 will be based on data from 2014 to 2016.

**Primary 1-Hour SO<sub>2</sub> Standard** – Air quality meets the 2010 primary 1-hour SO<sub>2</sub> standard when the 99<sup>th</sup> percentile of 1-hour daily maximum concentrations, averaged over 3 years, does not exceed 75 parts per billion (ppb).

**Design Values** – The three-year average of the 99<sup>th</sup> percentile of 1-hour daily maximum concentrations is referred to as the Design Value.

**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**.

# 2016 SO<sub>2</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 owned and operated 9 SO<sub>2</sub> monitors located in 7 counties across Indiana.
- There were 9 source-oriented SO<sub>2</sub> monitors collecting data in 9 counties in Indiana.

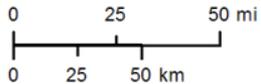
## Calculating the Design Value

- A monitor's Design Value is calculated at the end of the year, once all of the data has been quality assured.
  - SO<sub>2</sub> Design Value: the 99<sup>th</sup> percentile of 1-hour daily maximum concentrations, averaged over 3 years.

# SO<sub>2</sub> 1-Hour Design Values Monitors

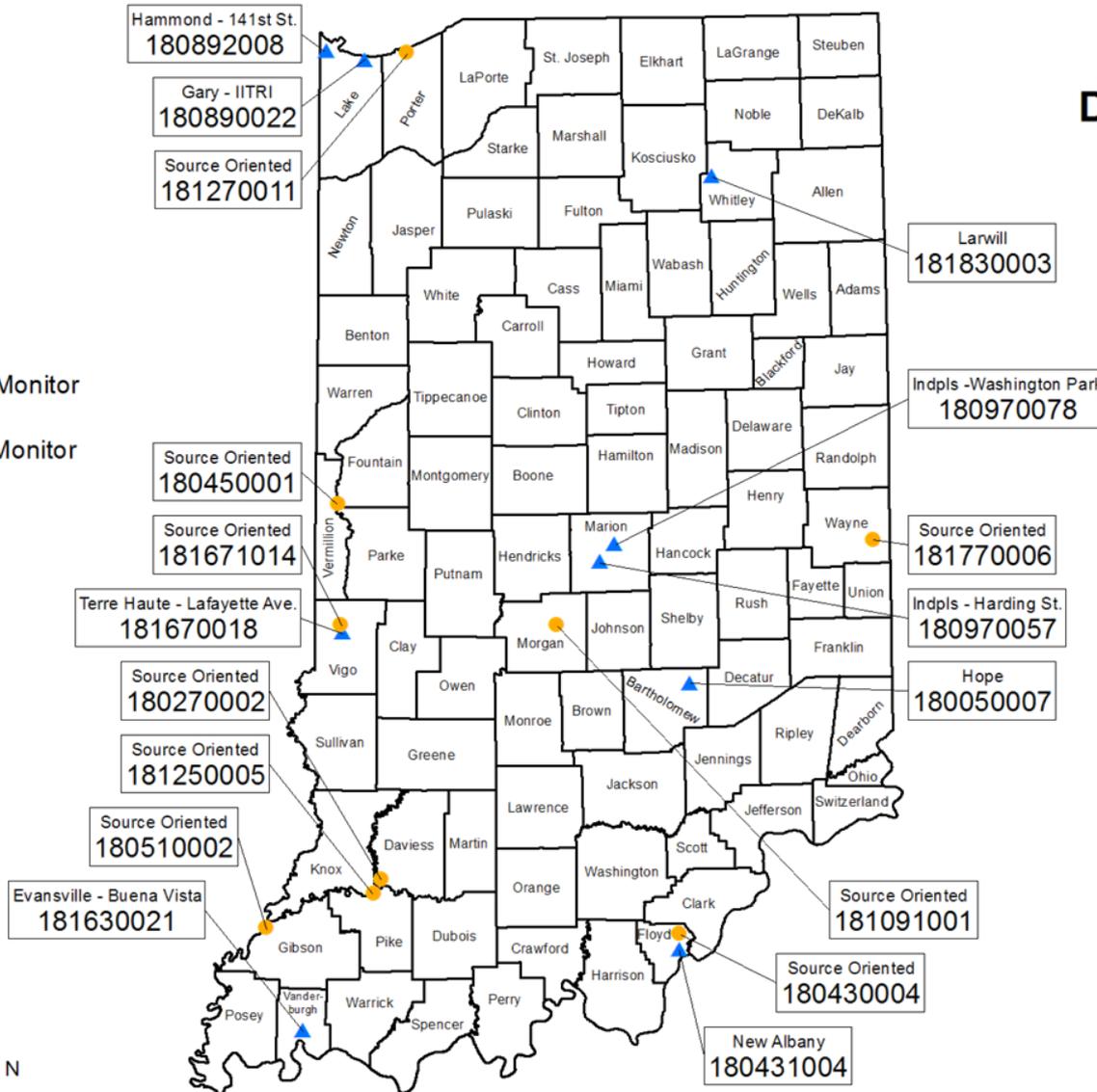
## Legend

- Indiana Operated Monitor
- Source Operated Monitor



**Notes:**  
 Numbers are Site Identification Numbers Used by U.S. EPA's Air Quality System Database

**Date:** 04/28/2017  
**Mapped by:** C. Mitchell, OAQ  
**Sources:** Office of Air Quality  
**Map Projection:** UTM Zone 16 N  
**Map Datum:** NAD83



# 2016 SO<sub>2</sub> Monitoring Data Summary

## Quality assured monitoring data for 2016

- No IDEM-operated monitor had a 99<sup>th</sup> percentile of 1-hour daily maximum SO<sub>2</sub> concentration above the 2010 1-hour primary standard of 75 ppb.
