2023 Ozone (O_3) Season Data Summary Report

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 ground-level ozone. Monitoring is conducted for Indiana's ozone season from March 1st through October 31st 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 ***2023 Ozone (O_3) Season Data Summary Report*** provides an overview of ground-level ozone and its impacts, national air health standards, Indiana's ozone monitoring network, a summary of 2023 ozone monitoring data, air quality trends for the last ten years, and the status of ozone designations in Indiana.

What is Ozone (O3)?

Ozone, referred to as O_3, is a gas that is comprised of three oxygen atoms. It occurs naturally, high above the earth, and provides important protection from the sun's harmful rays. O_3 can also form at ground level near the earth's surface when other manmade pollutants react together in heat and sunlight. Unfortunately, ground-level ozone is a pollutant that is unhealthy to breathe and can cause damage to trees and crops.

Where does ground-level ozone come from? Ground-level ozone is not emitted directly into the air. Instead, it is created by a chemical reaction between nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight. Some of the major sources of NO_x and VOCs are emissions from industrial facilities and electric utilities that use fossil fuel for combustion, motor vehicle exhaust, and vapors from gasoline and chemical solvents. O_3 is most likely to form at ground level during the summer when there are long days of sunlight and still winds. Unhealthy levels are most likely to build up in urban areas with many local sources of NO_x and VOCs. Since wind can transport pollutants hundreds of miles, rural areas are also affected.

What are the health effects of exposure to ground-level ozone? Breathing O_3 can cause respiratory problems for anyone. However, sensitive groups such as young children, the elderly, and individuals with asthma or other chronic respiratory ailments are particularly vulnerable to ill health effects. Exposure can:

- Cause chest pain, coughing, throat irritation, and congestion.
- Worsen bronchitis, emphysema, and asthma.
- Decrease lung function and inflame the linings of the lungs.
- Scar lung tissue.

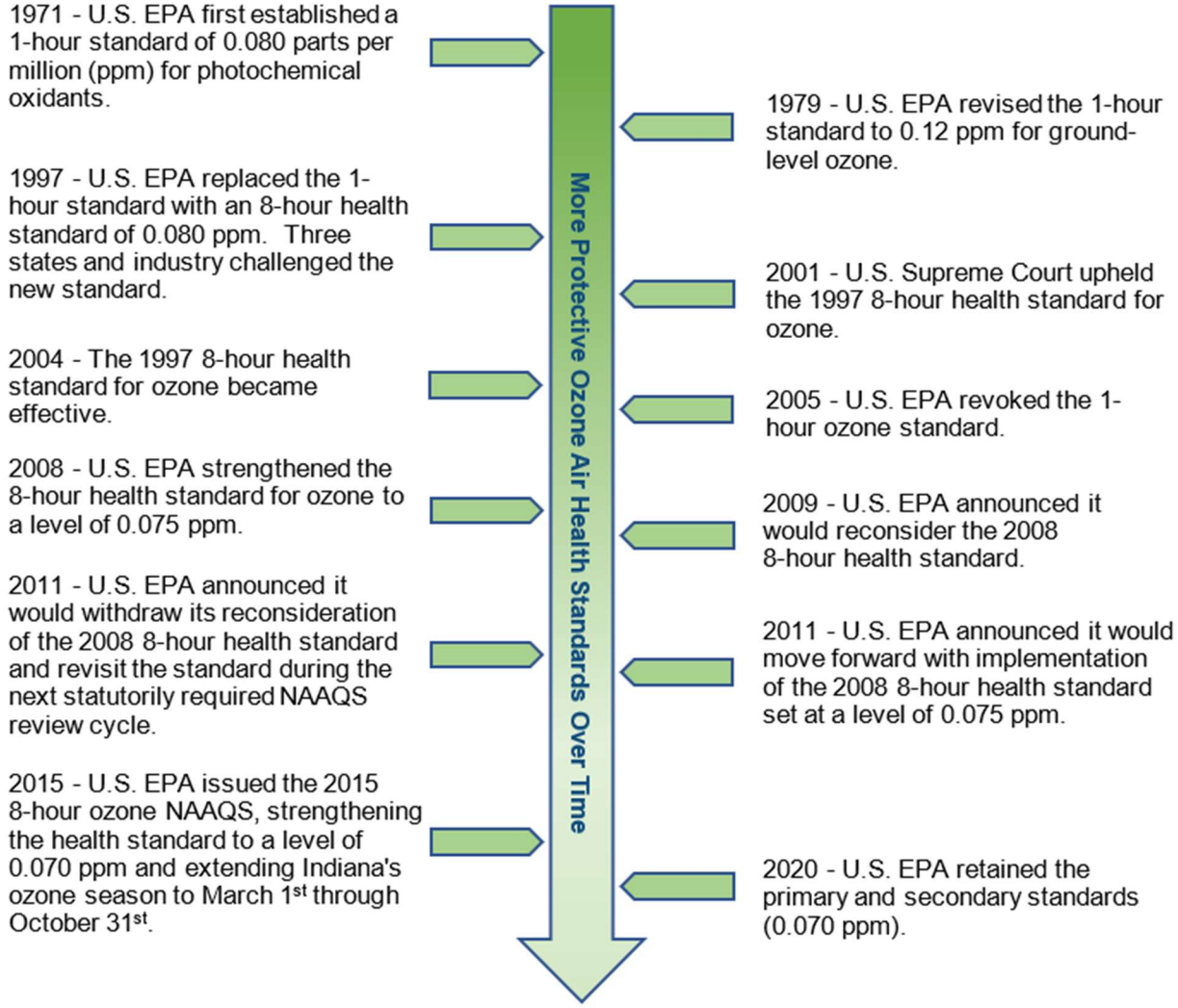
National Ambient Air Quality Standards (NAAQS) for Ozone

