

2020 Sulfur Dioxide (SO₂) Data Summary Report



INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

Indiana Department of Environmental Management (IDEM)
Office of Air Quality

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About This Report

The Indiana Department of Environmental Management (IDEM) collects and analyzes outdoor air samples for regulated pollutants, including sulfur dioxide (SO₂). Monitoring is conducted for SO₂ year-round, as mandated by United States Environmental Protection Agency (U.S. EPA), and the data is reported to U.S. EPA's Air Quality System (AQS). This **2020 Sulfur Dioxide (SO₂) Data Summary Report** provides an overview of SO₂ and its impacts, national air health standards, Indiana's SO₂ monitoring network, a summary of 2020 SO₂ monitoring data, air quality trends over the last ten years, and the status of SO₂ designations in Indiana.

What is Sulfur Dioxide (SO₂)?

SO₂ is one of several highly reactive gases in a larger group of gases known as sulfur oxides (SO_x). Highly reactive gases are those that have a high potential to change in composition under certain conditions of pressure, temperature, light, or upon contact with another chemical. For example, SO₂ that is released into the atmosphere can dissolve in water vapor to form acid rain. Emissions of SO₂ generally lead to formation of other SO_x. SO_x can react with other compounds to form small particles and contribute to particulate matter (PM) pollution. At high concentrations, SO_x can damage foliage and decrease the growth of trees and plants. Of all the gases in the SO_x group, SO₂ is most prevalent in the atmosphere and considered to pose the greatest public health concerns.

Where does SO₂ come from? SO₂ can come from natural sources, like volcanic activity, but also from several manmade sources:

- Fossil fuel combustion at power plants and other industrial facilities.
- Industrial processes such as extracting metal from ore.
- Locomotives, large ships, and non-road equipment that use high-sulfur fuels.

What are the health effects of exposure to SO₂? Breathing SO₂ 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.

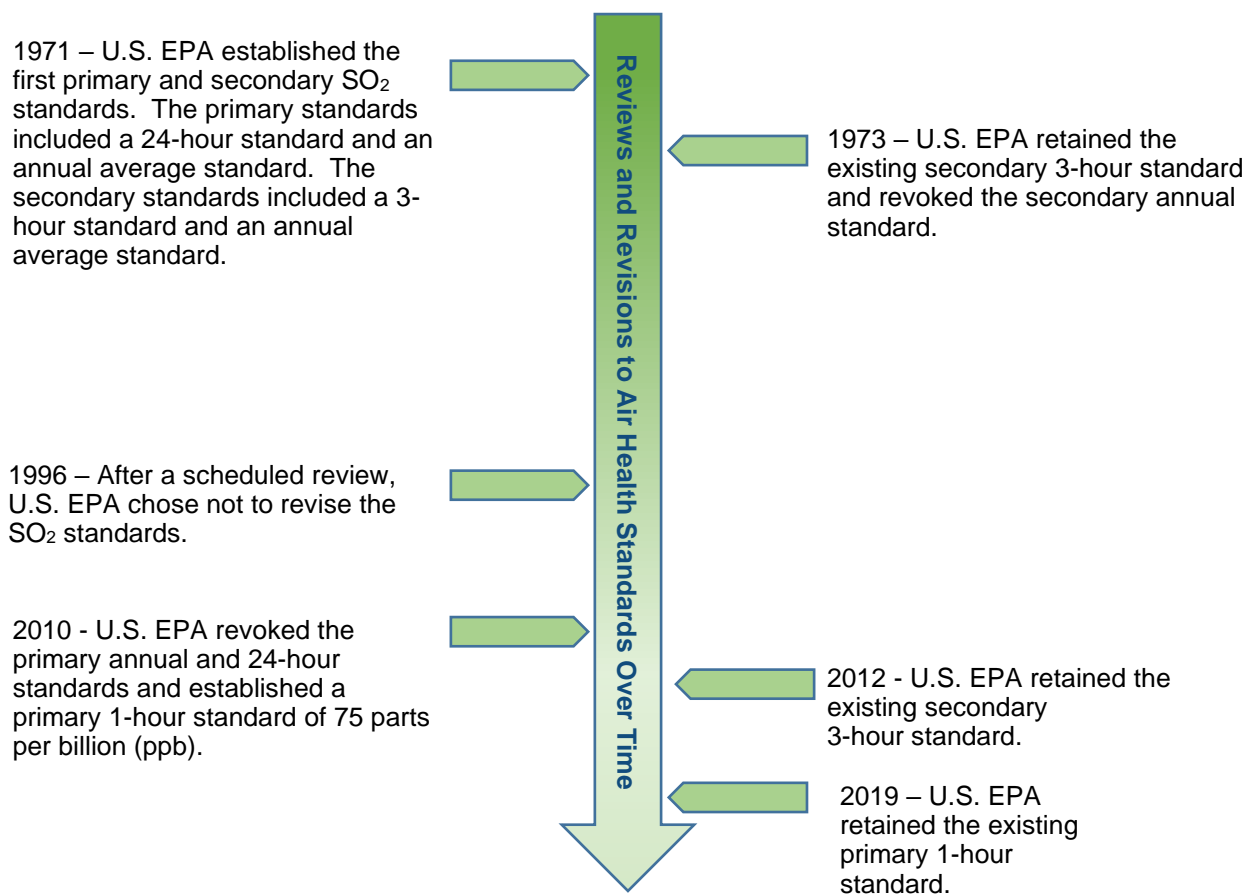
National Ambient Air Quality Standards (NAAQS) for SO₂

