CRITERIA POLLUTANTS

Air Quality Trend Analysis Report
(1980-2010)

Indiana Department of Environmental Management

Office of Air Quality

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Acronyms/Abbreviation List

AQI	Air Quality Index
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CO	carbon monoxide
CSAPR	Cross-State Air Pollution Rule
D.C.	District of Columbia
EGUs	electric generating units
FR	Federal Register
IAC	Indiana Administrative Code
IDEM	Indiana Department of Environmental Management
MWe	megawatt electrical
NAAQS	National Ambient Air Quality Standard
NO_2	nitrogen dioxide
NO_x	nitrogen oxides

$PM_{2.5}$ ..... particulate matter less than or equal to 2.5 $\mu g/m^3$ or fine particles

PM_{10} ..... particulate matter less than or equal to 10 $\mu g/m^3$ or particulate matter

ppb ..... parts per billion

ppm ..... parts per million

RACT ..... reasonably available control technology

SIP ..... State Implementation Plan

SO_2 ..... sulfur dioxide

SUVs ..... sport utility vehicles

TSP ..... total suspended particles

U.S. EPA ..... United States Environmental Protection Agency

$\mu g/m^3$ ..... micrograms per cubic meter

VOC ..... volatile organic compound

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Introduction

The Indiana Department of Environmental Management (IDEM) conducted a detailed analysis of air quality trends in Indiana over the last thirty years. This report is based on data from Indiana's extensive state-wide air monitoring network and reflects the result of IDEM's analysis. Indiana first began monitoring for air quality in 1971 and gradually expanded the network over the several years that immediately followed. This report covers the monitors within Indiana's network that were active during the period from 1980 through 2010[1].

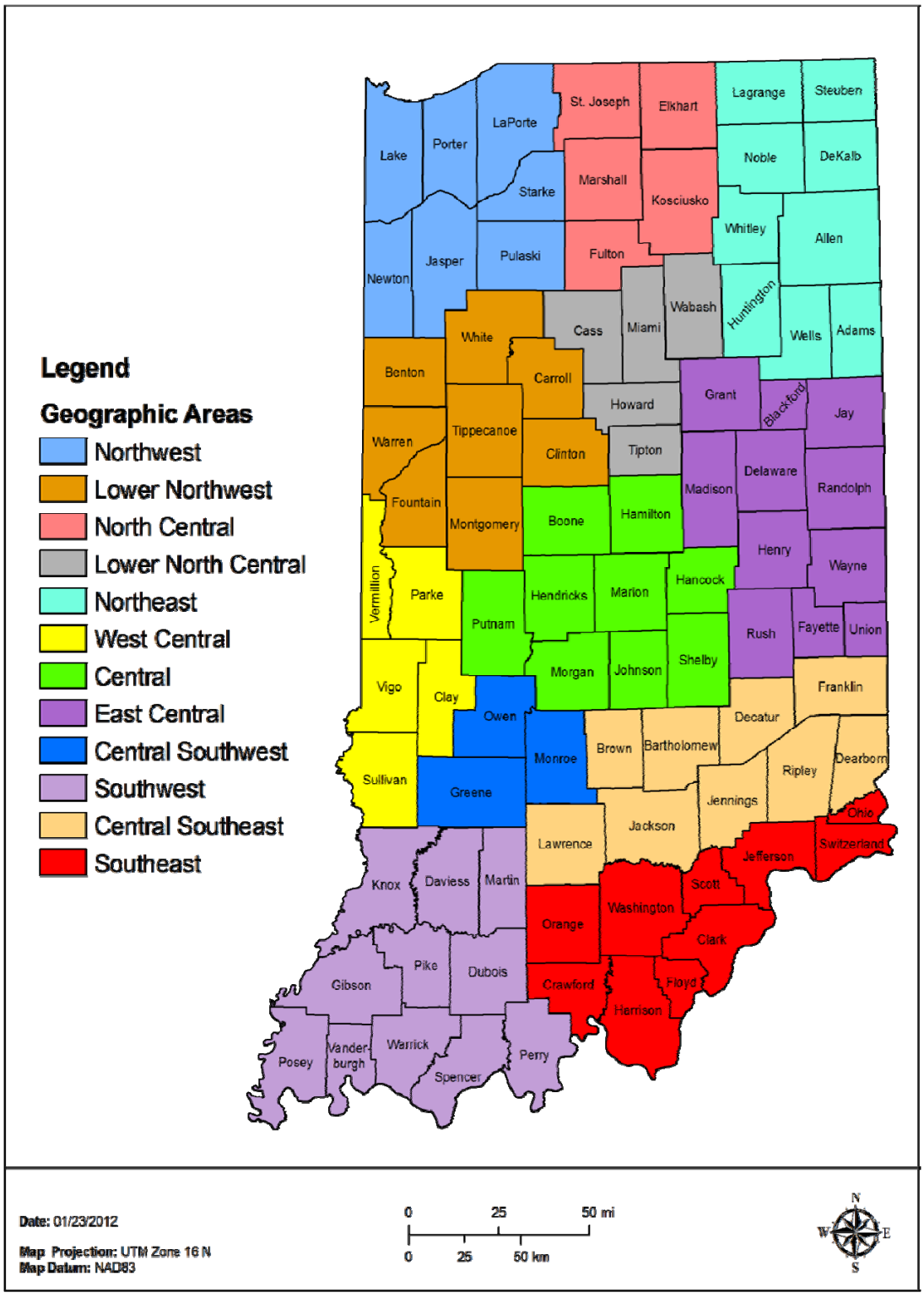
Each region of the state has a section in this report that provides detailed information including monitoring data, trend charts, health and environmental impacts, and health-based standards. Also, there are emissions data for each of the criteria pollutants regulated by the Clean Air Act (CAA). The regulated criteria pollutants are carbon monoxide (CO), fine particles ($PM_{2.5}$), lead, nitrogen dioxide (NO_2), ozone, particulate matter (PM_{10}), and sulfur dioxide (SO_2). Information about total suspended particles (TSP) has also been included. TSP, the original form of the particulate matter standard, was replaced by PM_{10} in 1987.