- One source-oriented monitor had a 99<sup>th</sup> percentile of 1-hour daily maximum SO<sub>2</sub> concentration above the 2010 1-hour primary standard of 75 ppb (ID# 18-167-1014 (Vigo County)).
- More information about the 1-hour standard is found on slides 4 through 6.

## Quality assured monitoring data for the 2014–2016 three-year timeframe

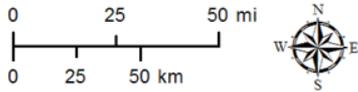
- No IDEM-operated monitor had an annual Design Value above 75 ppb.
- Two source-oriented monitors had an annual Design Value above 75 ppb (ID# 18-125-0005 (Pike County) and ID# 18-167-1014 (Vigo County)).
- At the end of 2016, Marion (Center, Perry and Washington Townships) and Morgan Counties (Clay and Washington Townships) recorded three years of complete, quality-assured ambient air quality monitoring data for the years 2014 – 2016 demonstrating attainment of the 2010 1-hour primary SO<sub>2</sub> standard. IDEM is currently pursuing redesignation of these areas to attainment.
- More monitoring information is found on slide 10.

# SO<sub>2</sub> 1-Hour Design Values 2014 - 2016 and SO<sub>2</sub> Nonattainment Areas

Standard Set at 75 ppb

## Legend

- SO<sub>2</sub> Monitor With Design Value Less Than or Equal to 75 ppb
- + SO<sub>2</sub> Monitor With Design Value Greater Than 75 ppb
- Nonattainment Area
- Attainment/Unclassifiable