The federal Clean Air Act requires U.S. EPA to establish National Ambient Air Quality Standards (NAAQS) for common outdoor air pollutants, including SO₂. The standards for SO₂ are designed to prevent adverse impacts from all of the SO_x gases. NAAQS, which are also known as air health standards, include:

- Primary standards for public health, which set pollutant limits to protect the most vulnerable groups such as young children, the elderly, and individuals with respiratory illnesses.
- Secondary standards for public welfare, which set limits to protect visibility and prevent damage to animals, crops, vegetation, and buildings.

Since the primary and secondary standards were first established for SO₂ in 1971, revisions have been made to both. The 1971 primary standards included both a 24-hour standard of 0.14 parts per million (ppm) not to be exceeded more than once per year and an annual average standard of 0.03 ppm. Both 1971 primary standards were revoked in 2010 and replaced by a more stringent 1-hour primary standard of 75 parts per billion (ppb). The 1971 secondary standards included both a 3-hour standard of 0.5 ppm not to be exceeded more than once per year and an annual average standard of 0.02 ppm. The 1971 secondary annual standard was revoked in 1973. The 1971 secondary 3-hour standard remains in effect. The timeline in Figure 1 notes these milestones in the NAAQS development over the years.¹

Figure 1: History of the SO₂ NAAQS



¹ Source, U.S. EPA: <https://www.epa.gov/so2-pollution/timeline-sulfur-dioxide-national-ambient-air-quality-standards-naaqs>

Attaining the SO₂ Standards

Air quality monitoring data must measure at or below concentrations set by U.S. EPA for three complete, consecutive years to be in attainment of the NAAQS. For example, an evaluation in 2022 will be based on data from 2019 through 2021.

How does an area attain the primary 1-hour standard? An area is determined to be attaining the primary 1-hour SO₂ NAAQS when the 99th percentile of the daily maximum 1-hour concentrations, averaged over three years, does not exceed 75 parts per billion (ppb).

What is a design value? The three-year average of the 99th percentile of the daily maximum 1-hour concentrations is referred to as 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.

What is the difference between an exceedance and a violation? When a monitor records a concentration above the limit established by the NAAQS, it is referred to as an **exceedance**. A monitor can have an exceedance without being in **violation** of the standard. If a monitor's three-year design value exceeds the NAAQS, the monitor is in violation.

