



# Indiana Department of Environmental Management

## 2015 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 **2015 Sulfur Dioxide (SO<sub>2</sub>) Summary Report** provides an overview of SO<sub>2</sub>, including 2015 data and air quality trends over the past 10 years (2006-2015).

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 7-9*)
- Summary of 2015 SO<sub>2</sub> monitoring data (*slides 10-11*)
- SO<sub>2</sub> air quality trends over the last 10 years (*slides 12-14*)
- Status of SO<sub>2</sub> designations (*slides 15-18*)
- Links for additional information (*slide 19*)
- Contact information (*slide 20*)

# 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 2016 will be based on data from 2013 to 2015.

**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**.

# 2015 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 owns and operates 9 SO<sub>2</sub> monitors located in 7 counties across Indiana.
- There are 10 source-oriented SO<sub>2</sub> monitors collecting data in 10 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.

## 2015 SO<sub>2</sub> Monitoring Network (Cont.)


*Monitors are located in the following regions. The map on the following slide provides additional location and monitor information.*


Region	Counties
Central	Bartholomew, Morgan, Marion
East Central	Wayne
Northeast	Whitley
Northwest	Jasper, Lake, Porter
Southeast	Floyd
Southwest	Daviess, Gibson, Pike, Vanderburgh
West Central	Fountain, Vigo