The federal Clean Air Act (CAA) requires U.S. EPA to establish National Ambient Air Quality Standards (NAAQS) for common outdoor air pollutants, including ground-level ozone. NAAQS, which are also known as air health standards, include:

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

Primary and secondary NAAQS were first established for total photochemical oxidants in 1971 and further developed over the years. U.S. EPA made revisions in 1979 and established a 1-hour standard for measurements of hourly ozone concentrations. In 1997, the 1-hour standard was replaced with an 8-hour standard based on a maximum daily 8-hour average ozone concentrations. A more stringent 8-hour standard was adopted in 2008, and again in 2015. Figure 1 notes milestones in the history of the ozone NAAQS.

Figure 1: History of the Ozone NAAQS



Attaining the Ozone Standards

Air quality monitoring data for ground-level ozone must measure at or below the maximum concentration set by U.S. EPA for three complete, consecutive years to be in attainment of the primary and secondary ozone standards, which are set at the same level. For example, an evaluation in 2025 will be based on data from 2022 through 2024.

How does an area attain the current ozone standards? An area is determined to be attaining both the 2015 primary and secondary 8-hour ozone NAAQS when the annual fourth (4th) highest daily maximum 8-hour average concentration, averaged over three consecutive years, does not exceed 0.070 parts per million (ppm).

What is a design value? The three-year average of the annual 4th highest daily maximum average concentration is called the **design value**. Monitor design values are calculated at the end of each ozone season once all the data from Indiana's monitoring network has been quality assured. Indiana's ozone season runs from March 1st through October 31st, as established in the 2015 ozone NAAQS. U.S. EPA uses design values to determine whether an area is attaining the NAAQS. Where two or more monitors are located within the same area, the monitor with the highest design value is used for the air quality designation.

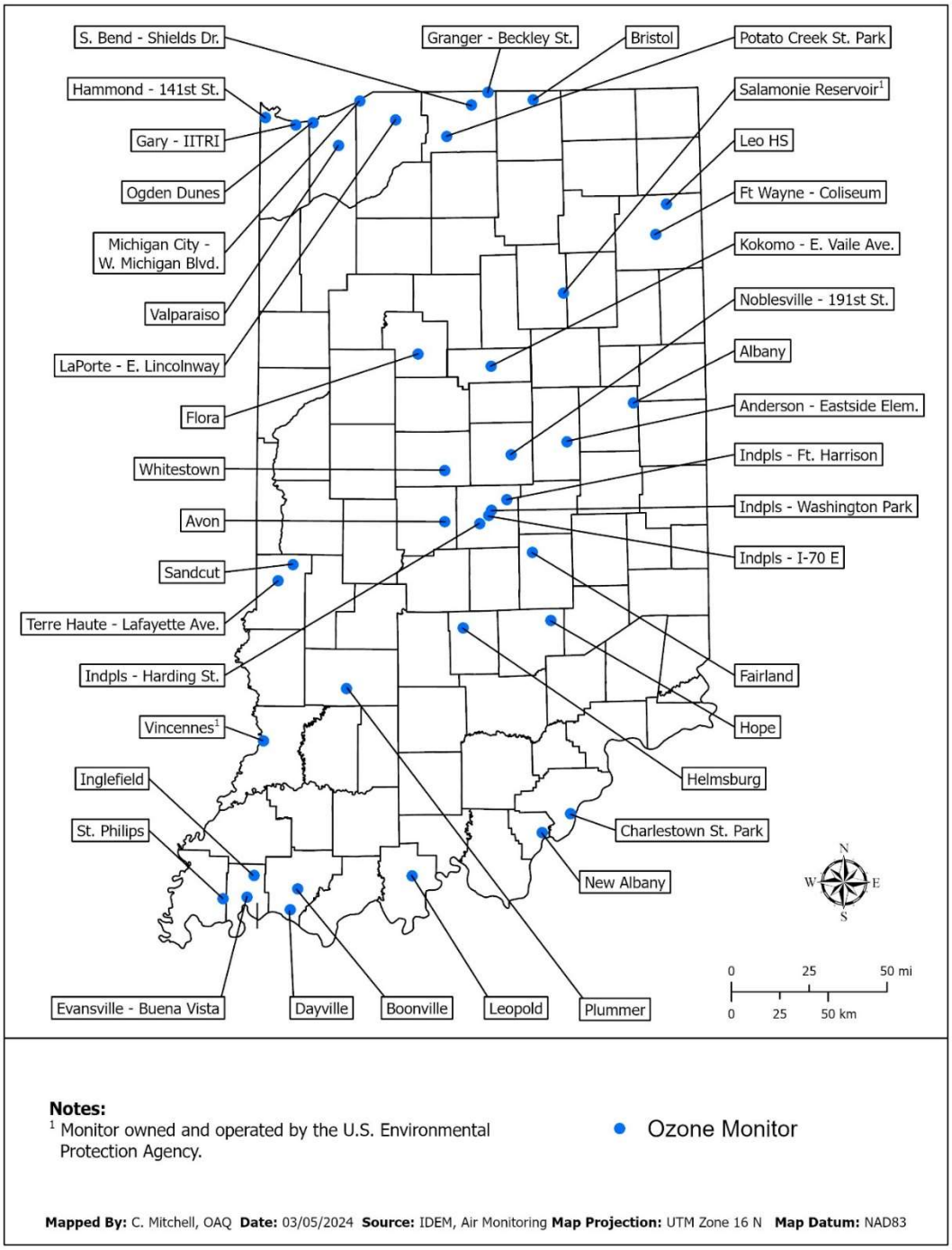
What is the difference between an exceedance and a violation? When a monitor records a concentration above the limit established by the NAAQS, it is referred to as an **exceedance**. A monitor can have an exceedance without being in **violation** of the standard. However, if a monitor's three-year design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