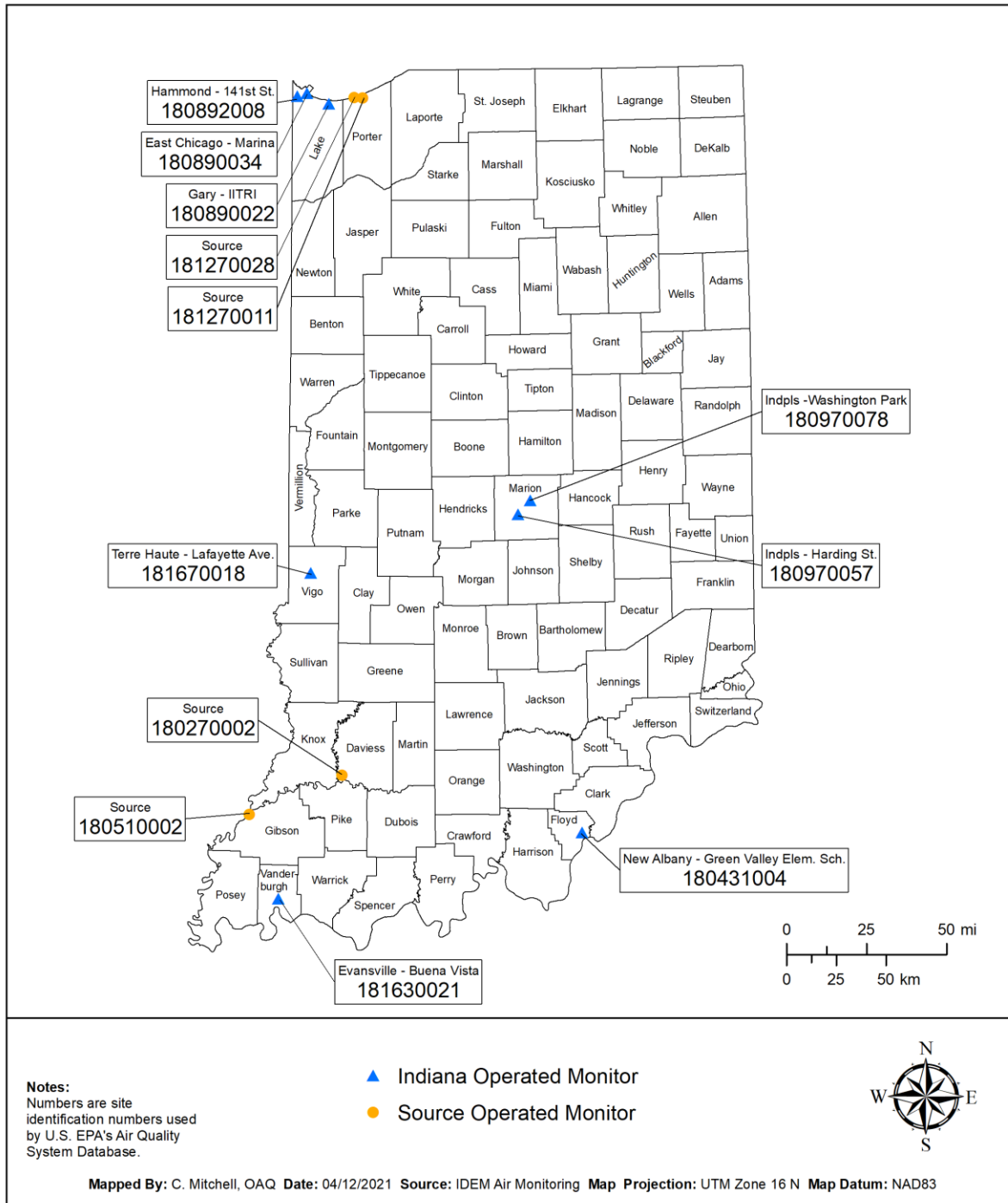
2020 SO₂ Monitoring Network

Indiana's 2020 monitoring network included eight SO₂ monitors in five Indiana counties. The placement of SO₂ monitors in Indiana's network is determined according to U.S. EPA guidance on factors including population and manufacturing levels. IDEM conducts annual reviews of the monitoring network, which are published each year in the *Indiana Ambient Air Monitoring Network Plan* at <https://www.in.gov/idem/airmonitoring/indianas-ambient-air-monitoring-network/>.

In addition to the monitors operated by IDEM, four source oriented SO₂ monitors were operated by SO₂ emissions sources in three Indiana counties.

Figure 2 shows SO₂ monitor locations in Indiana for 2020.