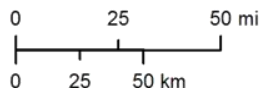


## SO<sub>2</sub> 1-Hour Design Values Monitors

### Legend

 Indiana Operated Monitor

 Source Operated Monitor



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

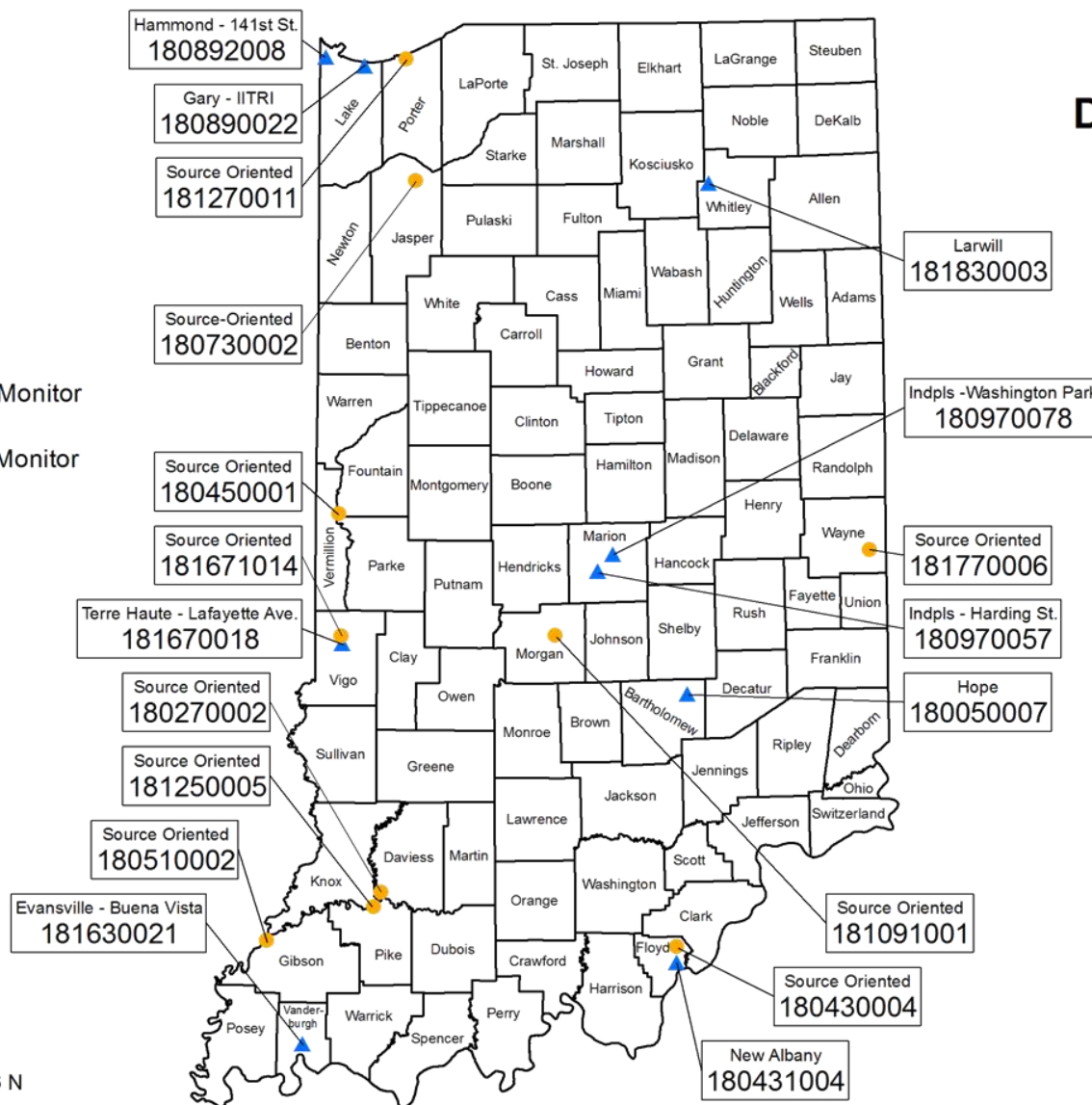
**Date:** 06/07/2016

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

**Sources:** Office of Air Quality

**Map Projection:** UTM Zone 16 N

**Map Datum:** NAD83



# 2015 SO<sub>2</sub> Monitoring Data Summary

## Quality assured monitoring data for 2015

- No IDEM-operated monitor had a 99<sup>th</sup> percentile of 1-hour daily maximum SO<sub>2</sub> concentrations above the 2010 1-hour primary standard of 75 ppb.
- Two source-oriented monitors had a 99<sup>th</sup> percentile of 1-hour daily maximum SO<sub>2</sub> concentrations above the 2010 1-hour primary standard of 75 ppb (ID# 18-027-0002 (Daviess County) and 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 2013–2015 three-year timeframe

- Two IDEM-operated monitors had an annual Design Value above 75 ppb (Indpls – Harding St. (Marion County) and Terre Haute – Lafayette Ave. (Vigo County)).
- Three source-oriented monitors had an annual Design Value above 75 ppb (ID# 18-027-0002 (Daviess County), ID# 18-125-0005 (Pike County), and ID# 18-167-1014 (Vigo County)).
- Morgan County (Clay and Washington Townships) had an annual Design Value at the end of 2015 below the 1-hour primary standard for the first time since the standard went into effect in 2010 and is pending redesignation to attainment.
- More monitoring information is found on slide 11.

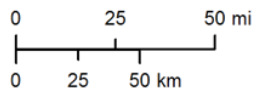
## Legend

- 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

Redesignation Pending

Attainment/Unclassifiable



### Notes:

- Posted Data Represent 1-Hour Average Design Values, 2013 - 2015
- Posted Data are in Units of Parts Per Billion (ppb)