2023 Ozone Monitoring Network

Indiana's 2023 monitoring network included 37 ozone monitors placed in 25 counties across Indiana. U.S. EPA provides guidance on monitor placement. The major determining factors are population density and manufacturing levels. IDEM conducts annual reviews of the monitoring network, which are published each year in the *Indiana Annual Ambient Air Monitoring Network Plan* and can be viewed on Indiana's Ambient Air Monitoring Network Web page at: https://www.in.gov/idem/airmonitoring/indianas-ambient-air-monitoring-network.

U.S. EPA operated two additional ozone monitors in rural counties as part of its Clean Air Status and Trends Network (CASTNET). Figure 2 shows the monitor locations in Indiana for ozone in 2023.

Figure 2: 2023 Ozone Monitoring Network



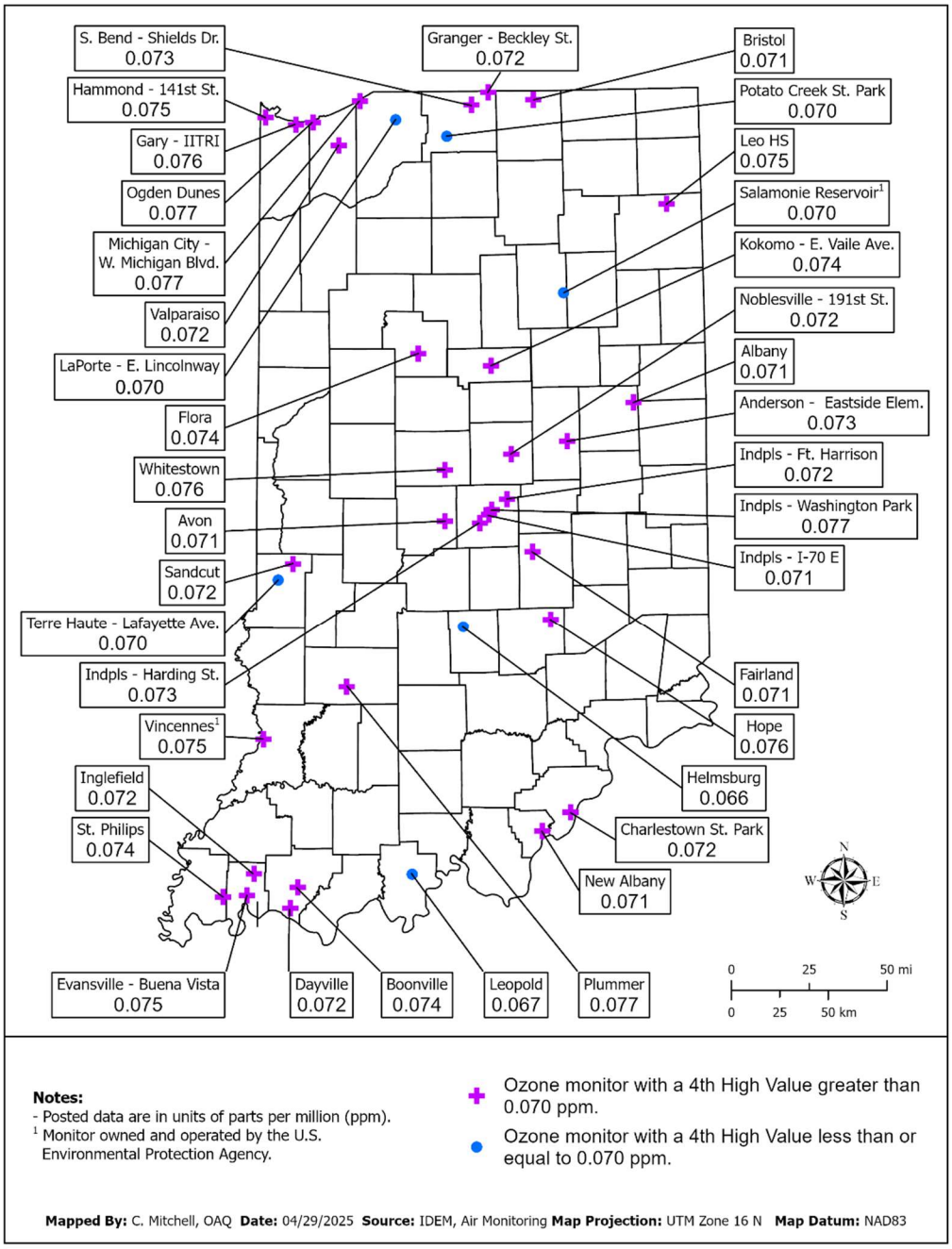
2023 Ozone Monitoring Data Summary

Data has been quality assured for the 2023 ozone season.