Figure 2: SO₂ Monitoring Network in 2020

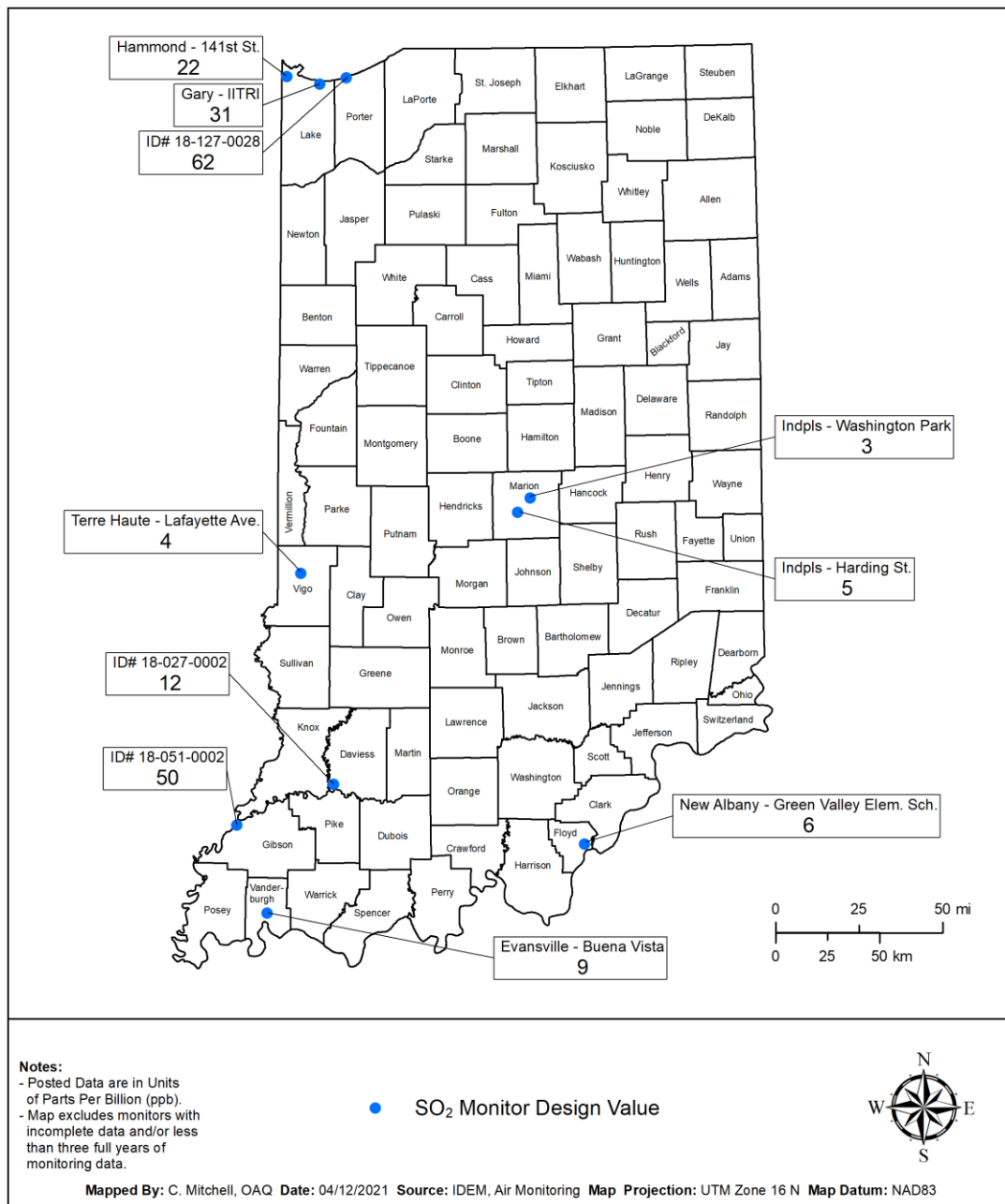


2020 SO₂ Monitoring Data Summary

SO₂ monitoring data has been quality assured for 2020.

Design Values for 2018-2020: For 2018-2020, design values for all IDEM and source-oriented SO₂ monitors were below the primary 1-hour standard, as shown in Figure 3.