Regional Air Quality Data

IDEM provides current and historical information about Indiana's air quality on its website[2] and through various publications. This level of information is useful to evaluate long-term trends and to make comparisons with data from other states. However, a more thorough evaluation of air quality information can be conducted at regional and county levels. This report outlines IDEM's evaluation of regional and county level data from 1980 to 2010, based on availability. The datasets are divided into 12 regions as indicated on the color coded map in Figure 1.

[1] Monitor locations with at least 5 continuous years of data.
[2] www.smogwatch.IN.gov

Figure 1: Map of Twelve Regions



IDEM has incorporated all available data that is representative for each region. However, monitoring data are not available for each pollutant in each region. A regional approach was developed by IDEM to provide detailed local information so that a reader may focus on the geographic area of the state where he/she lives and works. The boundaries of these regions have no policy or legal implications. The goal is to present historical air quality data in an easy to read format. Specific data for the regulated criteria pollutants and emissions are explained in detail for each region.

Air Monitoring Data

As of 2011, IDEM has 84 air monitors located across the state. These monitors measure the following regulated criteria air pollutants: CO, $PM_{2.5}$, lead, NO_2, ozone, PM_{10}, and SO_2. Other pollutants for which an ambient standard has not been established are also monitored in Indiana. These monitors also include air toxics, carbonyls, metals, volatile organic compounds (VOCs), and speciated compounds for specific pollutants (i.e., $PM_{2.5}$ and VOCs). In addition, meteorological data, such as wind speed and direction, are also collected at these monitors to aid in analysis of the data. Monitoring air quality allows Indiana to track compliance with applicable primary and secondary ambient air quality standards, support the timely reporting of air quality forecasts and long-term health assessments, and track the long-term air quality trends to gauge the effectiveness of emission control and abatement strategies. Monitoring the levels of pollutants in the air allows IDEM to evaluate changes over time and provides assurance that the air is safe for the public to breathe.

Air Quality Measurements

Air monitoring measures pollution by taking samples of air and testing the sample to find out how much of a pollutant is present. Air monitoring is a direct measure of the concentration of a pollutant in the atmosphere at a particular time. IDEM collects samples on either a continuous or intermittent basis. Continuous samplers collect data in a constant stream and provide information on an hourly basis, everyday. Intermittent samples are collected over a twenty-four hour period every one, three, or six days. Monitoring results may be reported as a

concentration of the number of parts of the pollutant per one million or one billion parts of air. These concentration units are called parts per million (ppm) or parts per billion (ppb). Results may also be in the form of the mass of the pollutant, in micrograms in a cubic meter of air ($\mu g/m^3$). A microgram is one-millionth of a gram.

Table 1: Examples of ppm and ppb

What Does One In A Million Mean?	**What Does One In A Billion Mean?**
One ppm	One ppb
1×10^{-6}	1×10^{-9}
One inch in 16 miles	One inch in 15,780 miles
One cent in $10,000	One cent in $10 million
One second in about 12 days	One second in 32 years
One ounce of salt in about 31 tons of potato chips.	One ounce of salt in 31,250 tons of potato chips.

Health and Environmental Effects of Air Pollution

Air pollution can have numerous adverse health effects. Children, the elderly, and people with lung disease, such as emphysema and asthma, are especially susceptible to health complications from air pollution. Pollutants in the air are known or suspected to cause both acute health effects, from short-term exposure, as well as chronic health effects, from long-term or repeated exposure. Specific health risks and their severity depend upon the amount of pollutant to which an individual is exposed, the duration of the exposure, and the sensitivity of the individual exposed. Acute exposure to air pollution can cause an irritation of the eyes, nose, throat, coughing, difficulty breathing, inflamed lung tissue, and other health-related problems. Chronic exposure to air pollution could have more severe effects on human health, including cancer, reduced immune defenses, and cardiovascular and lung diseases.

Without clean air, the health of people, ecosystems, and even economies may be harmed. Air pollution, in many cases, may impact the health of people, plants, and animals, as well as degrade water quality. In addition, air pollution has been proven to damage crops and reduce yields, which affects farmers and consumers. Automobiles, buildings, statues, and monuments can be damaged when pollutants in the air degrade painted surfaces, metal, marble, and

limestone, costing individuals and taxpayers' money. Air pollution in certain parts of the country can obscure views from tall buildings, scenic overlooks, and parks, which can hamper tourism and local economies. Specific health effects for each of the criteria pollutants are explained below in further detail.

Air Quality Index

The Air Quality Index (AQI) is a health index which combines the evaluation of various air pollutants in order to provide an easily understood measure of air quality. The AQI focuses on health effects that can occur within a few hours or days after breathing polluted air. Air monitoring data are used to issue health alerts to warn the public of elevated pollution levels. The index provides a scale to which air quality is compared and indicates the associated health effects of concern. IDEM issues health alerts for high ozone levels and high $PM_{2.5}$ levels based on the AQI.

The AQI uses index numbers, health effect levels, and colors to communicate the health levels. The higher the AQI value, the greater the level of air pollution and the greater the chance of health impacts. For example, an AQI value of 50 represents good air quality and little potential to affect public health, while an AQI value over 300 represents hazardous air quality that could cause health effects. An AQI value of 100 generally corresponds to the National Ambient Air Quality Standard (NAAQS) for the pollutant, which is the level the United States Environmental Protection Agency (U.S. EPA) has set to protect public health. AQI values below 100 are generally regarded as satisfactory. When AQI values are above 100, air quality is considered to be unhealthy, first for certain sensitive groups of people, then for everyone as AQI values get higher.

Figure 2: Air Quality Index Values

Air Quality Index Levels of Health Concern	Numerical Value	Meaning
Good	0 to 50	Air quality is considered satisfactory, and air pollution poses little or no risk
Moderate	51 to 100	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.
Unhealthy for Sensitive Groups	101 to 150	Members of sensitive groups may experience health effects. The general public is not likely to be affected.
Unhealthy	151 to 200	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.
Very Unhealthy	201 to 300	Health alert: everyone may experience more serious health effects
Hazardous	301 to 500	Health warnings of emergency conditions. The entire population is more likely to be affected.