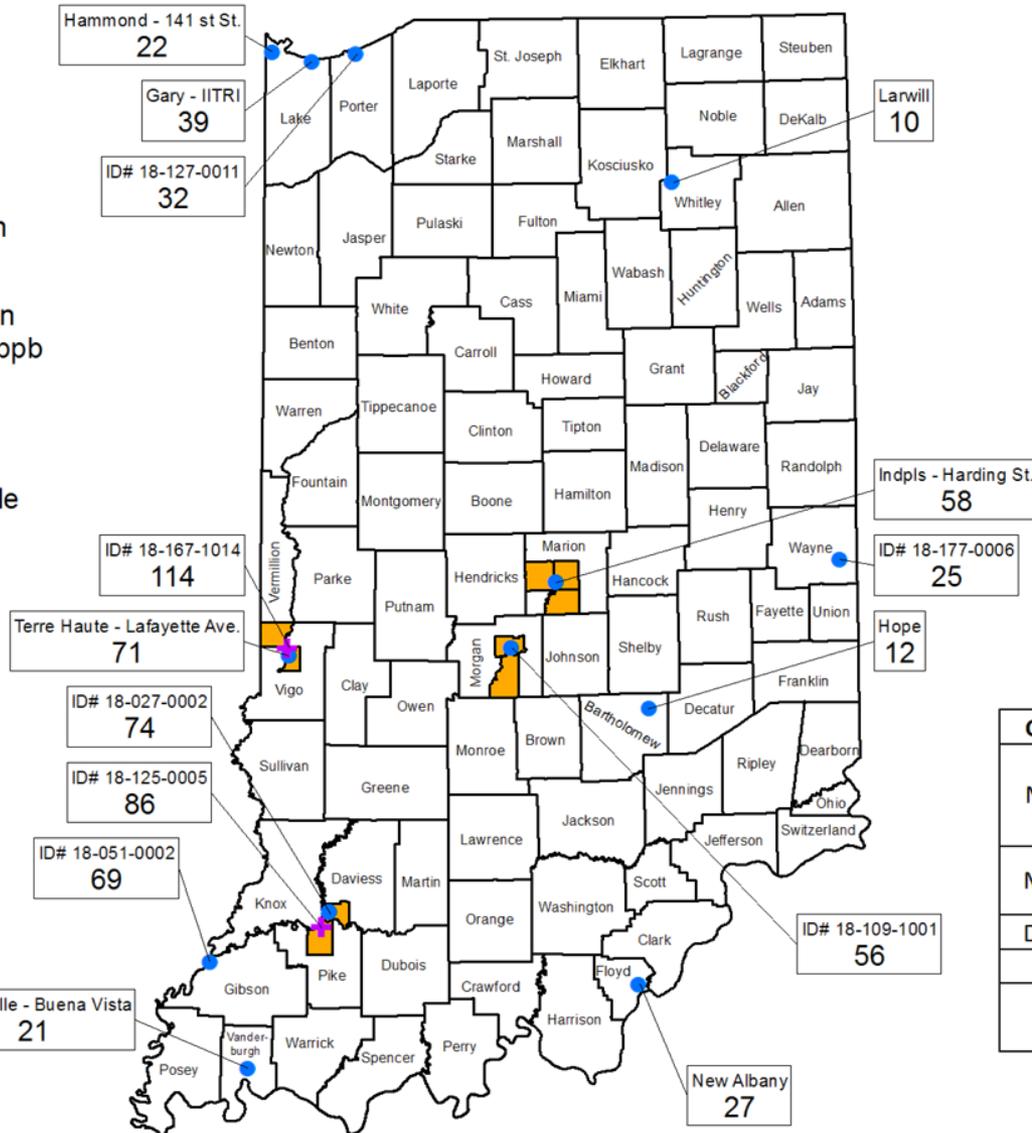
### Notes:

- Posted Data Represent 1-Hour Average Design Values, 2014 - 2016
- Chart excludes monitors with incomplete data and/or less than three full years of monitoring data
- Posted Data are in Units of Parts Per Billion (ppb)

Date: 05/19/2017

Mapped by: C. Mitchell, OAQ  
Sources: Office of Air Quality

Map Projection: UTM Zone 16 N  
Map Datum: NAD83



County	Nonattainment Area
Marion	Center Township
	Perry Township
	Wayne Township
Morgan	Clay Township
	Washington Township
Daviess	Veale Township
Pike	Washington Township
Vigo	Fayette Township
	Harrison Township