Annual 4th highest concentrations: In 2023, thirty-two monitors in Indiana had an annual 4th highest daily maximum concentration above the 2015 ozone standard of

0.070 ppm as shown in Figure 3. During 2023 smoke, mainly from wildfire events across Canada and western and southern United States, severely affected ozone formation in Indiana. Across Indiana 42 separate days were affected by either smoke from wildfires or smoke from July 4th festivities. These events make any conclusions as to the cause of ozone formation very challenging.

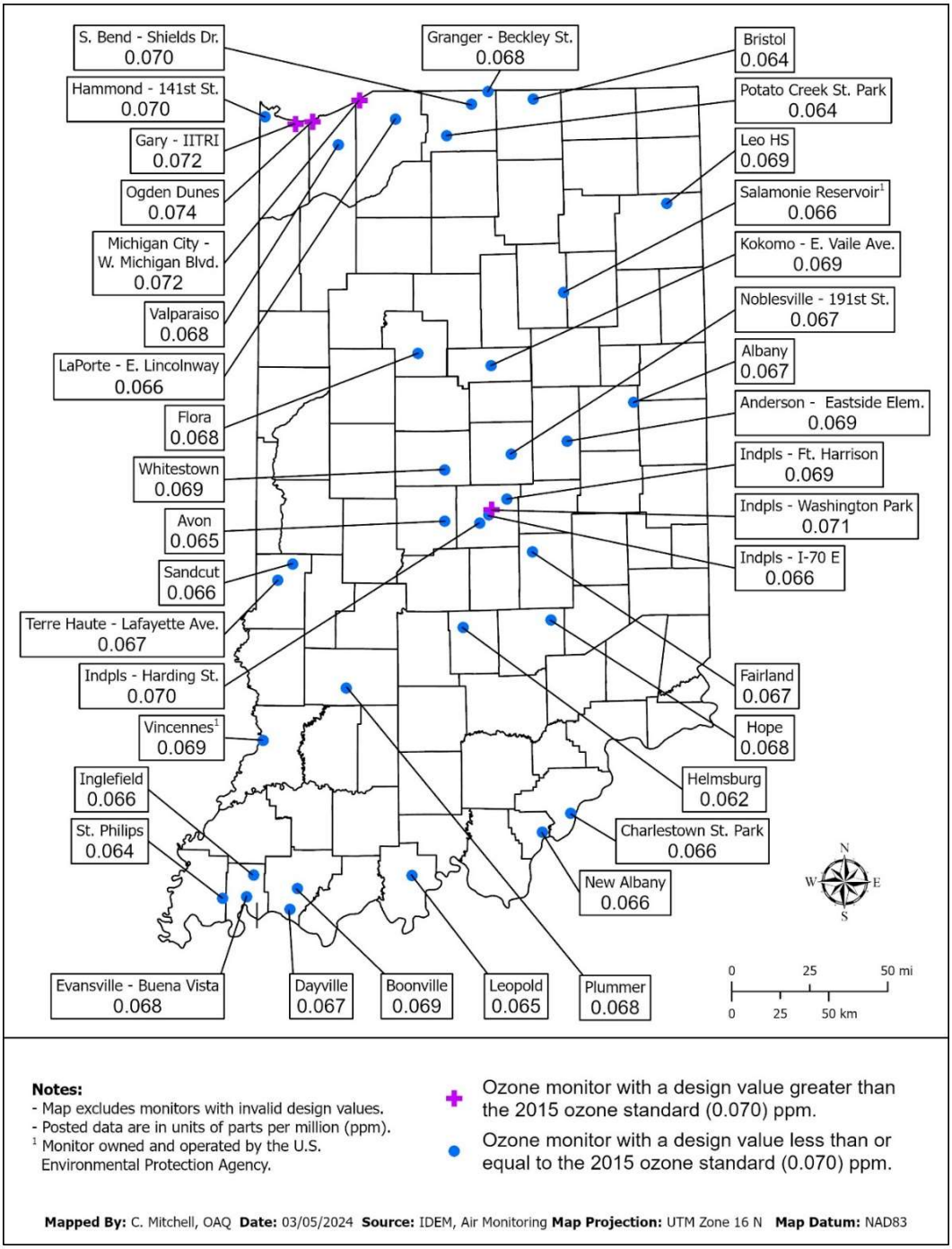
Figure 3: 2023 4th High Ozone Values



Exceedances in 2023: Exceedances, or concentrations above the 2015 ozone standard, were recorded on 30 days during 2023.

Design values: In 2023, four monitors in Indiana had 2021-2023 design values above the 2015 ozone standard of 0.070 ppm as shown in Figure 4.

Figure 4: Ozone Monitor Design Values for 2021-2023



Air Quality Action Days: IDEM works throughout the ozone season to analyze continuous monitoring data and issue air quality forecasts in coordination with local,

state, and regional partners. Public alerts called **Air Quality Action Days** (AQADs) are issued when unhealthy air is predicted. AQADs were issued for ozone on 28 days in 2023. The public can find daily air quality forecasts and sign up to receive email or text alerts on IDEM's SmogWatch website at: https://apps.idem.in.gov/smogwatch/Today.aspx.

Ozone Air Quality Trends

Ozone monitoring data in Charts 1 and 2 below are divided into regions as shown in Figure 5.