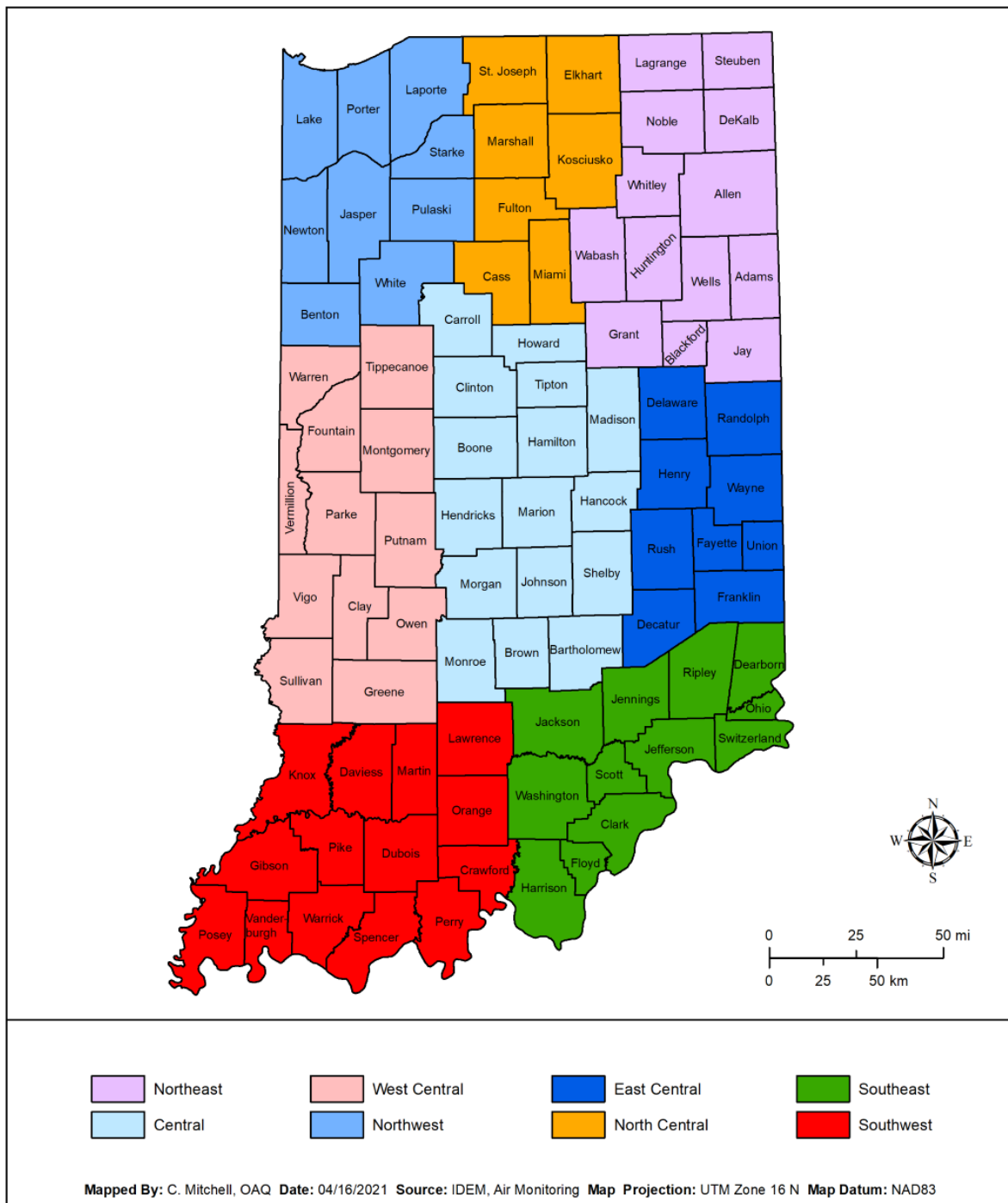
Figure 3: Primary 1-Hour SO₂ Design Values for 2018-2020



SO₂ Air Quality Trends

SO₂ monitoring data in Chart 1 and Chart 2 below is divided into regions as shown in Figure 4.

Figure 4: Indiana Regions



The annual 99th percentile daily maximum concentrations for the ten-year period 2011 – 2020, for each area are plotted in comparison with the primary 1-hour standard in Chart 1. Design values, for the eight-year period, 2013-2020, are plotted in comparison with the standard in Chart 2.