## **SO<sub>2</sub> Air Quality Trends**

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

# SO<sub>2</sub> Air Quality Trends – 1-Hour NAAQS Annual 99<sup>th</sup> Percentile Values (2007-2016)

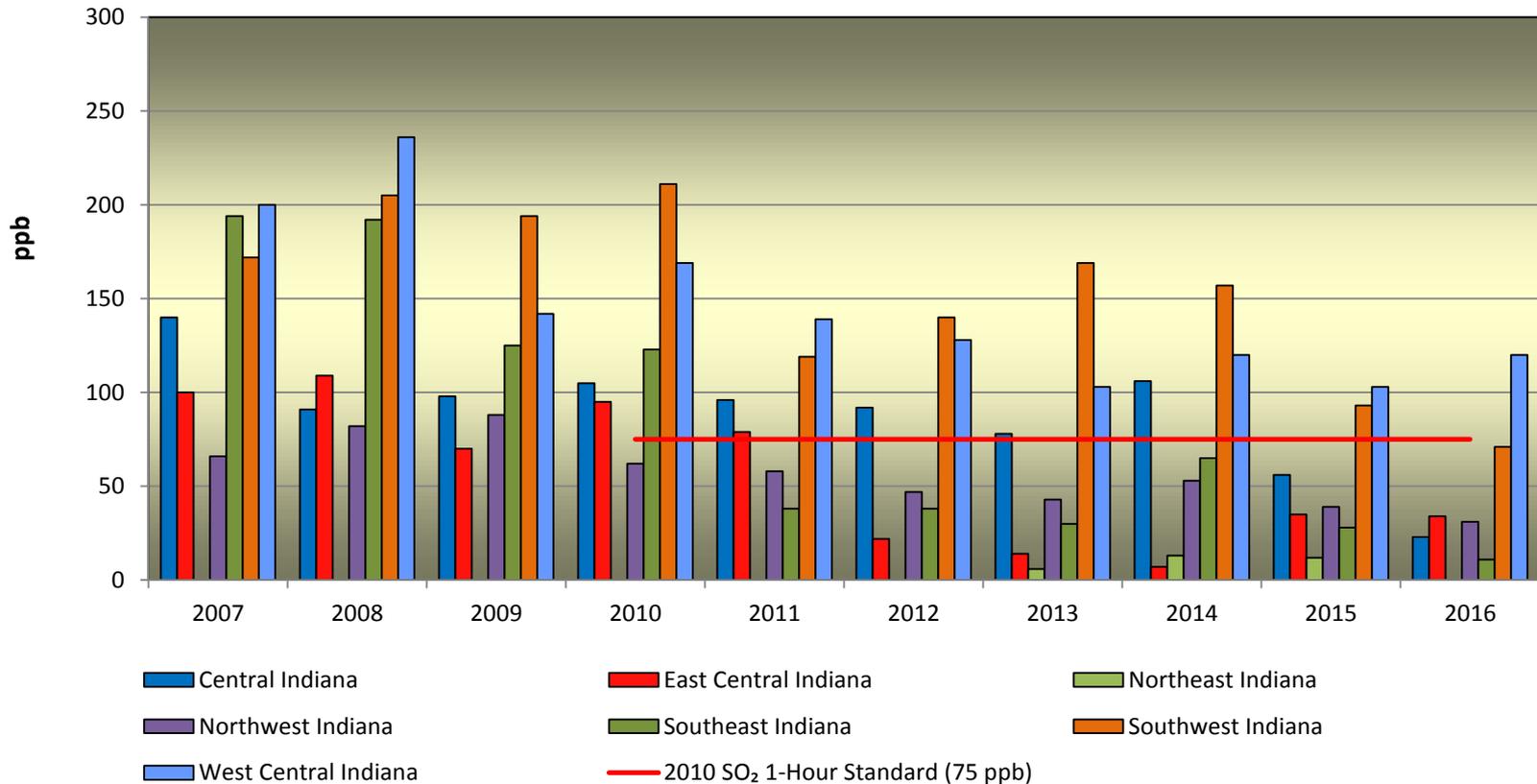


Chart excludes monitors with incomplete data and/or less than three full years of monitoring data.  
ppb = parts per billion