Sources of Air Pollution

Air pollution in Indiana originates from multiple sources across the state, as well as outside of the state borders. Source categories are classified as point sources, area sources, onroad sources, or nonroad sources. Point sources are fixed site sources of pollution, which include electric generating units (EGUs)[1] and other large industrial facilities. Point sources are generally associated with having a stack or other engineered release point. Area sources can be a collection of similar emission units within a geographic area that collectively represent individual sources that are small and numerous and have not been inventoried as a specific point or mobile source. Examples of area sources include activities such as dry cleaning, vehicle refueling, and solvent usage. Onroad sources include mobile sources such as cars, buses, trucks, and

[1] An EGU is a fossil fuel fired stationary boiler, combustion turbine, or combined cycle system that sells any amount of electricity produced.

motorcycles. Nonroad sources consist of combustion engines in farm and construction equipment, gasoline powered lawn and garden equipment, recreational vehicles, and outboard motors. Specific sources for each of the regulated criteria pollutants are explained below in further detail.

How is Air Pollution Regulated?

The CAA provides the U.S. EPA and individual states joint responsibility for protecting and improving air quality. U.S. EPA delegates some of its responsibilities to IDEM. While most of IDEM's activities carry out requirements of the CAA, state statutes provide IDEM the authority to address air pollution not covered by federal requirements. In addition, state statutes authorize IDEM to implement rules that are specific to activities that occur in Indiana.

For Indiana to operate a federally delegated air quality program, it must have adequate legal authority to adopt and enforce regulations at least as stringent as federal requirements and must obtain approval from U.S. EPA. Federal approval ensures that there is consistency among different state programs and that each program complies with the requirements of the CAA. One key component for demonstrating compliance with the CAA and federal air rules is a State Implementation Plan (SIP), which includes statutes, regulations, and permits. A rule adopted by a state and approved into a SIP by U.S. EPA is legally binding under both state and federal law and may be enforced by both state and federal government.

The major requirements of the CAA are:

- Setting NAAQS for the regulated criteria pollutants that are released in large quantities across the country and have the potential to harm public health and the environment.
- Ensuring that the air quality standards are met by controlling air pollutant emissions from point sources, motor vehicles, and other sources.
- Reducing emissions of $PM_{2.5}$, NO_x, and SO_2 that cause acid rain and impair visibility with haze.
- Limiting the use of chemicals that damage stratospheric ozone (in the upper atmosphere) to prevent increased levels of harmful ultraviolet radiation.

- Assuring that all states implement programs to permit construction and operation of major stationary sources of air pollution that meet minimal requirements.
- Providing enforcement options when there are violations of the CAA.

Carbon Monoxide (CO)

What is Carbon Monoxide?

Carbon monoxide (CO) is a colorless and odorless gas that is formed during incomplete and/or inefficient combustion of fossil fuels such as gasoline, natural gas, and coal.

Sources of Carbon Monoxide

CO is a component of motor vehicle exhaust, which the U.S. EPA estimates to be the biggest source of CO emissions in the ambient air. Other sources of CO emissions include industrial processes (such as metal processing and chemical manufacturing), fuel combustion in boilers and incinerators, nonroad vehicles, wildfires, open burning, and burning in fireplaces and wood stoves. Ambient levels of CO have generally declined since the mid-1980's, primarily due to stricter emission standards for new vehicles, improved combustion techniques, and emission controls.

Health Effects of Carbon Monoxide

CO enters the bloodstream through the lungs and reduces oxygen delivery to the body's organs and tissues. Those that suffer from cardiovascular disease may experience health effects at lower concentrations of CO exposure than those without. At much higher levels of exposure (i.e. over 10 times the standard), CO can be poisonous, even deadly. Visual impairment, reduced work capacity, reduced manual dexterity, poor learning ability, and difficulty in performing complex tasks are all associated with exposure to high levels of CO, even in healthy people.

Environmental Effects of Carbon Monoxide

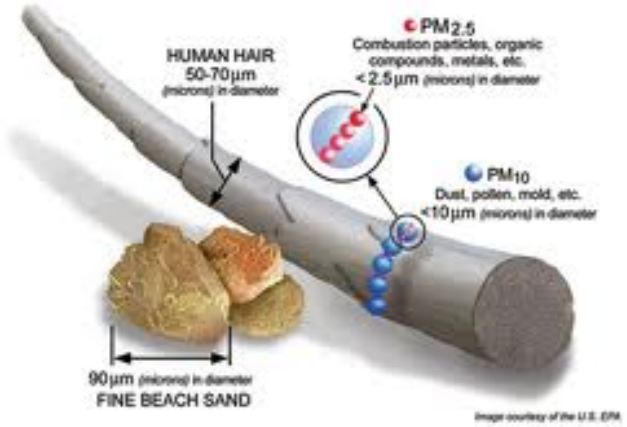
In the environment, CO contributes to the formation of ground level ozone. Information about ozone and how it if formed is outlined beginning on Page 13.

Fine Particles ($PM_{2.5}$) and Particulate Matter (PM_{10})

What are Fine Particles and Particulate Matter?

Particulate matter is the general term used for small pieces of aerosol mists, dust, dirt, and soot found in the air. Some particles are large or dark enough to be seen as soot or smoke. Others are so small they can be detected only with an electron microscope. Total suspended particles (TSP) include particles up to about one hundred micrometers in diameter. Fine particles ($PM_{2.5}$) are less than two and a half micrometers in diameter and larger particulate matter up to ten micrometers are referred to as particulate matter (PM_{10}). Figure 3 compares a human hair, which is approximately seventy micrometers wide, to $PM_{2.5}$ and PM_{10}.

Figure 3: $PM_{2.5}$ and PM_{10} Comparison



Sources of Fine Particles and Particulate Matter

$PM_{2.5}$ and PM_{10} are emitted directly into the air from combustion sources such as coal-fired power plants, motor vehicles, and open burning. $PM_{2.5}$ is also formed in the air via chemical reactions. Gas pollutants, such as ammonia, SO_2, and NO_x, change chemically in the air to become either liquid or solid fine particulate matter. PM_{10} comes from many different stationary and mobile sources, as well as unpaved roads, materials handling, and windblown dust. Some PM_{10} is emitted directly from sources, such as smokestacks and motor vehicles.