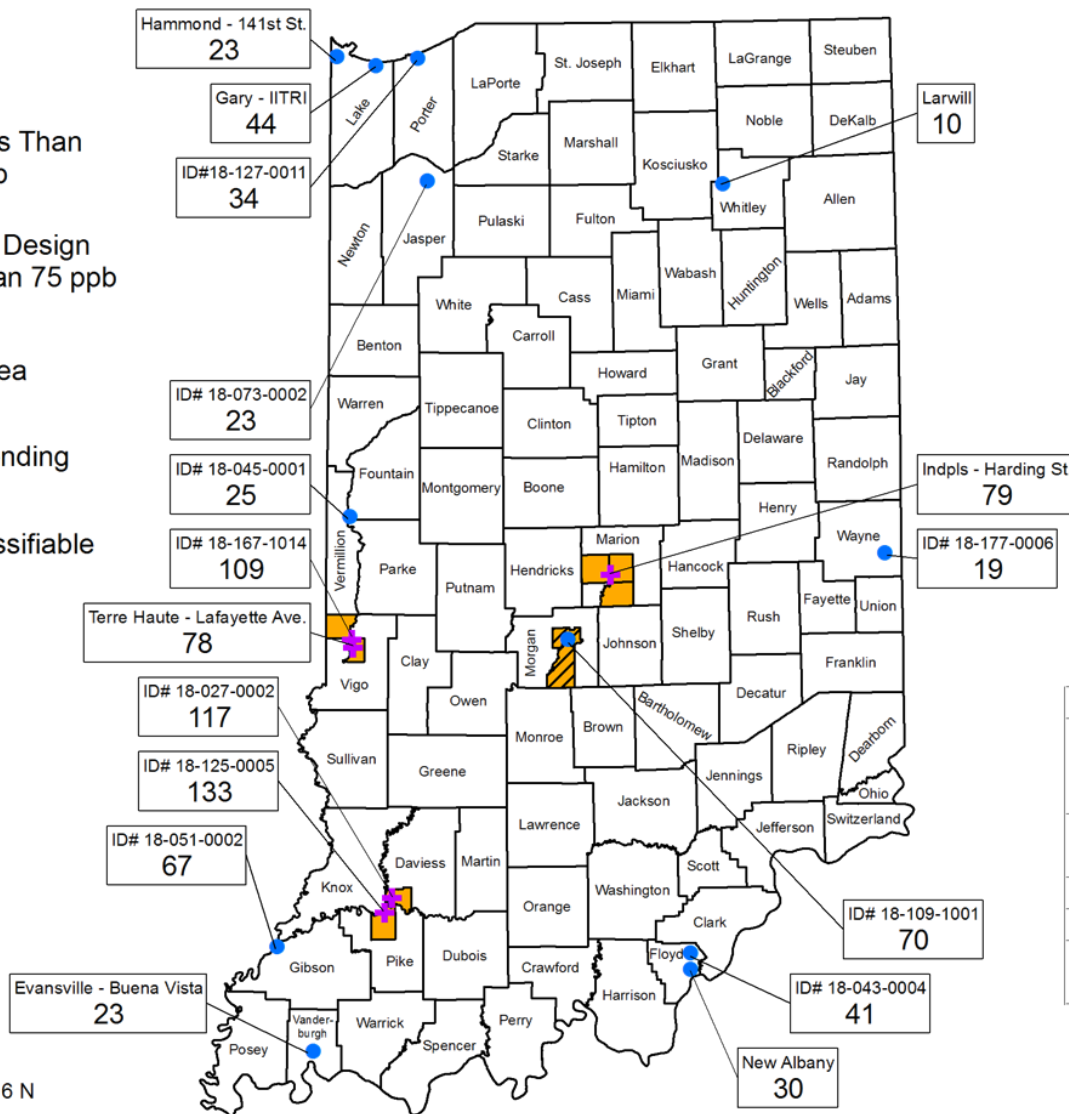
Date: 06/06/2016

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Map Projection: UTM Zone 16 N

Map Datum: NAD83



## SO<sub>2</sub> 1-Hour Design Values 2013 - 2015

## and SO<sub>2</sub> Nonattainment Areas

*Standard Set at 75 ppb*

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 (2006-2015)