Figure 5: Indiana Regions

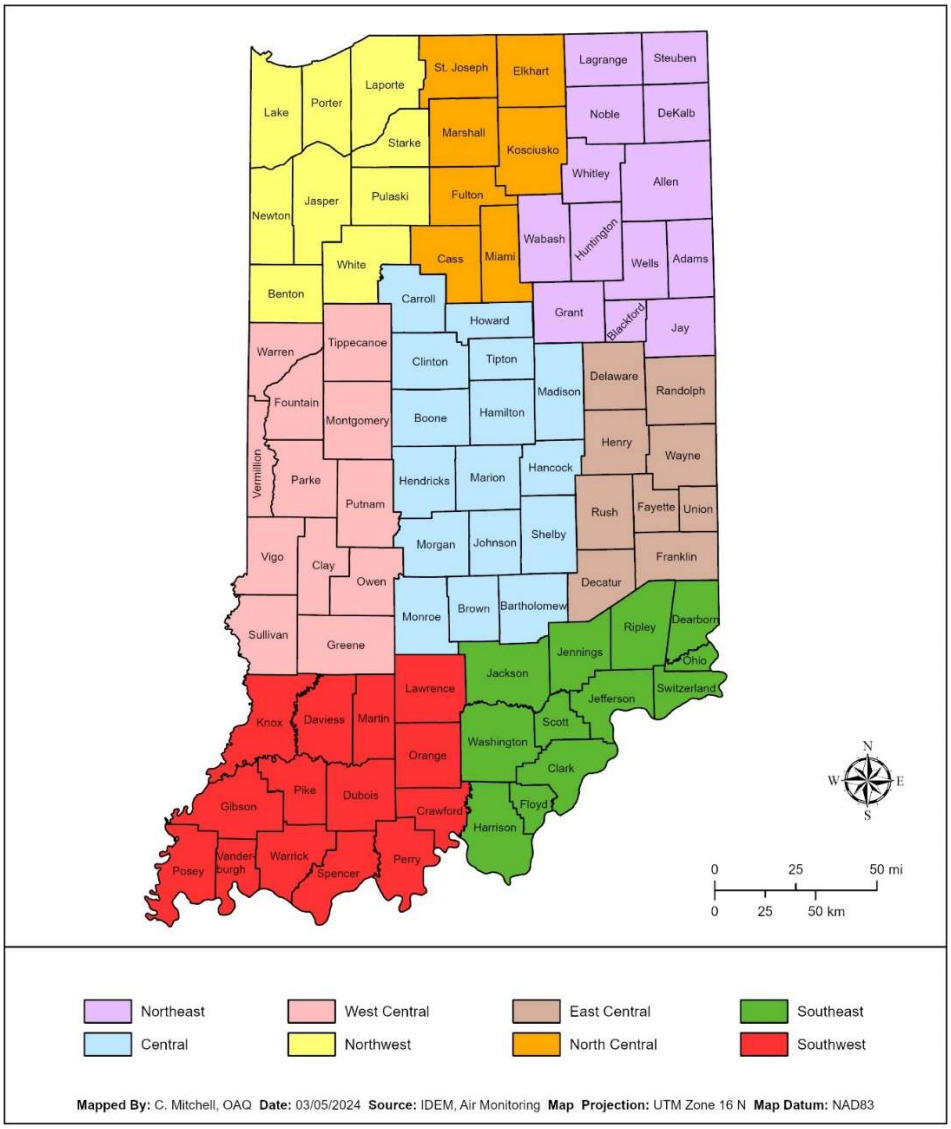


Chart 1 plots the annual 4th highest maximum daily ozone concentrations for 2012-2023. The 2008 ozone standard (0.075 ppm) and the 2015 ozone standard

(0.070 ppm) are shown for comparison. Chart 2 plots the highest 3-year design values for 2012-2014 through 2021-2023.