# SO<sub>2</sub> Air Quality Trends – 1-Hour NAAQS Three-Year Design Values (2007-2016)

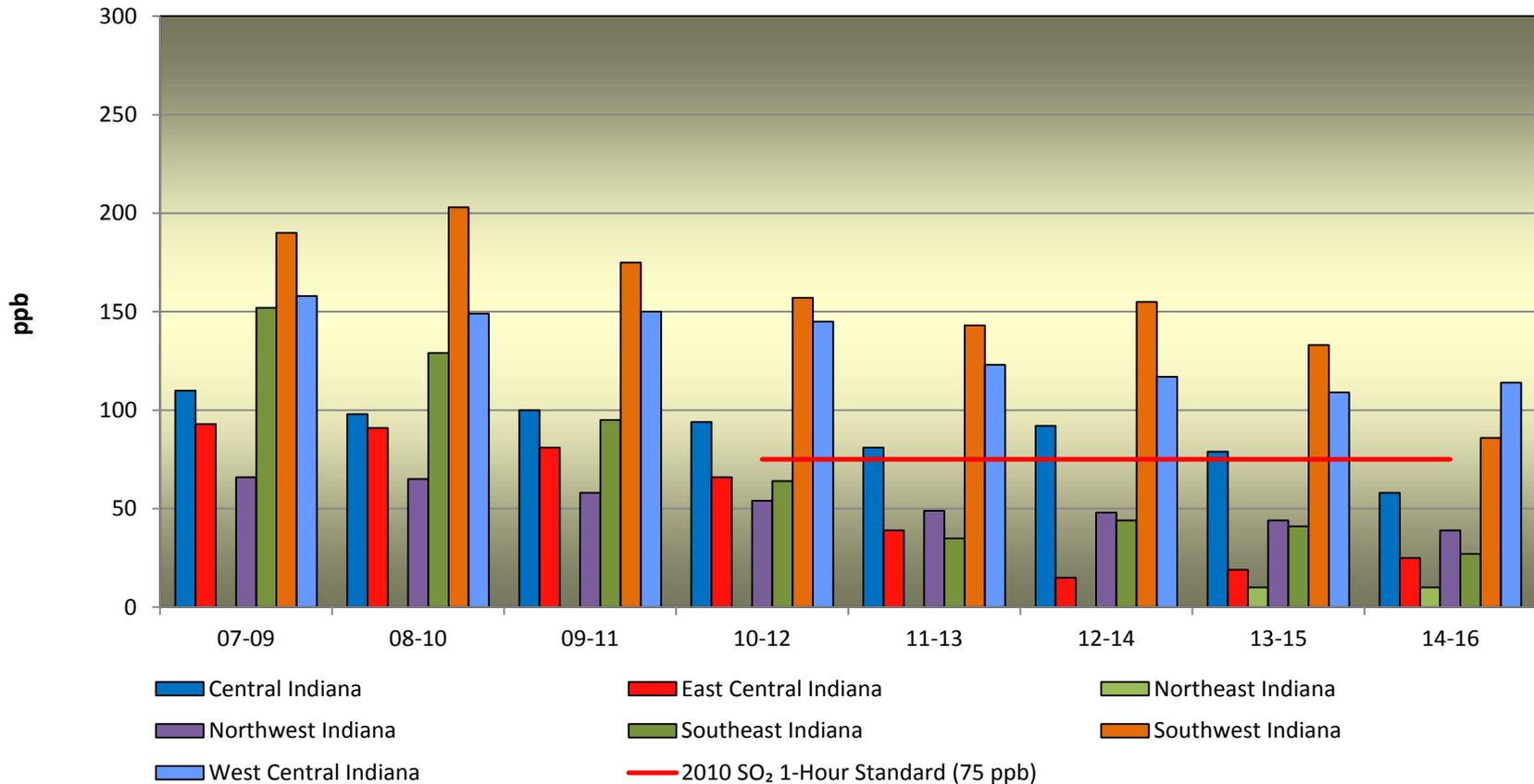
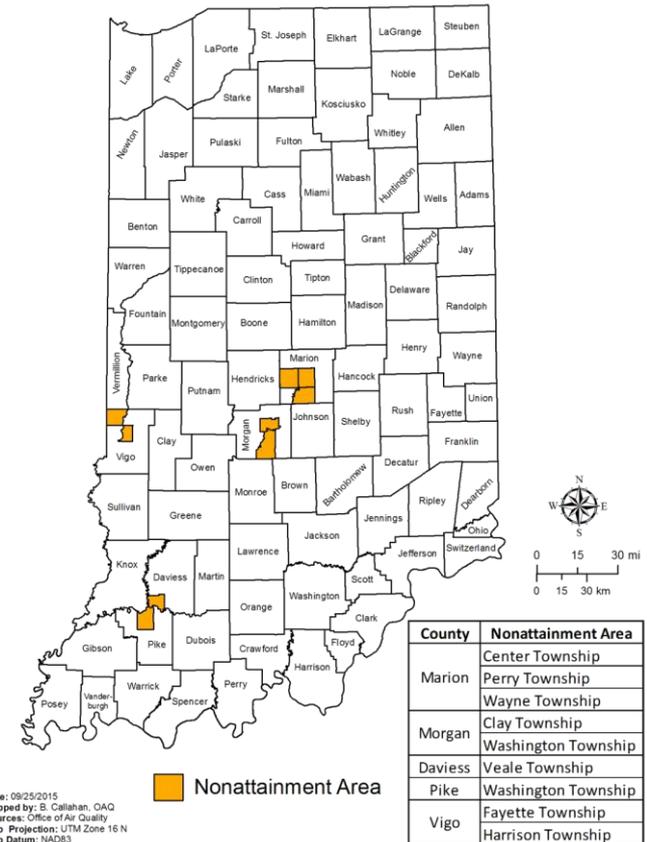