Health Effects of Fine Particles and Particulate Matter

Recent studies indicate that the smallest particles pose the most serious health threat because they can be inhaled more deeply into the lungs and are more difficult to exhale. Both fine and larger coarse particles are small enough to be inhaled into the lungs. These particles can accumulate in the respiratory system and are associated with numerous health effects. Elevated levels of $PM_{2.5}$ are associated with increased hospital admissions and emergency room visits for heart and lung disease, increased respiratory distress symptoms and disease, decreased lung function, and premature death. Sensitive groups that appear to be at the greatest risk include the elderly, individuals with cardiopulmonary disease such as asthma, and children.

Environmental Effects of Fine Particles and Particulate Matter

In addition to triggering health problems, $PM_{2.5}$ is the major cause of reduced visibility in many parts of the United States. Impaired visibility in all directions over a large area is referred to as regional haze. $PM_{2.5}$ causes haze, because the dust and soot particles scatter and absorb light effectively, which produces the hazy appearance of the sky. Haze affects the quality of life by impairing visibility in many scenic overlooks, national parks, and even from tall buildings in urban areas. Many types of $PM_{2.5}$ contribute to haze, including: elemental carbon (soot), crustal material (dust), nitrates, organic carbon (gaseous hydrocarbons), and sulfates. Airborne particles can also damage paints and building materials.

Lead

What is Lead?

Lead is a naturally occurring toxic metal that is found in the air in the form of small particles. In the past, motor vehicles were the major contributor of lead emissions to the atmosphere. Between 1975 and 1986, the U.S. EPA implemented rules which resulted in phasing lead out of gasoline. Since then, the amount of lead released to the air by the transportation sector has declined dramatically.

Sources of Lead

Today, metal processing, which uses lead to manufacture finished products, is one of the major sources of lead emissions in Indiana. Aviation fuel is also a source of lead emissions. The highest concentrations of lead monitored in the ambient air are found around lead smelters. In Indiana, lead smelters recycle material that contains lead and other substances, such as batteries, and processes the raw materials into usable products.

Health Effects of Lead

Excessive exposure to lead can result in lead poisoning and elevated blood-lead levels, which may cause mental and physical damage, especially to children. Exposure occurs mainly through ingesting lead in paint chips and soil, inhaling high concentrations of lead in the air and more rarely through contaminated food and water. Lead accumulates in the blood, bones, and soft tissues. Lead can adversely affect the kidneys, liver, nervous system, and other organs. Excessive exposure to lead may cause nervous system and brain impairments such as behavioral disorders, learning problems, and seizures. Even at doses previously considered acceptable, lead exposure is associated with damage to the nervous systems of fetuses and young children, resulting in learning deficiencies and lowered intelligence quotients.

Environmental Effects of Lead

Lead is an element of the Earth which cannot be created or destroyed and thus is persistent in the environment and accumulates in soils and sediments through deposition from air sources, direct discharge of waste streams to water bodies, mining, and erosion. Ecosystems near point sources of lead demonstrate a wide range of adverse effects including losses in biodiversity, changes in community composition, decreased growth and reproductive rates in plants and animals, and neurological effects in vertebrates.

Nitrogen Dioxide (NO_2)

What is Nitrogen Dioxide?

Nitrogen dioxide (NO_2) is one chemical in a class of seven highly reactive gases called nitrogen oxides (NO_x). The classes of NO_x come in many forms of nitrogen molecules and oxygen molecules bonded together. NO_2 has two oxygen molecules attached to one nitrogen molecule. NO_2 was chosen as the regulated criteria pollutant because it is the most common form in the air that is generated by human activities. It also plays a major role in the formation of ozone.

Sources of Nitrogen Dioxide

NO_2 gases form when fuel is burned at high temperatures, principally from motor vehicle exhaust and stationary fuel combustion, such as electric utilities and industrial boilers. The U.S. EPA expects NO_2 concentrations will continue to decrease in the future as a result of a number of mobile source regulations that are taking effect.

Health Effects of Nitrogen Dioxide

Exposure to high levels of NO_2 can irritate the lungs and lower resistance to respiratory infections, such as influenza. The effects of short-term exposure may lead to changes in airway responsiveness and lung function in adults. Frequent exposure to concentrations that are typically much higher than normally found in the ambient air may cause increased incidences of acute respiratory illness in children.

Environmental Effects of Nitrogen Dioxide

NO_2 can contribute to acid rain, regional haze, and water quality problems. One of the main components in the formation of ozone, NO_2, contributes to fish kills and algae blooms in waterways, especially in lakes and reservoirs.

Ozone

What is Ozone?

Ozone is a gas that forms in the atmosphere when three atoms of oxygen are combined. Ozone is not emitted directly into the air, but is created in the lower atmosphere. NO_x and VOC chemically react individually or collectively in the presence of sunlight to form ground-level ozone. Ozone has the same chemical structure whether it occurs high above the earth or at ground level and can be good or bad depending on its location in the atmosphere. Ozone in the upper atmosphere provides protection from the sun's radiation. Ozone at ground-level can trigger a variety of health problems. Ground-level ozone is an air quality problem in the summer months when temperatures are high, daylight hours are long, and there is little to no wind.

Sources of Ozone

Motor vehicles, manufacturing, and everyday activities emit NO_x and VOC that chemically react individually or collectively in the presence of sunlight to form ground-level ozone. NO_x emissions are produced primarily when fossil fuels are burned in motor vehicles, power plants, and industrial boilers. Emissions of NO_x from tall sources, such as smokestacks, are more likely than emissions near the ground (e.g. motor vehicles) to travel downwind and increase ozone levels in

surrounding areas and even other states. VOC emissions are produced from numerous sources such as motor vehicles, gasoline, some solvents and cleaners, paints, and burning oil, coal, or wood.

Health Effects of Ozone

According to the U.S. EPA, several groups of people are particularly sensitive to elevated ozone concentrations, especially when they are active outdoors. This is because ozone levels are higher outdoors, and physical activity causes faster and deeper breathing, drawing more ozone into the body.

In general, as concentrations of ground-level ozone increase, both the number of people affected and the seriousness of the health effects increase.