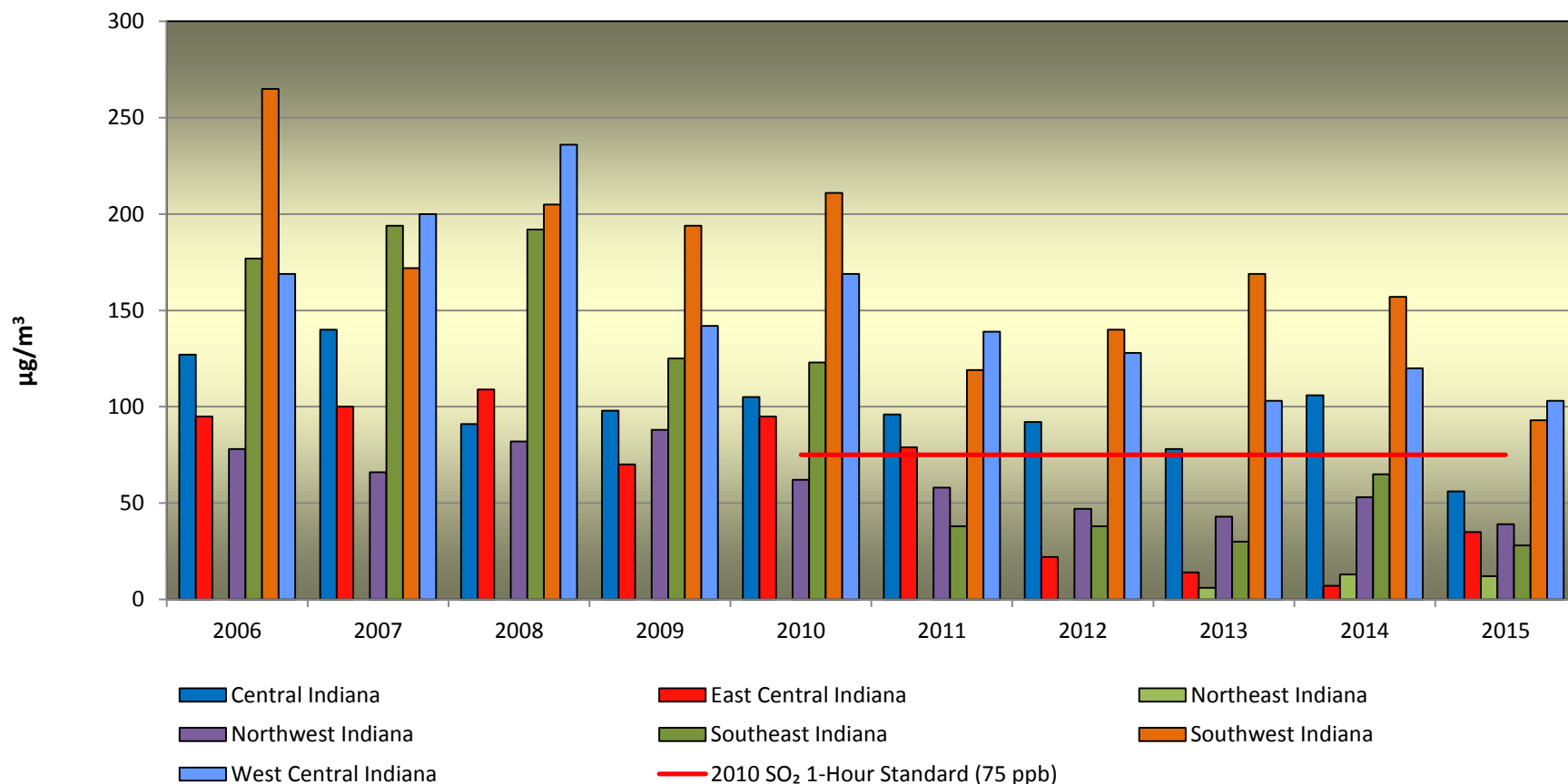


Chart excludes monitors with incomplete data and/or less than three full years of monitoring data.