Chart 1: Annual 4th Highest Ozone Value Trends by Region for 2012-2023

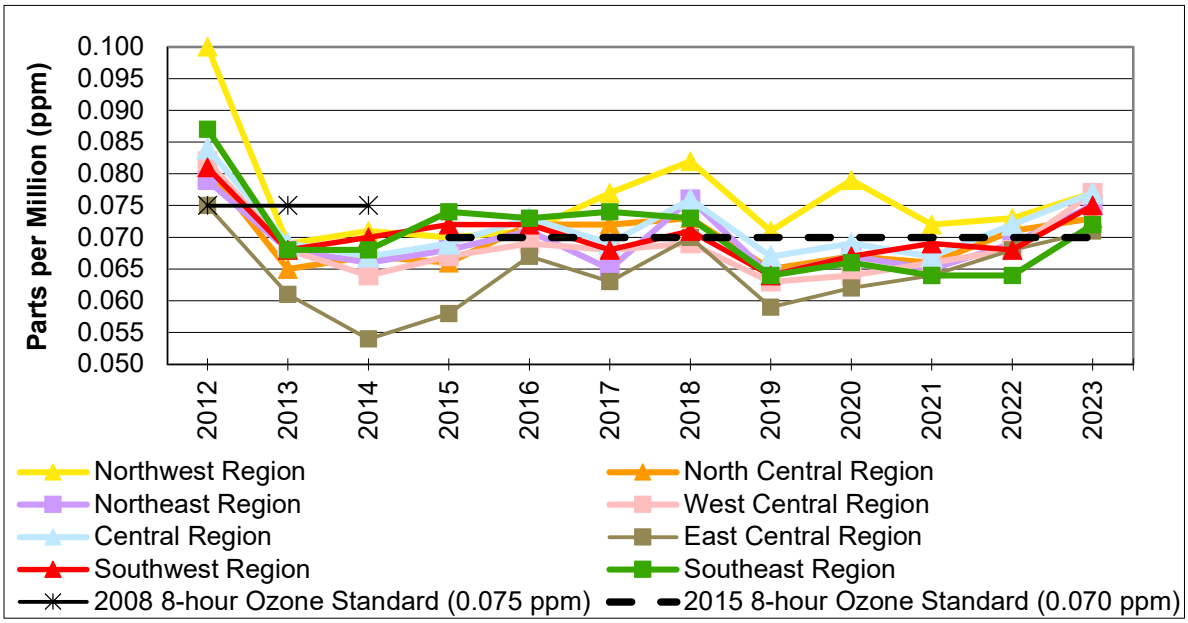


*Chart excludes monitors with incomplete data.

Chart 2: Ozone Design Value Trends by Region for 2012-2014 through 2021-2023

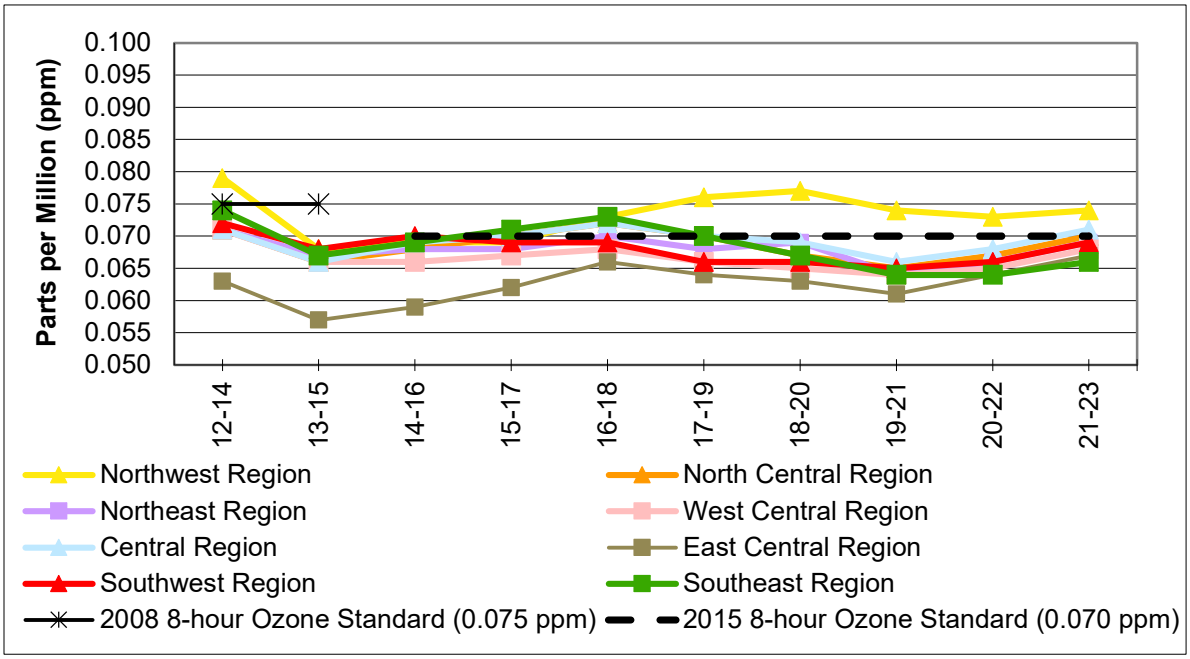


*Chart excludes monitors with incomplete data and/or less than three years of monitoring data.

Status of Ozone 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 based on monitoring data. 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 within Indiana attains the standard, IDEM submits a request to U.S. EPA for the area's redesignation to attainment status. This formal action ensures the area is recognized for its compliance.

Ground-level ozone has been reduced over the years. At the same time, health-based standards have become tighter based on scientific studies showing that health and environmental impacts can occur from lower concentrations of pollutants than previously believed. As a result, air quality still needs to improve in some areas of the country. The following are details concerning each NAAQS.

1997 8-Hour Ozone NAAQS: An 8-hour NAAQS was established in 1997 that set a limit of 0.080 ppm. Following the resolution of legal challenges to the new standard, designations were issued several years later, on April 30, 2004, and effective June 15, 2004 (69 FR 23858).[1] Although 23 counties and one township in Indiana were initially designated as nonattainment, subsequent monitoring data showed compliance. Indiana submitted requests for redesignation with maintenance plans for the affected counties and townships in 12 areas. Attainment status was approved for all areas by May 2010, as shown in Table 1.

[1] Federal Register (FR) notices (cited by volume and page number) can be viewed at https://www.federalregister.gov/.