People who may be particularly sensitive to ozone include:

- People with lung disease, such as asthma, chronic bronchitis, and emphysema will generally experience more serious health effects at lower ozone levels.

Children are at higher risk from ozone exposure because:

- They often play outdoors in the summer when ozone levels are higher.
- They are more likely to have asthma, which may be aggravated by ozone exposure.
- Their lungs are still developing.

Older adults may be more affected by ozone exposure, possibly because they are more likely to have pre-existing lung disease.

Environmental Effects of Ozone

According to the U.S. EPA, ground level ozone can have harmful effects on sensitive vegetation and ecosystems. When sufficient ozone concentrations enter the leaves of a plant, it can:

- Interfere with the ability of sensitive plants to produce and store food.
- Visibly damage the leaves of trees and other plants, harming the appearance of vegetation in urban areas, national parks, and recreation areas.

Sulfur Dioxide (SO_2)

What is Sulfur Dioxide?

SO_2 belongs to the family of gases called sulfur oxides and is formed when fuel that contains sulfur (mainly coal and oil) is burned. SO_2 may also be formed during metal smelting, oil refining, and other industrial processes.

Sources of Sulfur Dioxide

SO_2 in the ambient air mostly comes from stationary sources, and the highest monitored concentrations of SO_2 are recorded in the vicinity coal-fired EGUs. Many Indiana EGUs have greatly reduced emissions by using coal with lower sulfur content, increasing the use of lower polluting boilers, and investing in air pollution control equipment, such as scrubbers. In Indiana, large emitters are required by a state rule to monitor for SO_2.

Health Effects of Sulfur Dioxide

The major health concerns associated with exposure to high concentrations of SO_2 include adverse effects on breathing, respiratory illness, alterations in pulmonary defenses, and aggravation of existing cardiovascular diseases. Children, the elderly, and people with asthma, cardiovascular disease, or chronic lung disease (such as bronchitis or emphysema) are most susceptible to adverse health effects associated with exposure to SO_2.

Environmental Effects of Sulfur Dioxide

SO_2 is a primary contributor to acid rain, which causes acidification of soils, lakes, and streams and can accelerate damage to buildings, crops, monuments, and trees, as well as a key contributor to regional haze. In addition, sulfur compounds in the air are precursors to $PM_{2.5}$.

National Ambient Air Quality Standards (NAAQS)

The CAA requires U.S. EPA to set NAAQS for pollutants that cause or contribute to air pollution which may reasonably be anticipated to endanger public health and welfare. The U.S. EPA has set NAAQS for the six criteria pollutants (carbon monoxide, particulate matter, lead, nitrogen dioxide, ozone, and sulfur dioxide).

The technical staff of U.S. EPA conducts an extensive review of scientific, health, and technical data to determine the level of a pollutant below which human health effects are unlikely. Congress decided, and the Supreme Court upheld, that U.S. EPA may not consider cost when setting or revising air quality standards. U.S. EPA then obtains input from people with interest and experience in air quality and public health. Representatives of the scientific community, industry, public interest groups, the public, and the Clean Air Scientific Advisory Committee, a congressionally mandated group of independent scientific and technical experts, conduct reviews of any standards proposed by U.S. EPA. Before the U.S. EPA administrator announces a final decision on the standards, the proposed standards are published in the *Federal Register (FR)* for public review and comment. Once NAAQS are announced as final, the CAA sets a basic schedule for achieving the standards, and in some cases, requirements to meet the standards. The states have the primary responsibility for developing and implementing programs to improve air quality.

The CAA established both primary and secondary air quality standards for criteria pollutants. Primary standards, often referred to as the health standards, protect public health, including the health of sensitive populations such as asthmatics, children, and the elderly. Secondary standards protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. U.S. EPA is required to review the standards periodically to ensure that they include the most recent scientific information. IDEM collects data to determine whether the air in Indiana complies with the NAAQS established by U.S. EPA. The current NAAQS for each of the regulated pollutants is listed in Table 2.

Table 2: Current NAAQS*

	Primary Standards		Secondary Standards	
Pollutant	**Level**	**Averaging Time**	**Level**	**Averaging Time**
CO	9 ppm	8-hour	None	
	35 ppm	1-hour	None	
$PM_{2.5}$	15.0 µg/m^3	Annual (Arithmetic Average)	Same as primary	
	35 µg/m^3	24-hour	Same as primary	
Lead	0.15 µg/m^3	Rolling three-month average	Same as primary	
NO_2	53 ppb	Annual (Arithmetic Average)	Same as primary	
	100 ppb	1-hour	None	
Ozone	0.075 ppm	8-hour	Same as primary	
PM_{10}	150 µg/m^3	24-hour	Same as primary	
SO_2			0.5 ppm	3-hour
	75 ppb	1-hour	None	

*As of May 2012

NAAQS for Carbon Monoxide

Primary and secondary 1-hour and 8-hour CO air quality standards were first established in April 1971. The 1-hour CO NAAQS is 35 ppm and attainment is determined by evaluating the 2nd highest measured value for a year. Similarly, the 8-hour NAAQS is 9 ppm and attainment is determined by evaluating the 2nd high value for the year.

In September 1985, U.S. EPA revoked the secondary 1-hour and 8-hour CO standards and retained the existing primary 1-hour and 8-hour CO standards. U.S. EPA revoked the secondary standard due to a lack of evidence of adverse effects on public welfare at ambient concentrations. In August 1994, and again in August 2011, after reviewing available health science, U.S. EPA concluded that the existing primary standards for 1-hour and 8-hour CO provided the required level of public health protection and, therefore, retained the standards.

NAAQS for Total Suspended Particles, Particulate Matter, and Fine Particles

Primary and secondary air quality standards were established in April 1971 for TSP. To meet the primary annual TSP standard, the annual geometric mean must not have exceeded 75 micrograms per cubic meter ($\mu g/m^3$). There were no secondary annual standards for TSP. To meet the primary and secondary 24-hour TSP standards, the 2nd highest 24-hour TSP concentrations must not have exceeded 260 $\mu g/m^3$ and 150 $\mu g/m^3$ more than once per year.