ppb = parts per billion

# SO<sub>2</sub> Air Quality Trends – 1-Hour NAAQS Three-Year Design Values (2006-2015)

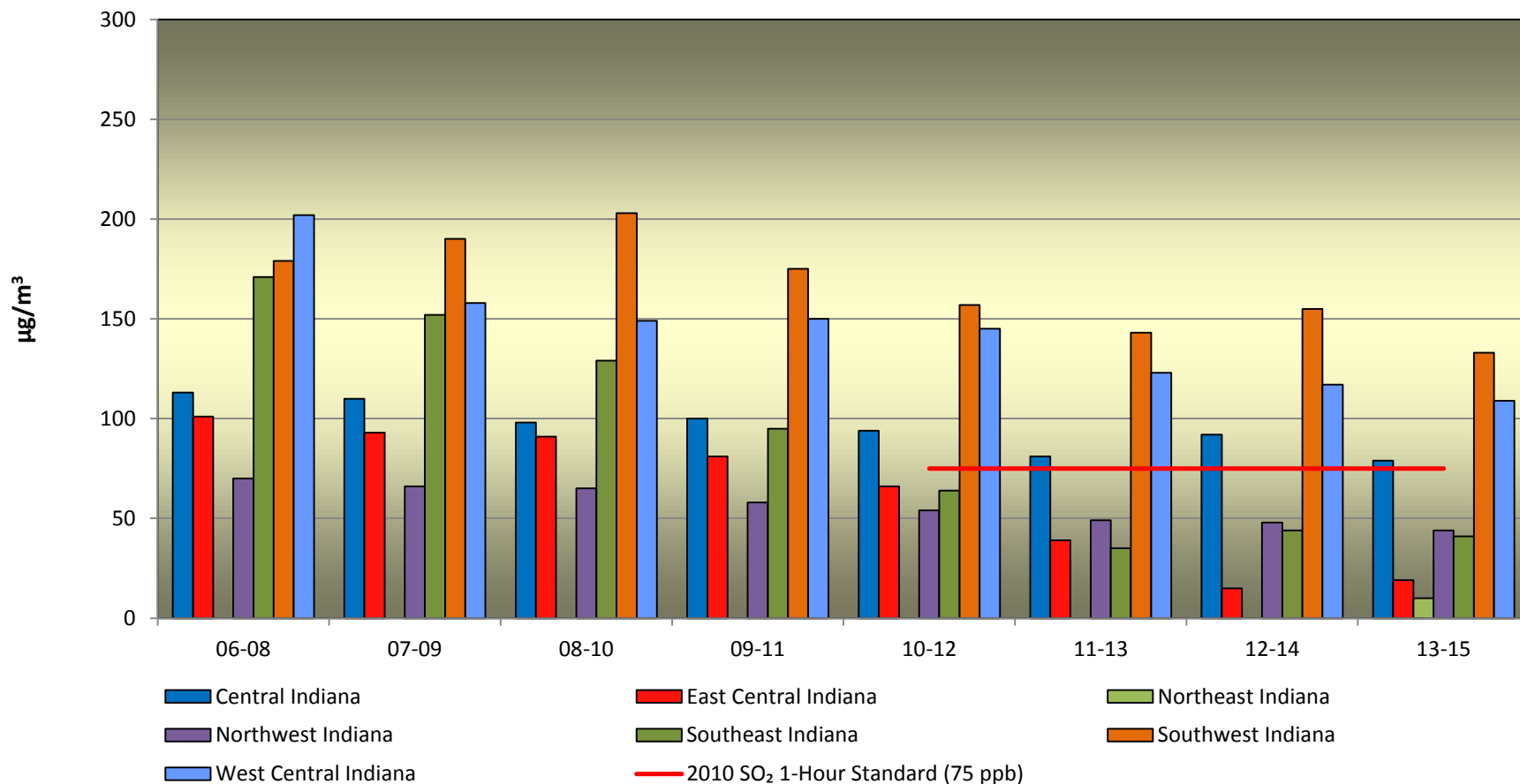


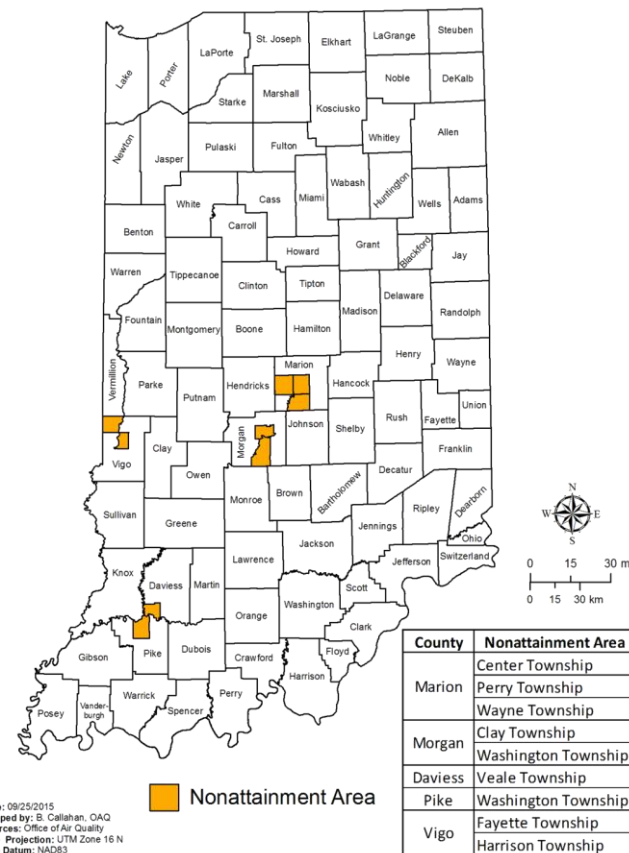
Chart excludes monitors with incomplete data and/or less than three full years of monitoring data.

ppb = parts per billion