Chart excludes monitors with incomplete data and/or less than three full years of monitoring data.  
ppb = parts per billion

# Sulfur Dioxide - Round 1 Area Designations

- On July 25, 2013, U.S. EPA designated four nonattainment areas, comprised of nine townships in five counties, under the 2010 1-hour SO<sub>2</sub> standard. Designations were effective October 4, 2013.
- On October 2, 2015, Indiana submitted an attainment demonstration to U.S. EPA for review and approval.
- On February 25, 2016, Indiana received a finding of “completeness” (meaning it has all the required elements) for the demonstration.
- By October 4, 2018, areas designated nonattainment must attain the standard. (At the time, U.S. EPA was not yet prepared to issue designations for the remaining areas of the state).

Round 1 SO<sub>2</sub> Nonattainment Areas

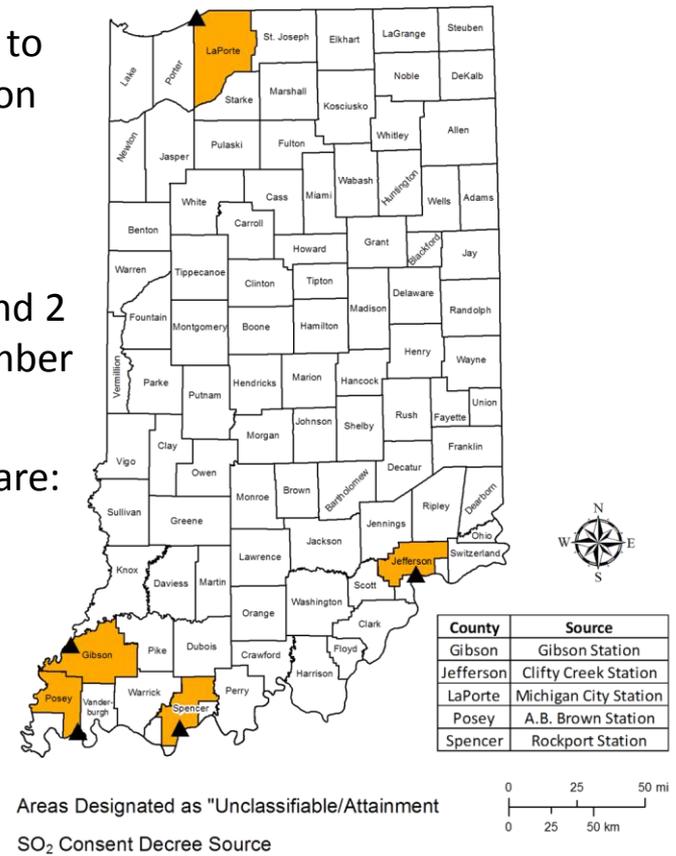


# Sulfur Dioxide - Round 2 Area Designations

- Due to a March 2, 2015 Consent Decree, U.S. EPA identified additional sources around which SO<sub>2</sub> must be characterized.
- U.S. EPA issued final Round 2 SO<sub>2</sub> designations in a letter to IDEM dated June 30, 2016. In that letter, Gibson, Jefferson (partial), LaPorte, Posey (partial), and Spencer (partial) counties in Indiana were designated “Unclassifiable/Attainment” for the 2010 1-hour NAAQS for SO<sub>2</sub>.
- Areas of the State not designated under Round 1 or Round 2 will be addressed by either December 31, 2017 or December 31, 2020 (Rounds 3 and 4).
- Areas of the State Designated unclassifiable/attainment are:

County	Area	
Gibson	Full County	
Jefferson	Partial County	Graham, Lancaster, Madison, Monroe, Republican, Shelby and Smyrna Townships
LaPorte	Full County	
Posey	Partial County	Bethel, Center, Harmony, Lynn, Marrs, Robb, Robinson and Smith Townships
Spencer	Partial County	That portion of Ohio township north of UTM 4187.580 km northing, and Carter, Clay, Grass, Hammond, Harrison and Jackson Townships

Round 2 Designated Areas

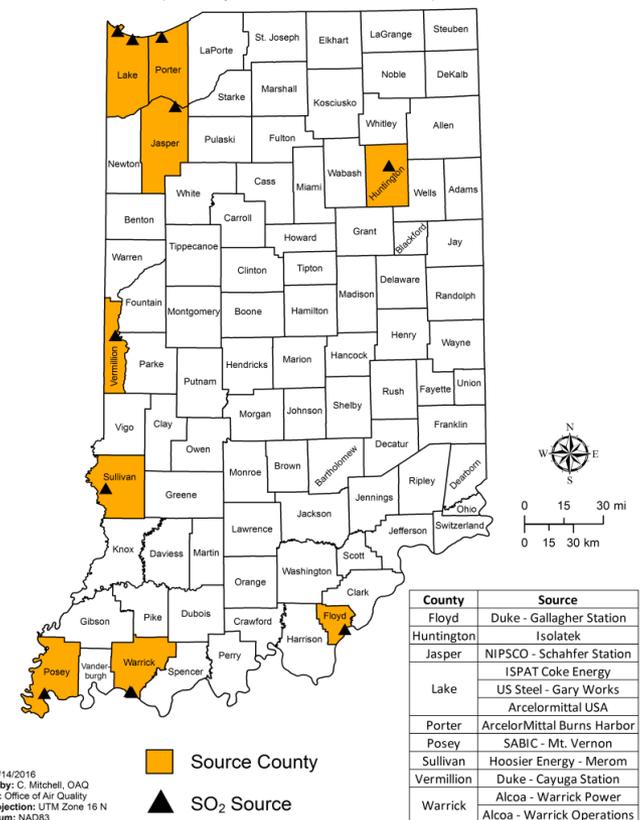


Date: 05/23/2017 Mapped by: C. Mitchell, OAQ Sources: Office of Air Quality Map Projection: UTM Zone 16 N Map Datum: NAD83

# Sulfur Dioxide - Round 3 and 4 Area Designations

- On August 10, 2015, U.S. EPA finalized the Data Requirements Rule (DRR), which requires states to characterize air quality around sources that emit 2,000 tons or more per year of SO<sub>2</sub>.
- On January 7, 2016, Indiana submitted to U.S. EPA a list of eleven stationary sources potentially subject to the DRR.
- In March 2016, U.S. EPA added Isolatek (U.S. Mineral Products) to the list of DRR sources requiring characterization.
- On January 13, 2017, IDEM sent preliminary recommendations to U.S. EPA concerning Round 3 Air Quality Designations for the 2010 Primary 1-Hour SO<sub>2</sub> NAAQS. IDEM recommended a designation of “attainment” for 10 of the 12 identified sources, deferred a recommendation for ArcelorMittal Burns Harbor in order to monitor SO<sub>2</sub> (Round 4), and requested that Isolatek be removed from the list of sources.

**SO<sub>2</sub> Sources Potentially Subject to the Data Requirements Rule**  
(not already addressed under Rounds 1 and 2)



# Sulfur Dioxide - Round 3 and 4 Area Designation Schedule

## Round 3

- On or about August 14, 2017, U.S. EPA will notify states of intended area designations.
- On or about December 14, 2017, U.S. EPA will finalize designations (can be no later than December 31, 2017).
- By August 2019, state attainment plans for modeled sources due to U.S. EPA.

## Round 4

- By May 1, 2020, ambient air monitoring data for the calendar year 2019 (to calculate 2017-2019 design values) must be certified.
- By September 2, 2020, U.S. EPA will notify states of intended designations.
- By December 31, 2020, U.S. EPA will finalize designations.
- By August 2022, state attainment plans for monitored sources due to U.S. EPA.

## Additional Information

- For additional SO<sub>2</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 sulfur dioxide, visit U.S. EPA's sulfur dioxide (SO<sub>2</sub>) Standards website:  
<https://www.epa.gov/naaqs/sulfur-dioxide-so2-primary-air-quality-standards>



## 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).