The standards were significantly revised in July 1987, when U.S. EPA changed the indicator of the standards and replaced TSP with PM_{10} to regulate inhalable particles smaller than or equal to, ten micrometers in diameter. The primary and secondary annual PM_{10} standards were set at 50 $\mu g/m^3$, which is attained when the expected annual arithmetic mean (the method used to derive the average of the monitoring values) is less than or equal to the NAAQS average over a three-year period. The primary and secondary 24-hour PM_{10} standards were set at 150 $\mu g/m^3$ and attainment is determined by evaluating the 4th highest 24-hour PM_{10} concentration average over a three-year period.

In July 1997, after a lengthy review, U.S. EPA added primary and secondary standards for $PM_{2.5}$ to target particles equal to or smaller than two and a half micrometers. The primary and secondary annual $PM_{2.5}$ standards were set at 15 $\mu g/m^3$ and the primary and secondary 24-hour $PM_{2.5}$ standards were set at 65 $\mu g/m^3$ averaged over a three-year period.

To attain the primary and secondary annual $PM_{2.5}$ standards, the three-year average, also known as the design value, of the annual arithmetic mean $PM_{2.5}$ concentration from single or multiple community-oriented monitors must not exceed 15.0 $\mu g/m^3$. To attain the primary and secondary 24-hour $PM_{2.5}$ standards, the design value of the 98th percentile (the method used to determine the value below which a certain percent of monitored observations fall) of 24-hour concentrations at each population-oriented monitor within an area must not exceed 65 $\mu g/m^3$. In addition, the U.S. EPA also retained, but slightly revised, the annual and primary standards for both annual and 24-hour PM_{10}, which were intended to regulate "inhalable coarse particles" that ranged from two and a half to ten micrometers in diameter. Annual and 24-hour PM_{10} measurements contain both fine and coarse particles.

In October 2006, the U.S. EPA tightened the primary and secondary 24-hour $PM_{2.5}$ standards from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ and retained the primary and secondary annual $PM_{2.5}$ standards at 15 $\mu g/m^3$. The primary and secondary 24-hour PM_{10} standards of 150 $\mu g/m^3$ were also retained. The U.S. EPA revoked the primary and secondary annual PM_{10} standards because available evidence does not suggest a link between long-term exposure to PM_{10} and health problems.

NAAQS for Lead

The primary and secondary lead standards were first established in October 1978 at 1.5 $\mu g/m^3$. Attainment was determined by evaluating each calendar quarter arithmetic average which must not exceed 1.5 $\mu g/m^3$ in a three-year period. U.S. EPA replaced the primary and secondary 1978 lead standards with new primary and secondary lead standards of 0.15 $\mu g/m^3$ in October 2008. The primary and secondary lead NAAQS were substantially strengthened to improve health protection for at-risk groups, especially children. Attainment of the primary and secondary 2008 lead standards is determined by evaluating the rolling three-month average. Any three consecutive monthly averages (January-March, February-April, March-May, etc.) must not exceed 0.15 $\mu g/m^3$ within a three-year period.

NAAQS for Nitrogen Dioxide

U.S. EPA first set primary and secondary standards for annual NO_2 in April 1971, setting both the primary and secondary standards at 53 ppb. Attainment of the annual NO_2 standards is determined by evaluating the annual arithmetic mean concentration in a calendar year, which must be less than or equal to 53 ppb. In June 1985 and again in October 1996, after reviewing available health science, U.S. EPA concluded that the existing annual primary and secondary standards appear to be both adequate and necessary to protect human health and public welfare against both long- and short-term NO_2 exposures. In February 2010, U.S. EPA added a primary 1-hour NO_2 standard set at 100 ppb and retained the existing primary and secondary annual standards. Attainment of the 1-hour NO_2 standard is determined by evaluating the 98^{th} percentile of the daily maximum 1-hour averages at each monitor within an area, which must not exceed 100 ppb averaged over a three-year period.

In April 2012, after reviewing available science, U.S. EPA concluded that the existing annual secondary NO_2 standard provided the requisite level of protection to vegetation from the direct effects of exposure to gaseous oxides of nitrogen and retained the existing standard. U.S. EPA also concluded that new standards to address effects associated with the deposition of nitrogen oxides on sensitive aquatic and terrestrial ecosystems will not be added at this time.

NAAQS for Ozone

In April 1979, the U.S. EPA established the primary and secondary 1-hour ozone standards at 0.12 ppm averaged over one hour. The fourth highest monitored concentration over a three-year period were used to determine attainment of the primary and secondary 1-hour ozone standards. Based on the U.S. EPA's published data handling guidelines, values above 0.124 ppm were deemed to be in violation of the standard. In March 1993, after reviewing available health science, U.S. EPA concluded that the existing 1-hour primary and secondary standards were both adequate and necessary to protect human health and public welfare.

In July 1997, U.S. EPA revised the primary and secondary ozone standards to 0.08 ppm averaged over eight hours. Based on the U.S. EPA's published handling guidelines, values above 0.084 ppm were deemed to be below the standard. Attainment of the primary and secondary 8-hour ozone standards is determined by first evaluating the design value of the 4^{th} highest 8-hour ozone concentration measured at each monitor within an area over each year. Second, the yearly design value for three consecutive years is averaged for each site, and the highest value from the individual sites becomes the area's design value. This value must not exceed the NAAQS. The change to an 8-hour averaging time is intended to protect sensitive subpopulations like children and people who work or spend time outside for longer periods of time. The primary and secondary 8-hour ozone standards were legally challenged in court and did not become effective until 2003. In June 2005, U.S. EPA revoked the primary and secondary 1-hour ozone standards after the primary and secondary 8-hour ozone standards were implemented.

In March 2008, U.S. EPA significantly strengthened the primary and secondary 8-hour ozone standards to a level of 0.075 ppm in order to be more protective of public health.

NAAQS for Sulfur Dioxide

The NAAQS for SO_2 were first established in April 1971. The primary SO_2 standards were set as an annual average of 0.03 ppm and a 24-hour level of 0.14 ppm. The secondary SO_2 standards were set as a 3-hour level of 0.50 ppm and an annual level of 0.02 ppm. The annual average primary and secondary standards were not to be exceeded, while the short-term standards (24-hour and 3-hour) were not to be exceeded more than once per year.