# Sulfur Dioxide - Round 1 Area Designations

- On August 5, 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.
- 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.
- U.S. EPA was not yet prepared to issue designations for the remaining areas.

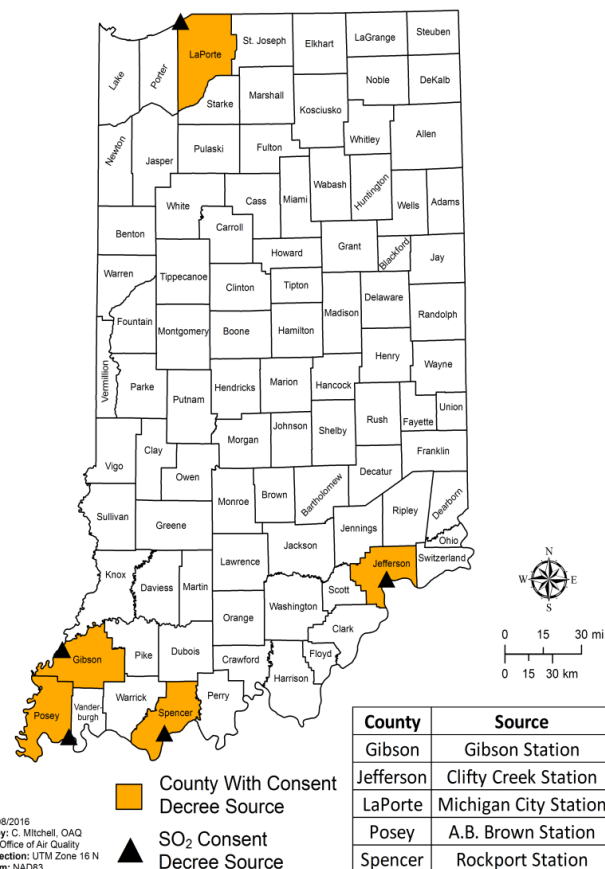
Round 1 SO<sub>2</sub> Nonattainment Areas