Table 1: Designations Under the 1997 Ozone NAAQS

County/Area	Status
Allen	Attainment, effective February 12, 2007 (72 FR 1292)
Central Indiana, including Boone, Hamilton, Hancock, Hendricks, Johnson, Madison, Marion, Morgan, and Shelby Counties	Attainment, effective October 19, 2007 (72 FR 59210)
Clark and Floyd Counties	Attainment, effective July 19, 2007 (72 FR 39571)
Dearborn County, Lawrenceburg Township Only	Attainment, effective May 11, 2010 (75 FR 26118)
Delaware County	Attainment, effective January 3, 2006 (70 FR 69443)
Greene County	Attainment, effective December 29, 2005 (70 FR 69085)
Jackson County	Attainment, effective December 29, 2005 (70 FR 69085)
Lake and Porter Counties	Attainment, effective May 11, 2010 (75 FR 26113)
LaPorte County	Attainment, effective July 19, 2007 (72 FR 39574)
St. Joseph and Elkhart Counties	Attainment, effective July 19, 2007 (72 FR 39577)
Vanderburgh and Warrick Counties	Attainment, effective January 30, 2006 (70 FR 77026)
Vigo County	Attainment, effective February 6, 2006 (71 FR 541)
All Other Indiana Counties	Unclassifiable/Attainment, effective June 15, 2004 (69 FR 23858)

2008 8-Hour Ozone NAAQS: The 8-hour NAAQS was strengthened to 0.075 ppm in 2008. Ozone nonattainment areas are classified as marginal, moderate, serious, severe, or extreme. Attainment dates are established by law for each classification.

On May 21, 2012, U.S. EPA issued designations for most areas of Indiana based on 2008-2010 data, effective July 20, 2012 (77 FR 30087). Lawrenceburg Township in Dearborn County was designated nonattainment as part of the Cincinnati, Ohio-Kentucky-Indiana (OH-KY-IN) nonattainment area with a classification of “marginal” and an attainment date of July 20, 2015. All other Indiana counties were designated as attainment/unclassifiable except for Lake and Porter counties in northwestern Indiana. On June 11, 2012, U.S. EPA designated Lake and Porter counties as part of the Chicago-Naperville, Illinois-Indiana-Wisconsin (IL-IN-WI) nonattainment area with a classification of “marginal” and an attainment date of July 20, 2015, effective July 20, 2012 (77 FR 34221). The designation was based on 2009-2011 data for the Chicago-Naperville, IL-IN-WI area.

Indiana has since worked with U.S. EPA on the submission of attainment demonstrations, maintenance plans, and requests for the redesignation of areas to attainment status based on subsequent data showing all monitors achieved the 2008 standard. On February 23, 2016, IDEM submitted a maintenance plan and request for

Lawrenceburg Township to be redesignated to attainment status based on 2012-2014 monitoring data for the Cincinnati, OH-IN-KY area. U.S. EPA approved the attainment designation on April 7, 2017 (82 FR 16940).

Monitoring data for 2012-2014 showed the Chicago-Naperville, IL-IN-WI nonattainment area failed to meet the standards by July 20, 2015. Therefore, U.S. EPA reclassified the area from "marginal" to "moderate" on May 4, 2016, with a new attainment date of July 20, 2018, effective June 3, 2016 (81 FR 26697). Monitoring data for 2015-2017 showed the area did not meet the standards by July 20, 2018, resulting in its reclassification from "moderate" to "serious" on August 23, 2019, with a new attainment date of July 20, 2021, effective September 23, 2019 (84 FR 44238). Monitoring data for 2019-2021 shows the entire Chicago-Naperville, IL-IN-WI area meets the 2008 standards and, on May 20, 2022, U.S. EPA redesignated Lake and Porter counties to attainment based on a request submitted by Indiana on December 6, 2021 (87 FR 30821).

Table 2 summarizes Indiana's status under the 2008 ozone standards.

Table 2: Designations Under the 2008 Ozone NAAQS

County/Area	Status
Dearborn County, Lawrenceburg Township Only	Attainment, effective April 7, 2017 (82 FR 16940)
Lake and Porter Counties	Attainment, effective May 20, 2022 (87 FR 30821)
All Other Indiana Counties	Unclassifiable/Attainment, effective July 20, 2012 (77 FR 30087)

2015 8-Hour Ozone NAAQS: On October 1, 2015, U.S. EPA finalized a rule that strengthened the 8-hour ozone standard to 0.070 ppm and extended Indiana's ozone season to March 1st through October 31st. On November 16, 2017, most Indiana counties were designated as attainment/unclassifiable, effective January 16, 2018 (82 FR 54232). On June 4, 2018, all remaining areas of Indiana were designated as attainment/unclassifiable, with the following exceptions, effective August 3, 2018 (83 FR 25776):

- Clark and Floyd counties were designated as part of the Louisville, Kentucky-Indiana (KY-IN) nonattainment area with a classification of "marginal" and an attainment date of August 3, 2021.
- Calumet, Hobart, North, Ross, and St. John townships in Lake County were designated as part of the Chicago, Illinois-Indiana-Wisconsin (IL-IN-WI) nonattainment area with a classification of "marginal" and an attainment date of August 3, 2021. U.S. EPA revised the Chicago, IL-IN-WI boundary on June 14, 2021, to include a portion of Porter County (Center, Jackson, Liberty, Pine, Portage, Union, Washington, and Westchester townships) in Indiana, effective July 14, 2021 (86 FR 31438).

On February 21, 2022, IDEM submitted a maintenance plan and request for Clark and Floyd counties to be redesignated to attainment status based on 2019-2021 monitoring data for the Louisville, KY-IN area. U.S. EPA approved the attainment designation on July 5, 2022 (87 FR 39750).

Monitoring data for 2019-2021 showed the Chicago, IL-IN-WI area failed to meet the 2015 ozone standards by August 3, 2021. Therefore, U.S. EPA reclassified the area from “marginal” to “moderate” on October 7, 2022, with a new attainment date of August 3, 2024, effective November 7, 2022 (87 FR 60897). Monitoring data for 2021-2023 indicates the Chicago, IL-IN-WI area does not meet the 2015 ozone standards.