In September 1973, U.S. EPA revoked the annual secondary SO_2 standard and retained the existing 3-hour secondary standard. U.S. EPA revoked the annual secondary standard due to a lack of evidence of adverse effects on public welfare at ambient concentrations. In May 1996, after reviewing available health science, U.S. EPA concluded that the existing primary standards for annual and 24-hour SO_2 provided the required level of public health protection and, therefore, retained the standards. In June 2010, U.S. EPA revoked both the primary annual and 24-hour SO_2 standards and established a new primary 1-hour SO_2 standard. The revised standard improves public health protection, especially for children, the elderly, and people with asthma, by reducing their exposure to high short-term (5-minute to 24-hour) concentrations. Attainment of the new primary 1-hour SO_2 standard is determined by evaluating the design value of the 99^{th} percentile values of the daily maximum 1-hour averages at each monitor within an area, which must not be equal to or exceed 75.5 ppb averaged over a three-year period.

In April 2012, after reviewing available science, U.S. EPA concluded that the existing 3-hour secondary SO_2 standard provided the requisite level of protection to vegetation from the direct effects of exposure to gaseous oxides of sulfur and retained the existing standard. U.S. EPA also concluded that new standards to address effects associated with the deposition of oxides of sulfur on sensitive aquatic and terrestrial ecosystems will not be added at this time.

Attainment and Nonattainment of an Air Quality Standard

If an area is classified as attainment, it means the concentrations of the pollutant are below the applicable standard. Nonattainment areas are regions within the country where measured concentrations of one or more criteria pollutants exceeds the levels set as the federal air quality standards or that U.S. EPA believes contribute significant amounts of pollutants to an area that measures air quality that exceeds the standard. Once U.S. EPA announces that an area does not meet the health standard, the state works with businesses, local governments, and the public to reduce the emissions from sources contributing to the nonattainment status of the area.

The CAA requires that, no later than one year after promulgation of a new or revised NAAQS, each state must submit a listing of all areas within the state that could be designated as any of the following:

- Nonattainment (monitored values above the standard or emissions within the area contribute to another area failing to attain the standards);
- Attainment (monitored values below the standard); or,
- Unclassifiable (insufficient information to make a determination).

Within one year of the state's submittal, U.S. EPA is to publish a list that outlines the designation status of all areas. States may contest U.S. EPA's designation of any area within its borders.

If a state has nonattainment areas within its borders, the state must submit a State Implementation Plan (SIP) to U.S. EPA detailing steps necessary to achieve the standard. SIPs must include an inventory of emissions, enforceable emission limitations, related control measures, and schedules and timetables for compliance that are necessary for the area to meet the applicable NAAQS. There must be an opportunity for public input as the SIP is developed. The control measures contained in the SIP may require reductions from large industry, small businesses, mobile sources, or all three.

Generally, the SIP also includes air quality modeling to demonstrate that the measures selected by the state will reduce emissions enough for the area to meet and maintain the standard. In addition, the CAA requires major sources of air pollution to meet stricter emission control requirements in nonattainment areas than are required in areas that meet federal health standards. For example, new or expanding sources of air pollution in nonattainment areas must meet stricter permitting requirements.

States may ask U.S. EPA to redesignate a nonattainment area to attainment if all of the following criteria are met:

- The area has monitored attainment of the NAAQS;
- The area has a fully approved SIP;
- U.S. EPA has determined that the improvement in air quality is due to permanent and enforceable reductions in emissions;
- The state has submitted, and U.S. EPA has approved, a maintenance plan for the area; and,
- The area has met all other applicable CAA requirements.

U.S. EPA may approve or deny the redesignation request based on air monitoring information, the activities listed in the SIP, and the comments submitted by the public.

Nonattainment areas which are later designated to attainment are considered maintenance areas. The steps to maintain air quality are defined in a maintenance plan. Generally, the control measures used to improve air quality remain in place. The maintenance plan must demonstrate continued compliance, considering projected growth, for a period of ten years. If ambient air monitors record a violation of the standard, the maintenance plan includes a commitment to determine appropriate measures to address the cause of the violation. Specific nonattainment history for each of the criteria pollutants is explained below in further detail.

Carbon Monoxide Designations and Redesignations

In March 1978, U.S. EPA designated areas under the primary 8-hour CO standard of 9 ppm and classified them as attainment, nonattainment, or unclassifiable based on monitoring data. These designations were also included in the November 1990 designation issued by U.S. EPA. Parts of two counties in Indiana were identified as being in violation of the primary 8-hour CO standard. Both of these areas were reclassified to attainment with a maintenance plan in March 2000. Table 3 lists the attainment status for the 8-hour CO standard. All areas of Indiana meet the primary 1-hour CO standard and have never been designated nonattainment for that standard.

Table 3: 8-Hour CO Designations

County	Date Classified as Nonattainment for the Primary 8-Hour CO Standard	Status of Area
Lake (Part of the City of East Chicago Only)	3/3/1978 11/15/1990	Redesignated to Attainment on 3/20/2000
Marion (Part of the City of Indianapolis Only)	3/3/1978 11/15/1990	Redesignated to Attainment on 3/20/2000
Note: There is no longer a secondary standard for CO.		

Total Suspended Particle Designations and Redesignations

In March 1978, U.S. EPA designated areas under the primary and secondary 24-hour TSP health standards and classified them as attainment, nonattainment, or unclassifiable. Four entire counties and eleven partial counties were identified as being in violation of the primary and secondary 24-hour TSP standards in Indiana. In July 1987, the primary and secondary 24-hour TSP standards were replaced by the primary and secondary 24-hour PM_{10} standards. Nonattainment designations for primary and secondary 24-hour TSP were never reclassified to attainment. Table 4 lists the counties originally designated nonattainment for the primary and secondary 24-hour TSP standard. The section pertaining to PM_{10} beginning on Page 27 further explains how these areas were addressed once the primary and secondary TSP standards were replaced.