Chart 1: SO₂ 99th Percentile Value Trends for 2011 – 2020

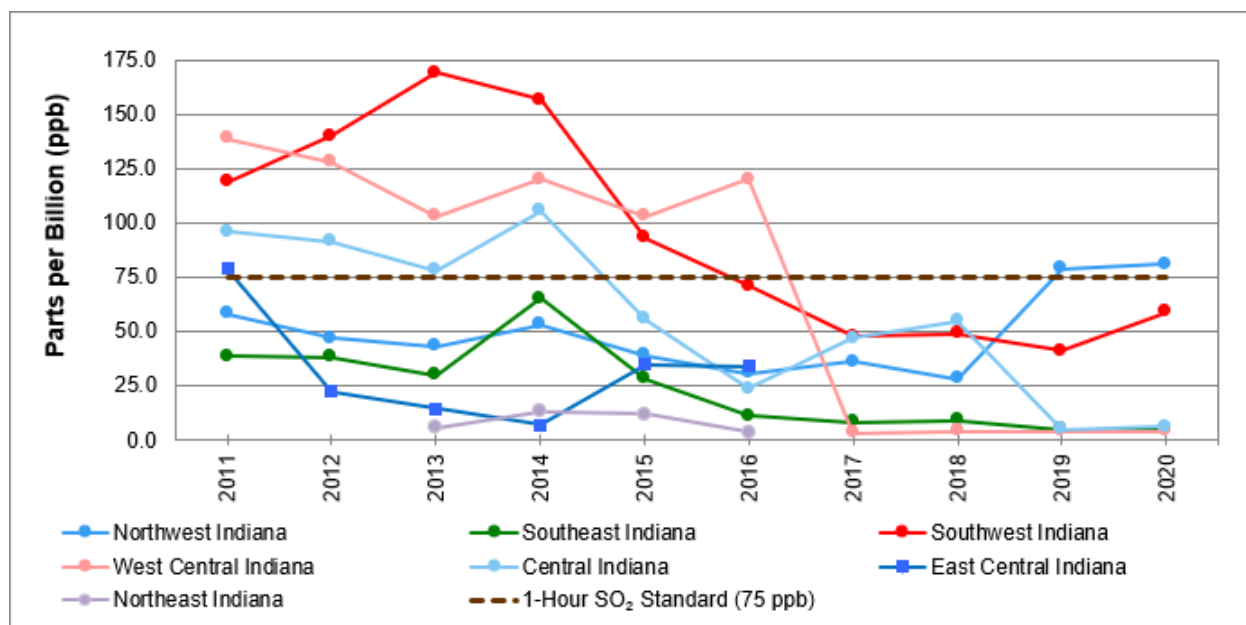
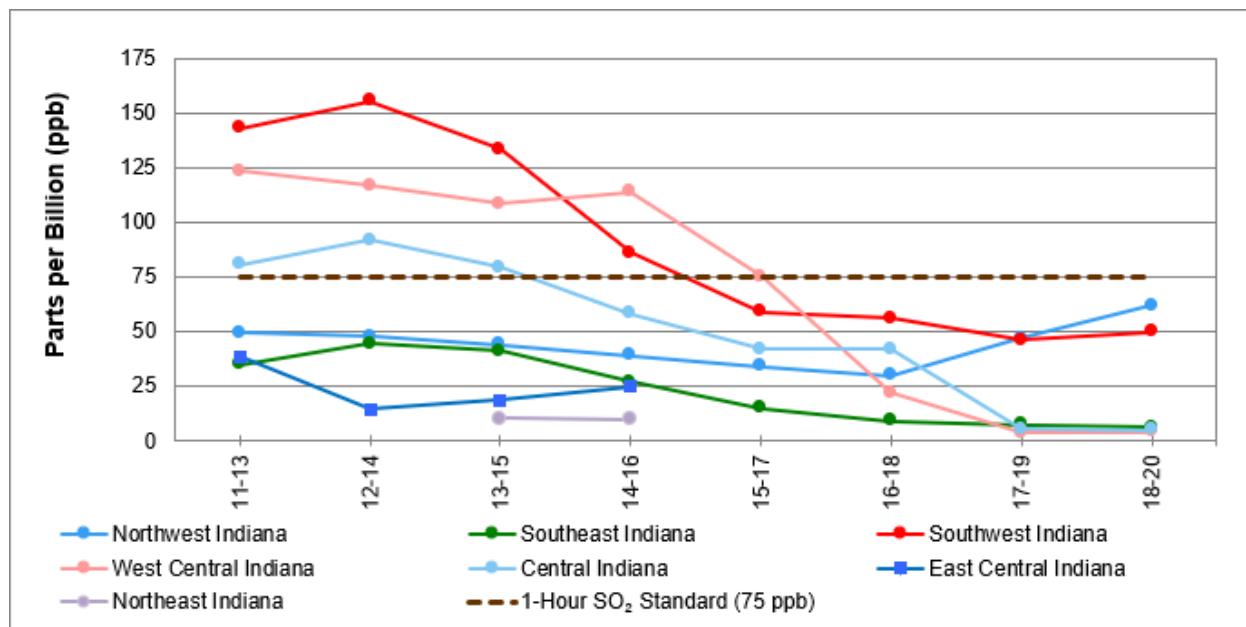


Chart 2: SO₂ Design Value Trends for 2011-2013 Through 2018-2020



Status of SO₂ Designations

When a NAAQS is issued, the implementation process begins. The first step is for U.S. EPA to designate air quality for all areas of the country. Areas that are not attaining the new standard and areas that are contributing to areas that are not attaining the standard are designated as nonattainment. When a nonattainment area attains the standard, IDEM ensures it is formally recognized for its compliance and redesignated to attainment status.

2010 Primary 1-Hour NAAQS: On August 5, 2013, U.S. EPA issued designations for areas with existing SO₂ monitors that violated the primary 1-hour standard, referred to as Round 1 designations. Portions of Daviess, Marion, Morgan, Pike and Vigo counties were designated as nonattainment in Round 1 based on 2009-2011 monitoring data as shown in Table 1.² More recent data shows that all monitors are achieving the standard. Indiana has been and will continue working closely with U.S. EPA on the submission of attainment demonstrations, maintenance plans, and timely requests for the redesignation of these areas to attainment status.

² <https://federalregister.gov/a/2013-18835> (78 FR 47191)

Table 1: Round 1 Designations Under the 2010 Primary 1-Hour SO₂ NAAQS

Area	County/Township	Current Status
Southwest Indiana, IN	Daviess County: Veale Township	Attainment: Set to be Redesignated on March 2, 2021 (86 FR 12107).
Indianapolis, IN	Marion County: Center, Perry, and Wayne Townships	Attainment: Redesignated on May 21, 2020 (85 FR 30844).
Morgan County, IN	Morgan County: Clay and Washington Townships	Attainment: Redesignated on September 16, 2020 (85 FR 57736).
Southwest Indiana, IN	Pike County: Washington Township	Attainment: Set to be Redesignated on March 2, 2021 (86 FR 12107).
Terre Haute, IN	Vigo County: Fayette and Harrison Townships	Attainment: Redesignated on July 8, 2019 (84 FR 32317).