# 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.
- In Indiana, U.S. EPA identified five coal-fired electric power plants as meeting Round 2 criteria.
- Indiana analyzed each location and recommended a designation of attainment for all five counties.
- On February 16, 2016, U.S. EPA proposed to designate Gibson, LaPorte, and Spencer (partial) counties as unclassifiable/attainment and Madison Township in Jefferson County and Marrs Township in Posey County as nonattainment under the 2010 1-hour SO<sub>2</sub> NAAQS.
- In the case of Jefferson and Posey counties, U.S. EPA has been working with IDEM in establishing federally enforceable emission limits that would support designations of unclassifiable/attainment for the relevant portions of these counties.
- On May 6, 2016, U.S. EPA approved Indiana's SIP submittal of Commissioner Orders for the A.B. Brown station and Clifty Creek station that establish permanent and enforceable SO<sub>2</sub> emission limits to ensure continued attainment of the NAAQS in the area surrounding these facilities.
- By July 2, 2016, U.S. EPA must issue final designations.

Round 2 SO<sub>2</sub> Consent Decree Sources

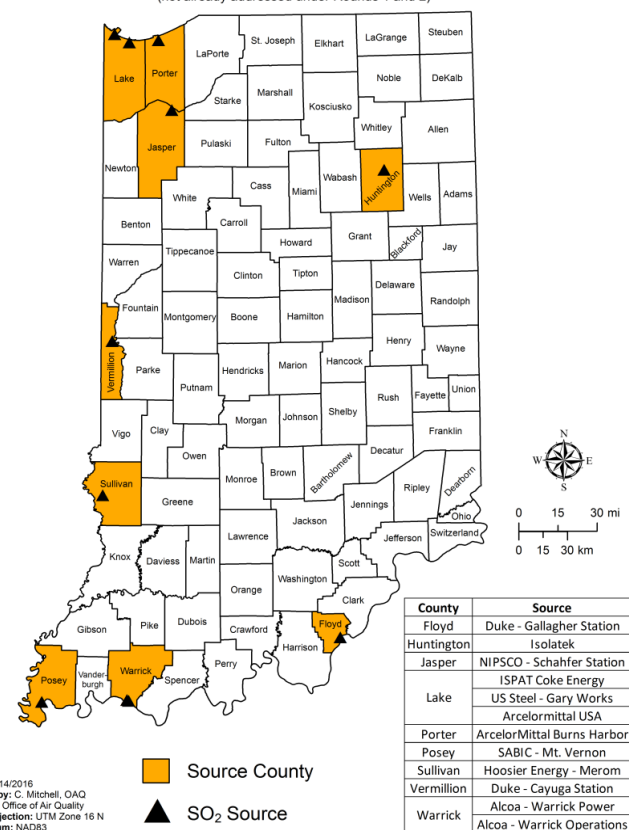




# Sulfur Dioxide - Round 3 and 4 Area Designations

- 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 a list of sources potentially subject to the DRR to U.S. EPA for review/consideration.
- In March 2016, U.S. EPA added Isolatek (U.S. Mineral Products) to the list of DRR sources.
- By July 1, 2016, states must identify whether they intend to use modeling (Round 3) or ambient monitoring (Round 4) to characterize air quality.
- States may avoid DRR requirements by adopting federally enforceable permanent emission limits that ensures an affected source will emit less than 2,000 tons of SO<sub>2</sub> per year.

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 Designations

## Round 3

- By July 1, 2016, modeling protocols for each affected source are due to U.S. EPA.
- By January 13, 2017, modeling analyses for each affected source are due to U.S. EPA.
- By August 2017, U.S. EPA will notify states of intended area designations.
- By December 31, 2017, U.S. EPA will finalize designations.
- By August 2019, state attainment plans for modeled sources due to U.S. EPA.

## Round 4

- By July 1, 2016, all relevant information regarding monitors being utilized to meet DRR requirements must be included in each state's 2017 Annual Monitoring Network Plan.
- By January 1, 2017, monitors being utilized to meet DRR requirements must be operational.
- By May 31, 2020, ambient air monitoring data for the calendar year 2019 must be certified.
- By August 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://www3.epa.gov/ttn/naaqs/standards/so2/s\\_so2\\_index.html](https://www3.epa.gov/ttn/naaqs/standards/so2/s_so2_index.html)

## 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).