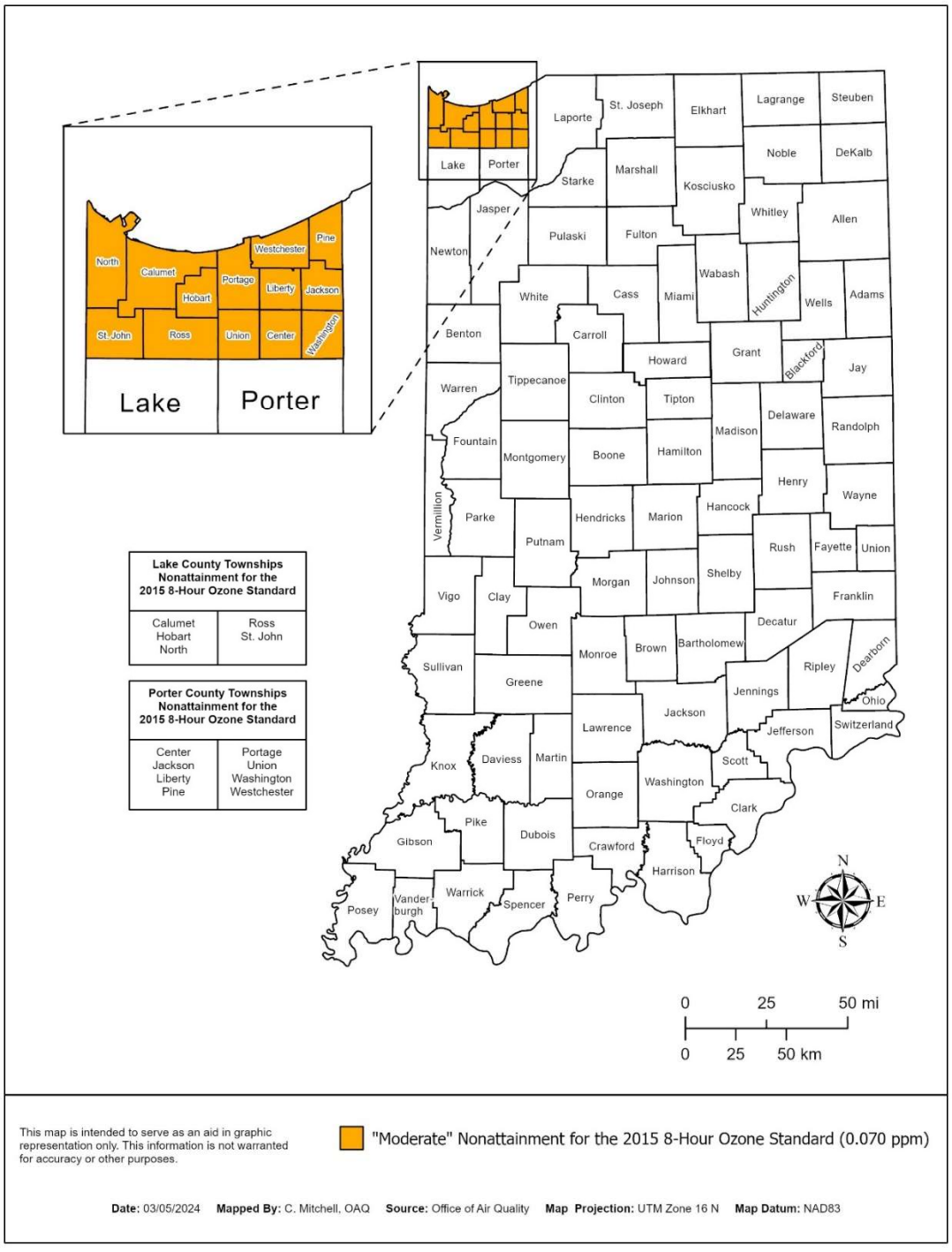
Table 3 summarizes Indiana’s status under the 2015 NAAQS.

Table 3: Designations Under the 2015 Ozone NAAQS

County/Area	Status
Clark and Floyd Counties	Attainment, July 5, 2022 (87 FR 39750)
Lake County (Partial) and Porter County (Partial)	Nonattainment, “Moderate” classification: effective November 7, 2022 (87 FR 60897). Attainment required by August 3, 2024.
All Other Indiana Counties	Attainment/Unclassifiable, effective January 16, 2018 (82 FR 54232) and August 3, 2018 (83 FR 25776)

Figure 6 contains a map showing ozone nonattainment areas in Indiana.

Figure 6: Indiana's Ozone Nonattainment Areas



Additional Information

- For near-real time continuous ozone monitoring data, data summaries, and air quality reports, visit IDEM's Air Quality Data Web page at: https://www.in.gov/idem/airmonitoring/air-quality-data/.
- For air quality designations, attainment demonstrations, and requests for redesignation and maintenance plans, visit IDEM's State Implementation Plans website at: https://www.in.gov/idem/sips/.
- For information about ground-level ozone and NAAQS implementation, visit U.S. EPA's NAAQS website: https://www.epa.gov/naaqs.
- Learn about U.S. EPA's Air Quality System (AQS) at: https://www.epa.gov/aqs.
- Learn about U.S. EPA's Clean Air Status and Trends Network (CASTNET) at: https://www.epa.gov/castnet.

Contact IDEM's Office of Air Quality

Please feel free to direct questions or comments to 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*).