As a result of a Consent Decree and subsequent court order, U.S. EPA was required to complete designations for the remainder of the country in three additional rounds. Round 2 designations were issued on July 12, 2016 and included unmonitored areas around certain large sources of SO₂ emissions that were identified according to U.S. EPA Air Markets Database.³ Designations were based on data from air models, which are computer-generated air quality predictions based on weather and emissions data. As shown in Table 2, Gibson County, Jefferson County (partial), LaPorte County, Posey County (partial) and Spencer County (partial) were designated as attainment/unclassifiable in Round 2 (81 FR 45039).

³ Areas that recorded new monitor violations since Round 1 were also addressed in Round 2; however, no new monitor violations were recorded in Indiana.

Table 2: Round 2 Designations Under the 2010 Primary 1-Hour SO₂ NAAQS

Source	County/Area	Current Status
Duke Energy Gibson Station	Gibson County	Attainment/Unclassifiable
IKEC Clifty Creek Station	Jefferson County: Graham, Lancaster, Madison, Monroe, Republican, Shelby, and Smyrna Townships	Attainment/Unclassifiable
NIPSCO Michigan City Station	LaPorte County	Attainment/Unclassifiable
Vectren A.B. Brown Station	Posey County: Bethel, Center, Harmony, Lynn, Marrs, Robb, Robinson, and Smith Townships	Attainment/Unclassifiable
AEP Rockport Station	Spencer County: Ohio Township north of UTM 4187.580 km northing, and Carter, Clay, Grass, Hammond, Harrison, and Jackson Townships	Attainment/Unclassifiable

Round 3 designations were issued on January 9, 2018, based on modeling data for areas around SO₂ emissions sources identified as being subject to U.S. EPA's Data Requirements Rule (DRR).⁴ Designations for areas that installed new monitors for the purpose of designation, and all other remaining areas, were not designated. As shown in Table 3, a designation of attainment/unclassifiable was issued for all Round 3 areas of Indiana, except for Huntington Township in Huntington County (83 FR 1098).

⁴The DRR was finalized on August 21, 2015 (80 FR 51052). View a copy at: <https://federalregister.gov/a/2015-20367> (80 FR 51052).

Table 3: Round 3 Designations Under the 2010 Primary 1-Hour SO₂ NAAQS

Source	County/Area	Current Status
Duke Energy Gallagher Station	Floyd	Attainment/Unclassifiable
U.S. Mineral Products Isolatek	Huntington County: Huntington Township	Nonattainment: On April 9, 2018, IDEM submitted a petition to U.S. EPA requesting that it reconsider the nonattainment designation and reclassify the township as “unclassifiable.”
NIPSCO R.M. Schahfer Station	Jasper	Attainment/Unclassifiable
ISPAT Cokenergy	Lake	Attainment/Unclassifiable
U.S. Steel Gary Works		
Cleveland-Cliffs Steel (316) ¹		
SABIC Innovative Plastics	Posey	Attainment/Unclassifiable
Hoosier Energy Merom Station	Sullivan	Attainment/Unclassifiable
Duke Energy Cayuga Station	Vermillion	Attainment/Unclassifiable
ALCOA Warrick Power Plant	Warrick	Attainment/Unclassifiable
ALCOA Warrick Operations		
All remaining areas of Indiana, except Porter County.		Attainment/Unclassifiable

¹ Formerly known as ArcelorMittal USA.

The fourth and final round of designations is set to be issued by March 26, 2021, for areas around DRR sources that elected to install new monitors. Porter County is the only remaining undesignated area in Indiana. U.S. EPA is set to designate Porter County as attainment/unclassifiable, as shown in Table 4.

Table 4: Round 4 Designations Under the 2010 Primary 1-Hour SO₂ NAAQS

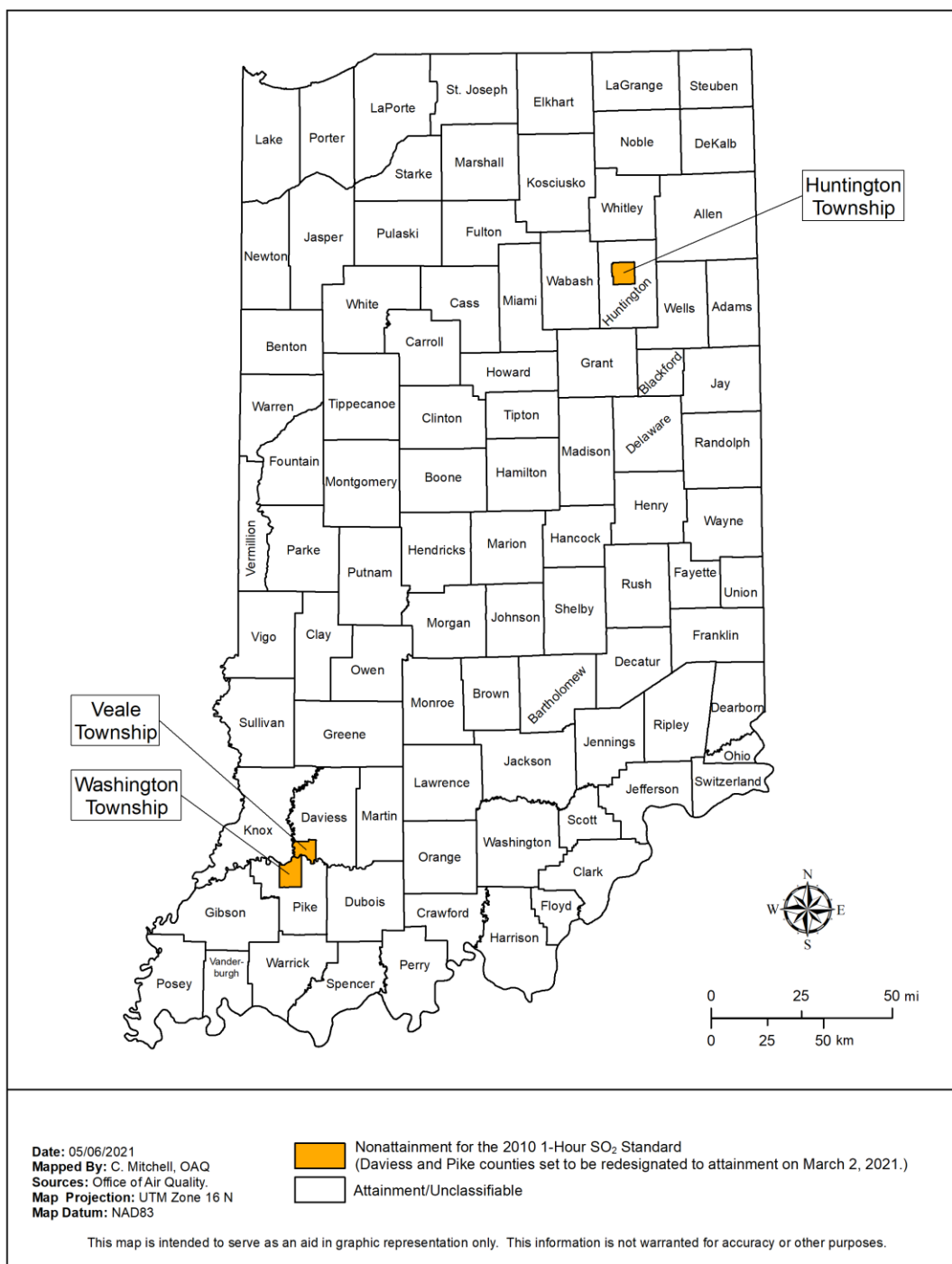
Source	County/Area	Current Status
Cleveland-Cliffs Burns Harbor	Porter County	Attainment/Unclassifiable

¹ Formerly known as ArcelorMittal Burns Harbor.

Secondary 3-Hour SO₂ NAAQS: Indiana has never had any nonattainment areas for the secondary 3-hour SO₂ standard.

Indiana's SO₂ nonattainment areas are shown in Figure 5.

Figure 5: Nonattainment Areas Under the 2010 Primary 1-Hour SO₂ Standard



Additional Information

- Continuous monitoring data and air quality reports: <https://www.in.gov/ideM/airmonitoring/>
- Air quality designations, nonattainment plans, redesignation petitions and maintenance plans: <https://www.in.gov/ideM/airquality/information-about/nonattainment/nonattainment-status-for-indiana-counties/>
- U.S. EPA information about SO₂ pollution and NAAQS implementation: <https://www.epa.gov/naaqs>.
- U.S. EPA AQS: <https://www.epa.gov/aqs>.

Contact IDEM's Office of Air Quality

Please feel free to direct questions or comments to Mrs. Michele Boner, environmental manager with IDEM's Office of Air Quality, at (800) 451-6027 Option 4 (*toll free*), (317) 233-6844 (*direct*), or mboner@idem.in.gov (*email*).