Table 4: 24-Hour TSP Designations

County	Date Classified as Nonattainment for the Primary and Secondary 24-hour TSP Standards	Status of Area
Clark (Charlestown, Jeffersonville, Silver Creek, and Utica, Townships)	3/3/1978 10/5/1978 (Primary) 4/22/1985 (Jefferson Township designation changed to secondary nonattainment)	Charlestown, Silver Creek, and Utica Townships redesignated to attainment on 11/2/1982 TSP designations removed from CFR on 6/16/1997
Dearborn County (Center, Hogan, Lawrenceburg, and Manchester Townships)	3/3/1978 10/5/1978 (Primary) 1/27/1986 (Lawrenceburg Township designation changed to secondary nonattainment)	Center, Hogan, and Manchester Townships redesignated to attainment on 11/2/1982 TSP designations removed from CFR on 6/16/1997
Dubois (Bainbridge, Marion, and Patoka Townships)	3/3/1978 10/5/1978 (Primary) 4/22/1985 (Bainbridge Township designation changed to secondary nonattainment)	Marion and Patoka Townships redesignated to attainment on 11/2/1982 TSP designations removed from CFR on 6/16/1997
Floyd (Entire County)	3/3/1978 10/5/1978 (Unclassifiable)	Redesignated to attainment on 5/22/1985, except for New Albany Township which remained unclassifiable
Howard (Center and Howard Townships)	3/3/1978 10/5/1978 (Secondary)	Redesignated to attainment on 11/2/1982
Lake (Area bounded by U.S. 30 between Illinois state line and I-65, I-65 north I-94 intersection, east to I-94 to Lake/Porter county line, north to Lake Michigan and west along the lake to Illinois state line)	3/3/1978 10/5/1978 (Primary)	TSP designations removed from CFR on 6/16/1997
LaPorte (Center, Kankakee, New Durham, Pleasant, and Scipio Townships, and north and west of I-94)	3/3/1978 10/5/1978 (Secondary)	Redesignated to attainment on 9/25/1981
Marion (Entire county except Washington Township east of White River, Franklin Township south of Thompson Road and east of Five Points Road)	3/3/1978 10/5/1978 (Primary)	TSP designations removed from CFR on 6/16/1997

Porter (Entire County)	3/3/1978 10/5/1978 (Unclassifiable)	Primary nonattainment designation of northern part of county rescinded making area unclassifiable on 12/13/1983
Porter (Area bounded on north by Lake Michigan, east by Mineral Springs Road, south by I-94, and west by Indiana 249 from I-94 to Burns Ditch and following Burns Ditch to Lake Michigan)	8/18/1982 (Northern part of county designated primary nonattainment)	Southern portion of county redesignated to attainment on 5/22/1985
St. Joseph (Industrialized area east of Pine Road and north of Kern Road)	3/3/1978 10/5/1978 (Secondary)	TSP designations removed from CFR on 6/16/1997
Sullivan (Entire County)	3/3/1978 10/5/1978 (Unclassifiable)	Redesignated to attainment on 5/11/1985
Tippecanoe (Entire County)	3/3/1978 10/5/1978 (Unclassifiable)	
Vanderburgh (Pigeon Township)	3/3/1978 10/5/1978 (Secondary)	TSP designations removed from CFR on 6/16/1997
Vigo (Fayette, Harrison, Honey Creek, Lost Creek, Otter Creek, and Sugar Creek Townships)	3/3/1978 10/5/1978 (Primary)	Redesignated to attainment on 7/16/1982, except for the 0.5 km radius around CAAP Monitoring Station in Harrison Township which remained primary nonattainment Harrison Township (0.5 km radius around CAAP Monitoring Station) redesignated to secondary nonattainment on 5/22/1985 TSP designations removed from CFR on 6/16/1997
Wayne (Boston, Center, Wayne, and Webster Townships)	3/3/1978 10/5/1978 (Primary)	Redesignated to unclassifiable on 12/2/1981 Boston, Center, and Wayne Townships redesignated to attainment on 3/17/1986
Note: The primary and secondary 24-hour TSP standards were the same.		

Particulate Matter Designations and Redesignations

In November 1990, U.S. EPA designated areas under the primary and secondary 24-hour PM_{10} health standards of 150 µg/m^3 and classified them as attainment, nonattainment, or unclassifiable based on monitoring data. Two partial counties in Indiana were identified as being in violation of the primary and secondary 24-hour PM_{10} standards. By the year 2003, these areas had been reclassified to attainment with a maintenance plan. Table 5 lists the current attainment status for the primary and secondary 24-hour PM_{10} standards. All areas of Indiana meet the primary and secondary annual PM_{10} standard and have never been designated nonattainment for those standards.

Table 5: 24-Hour PM_{10} Designations

County	Date Classified as Nonattainment for the Primary and Secondary 24-Hour PM_{10} Standards	Status of Area
Lake (Cities of East Chicago, Gary, Hammond, and Whiting)	11/15/1990	Redesignated to Attainment on 3/11/2003
Vermillion (Part of Clinton Township)	11/15/1990	Redesignated to Attainment on 10/27/1997
Note: The primary and secondary 24-hour PM_{10} standards were the same.		

Fine Particle Designations and Redesignations

In April 2005, U.S. EPA designated areas under the primary and secondary annual $PM_{2.5}$ standards of 15 µg/m^3 and classified them as attainment, nonattainment, or unclassifiable based on monitoring data. Twelve counties and five townships in Indiana were identified as being in violation of the primary and secondary annual $PM_{2.5}$ standards. All areas in Indiana currently monitor attainment of the primary and secondary annual $PM_{2.5}$ standards and have either been redesignated or are pending redesignation to attainment. Table 6 lists the current attainment status for the primary and secondary annual $PM_{2.5}$ standards. All areas of Indiana meet the primary and secondary 24-hour $PM_{2.5}$ standards and have never been designated nonattainment for either the old 24-hour $PM_{2.5}$ standards at 65 µg/m^3 or the revised 24-hour $PM_{2.5}$ standards at 35 µg/m^3.

Table 6: Annual $PM_{2.5}$ Designations*

County	Date Classified as Nonattainment for the Primary and Secondary Annual $PM_{2.5}$ Standards	Status of Area
Clark	04/05/2005	Pending Redesignation
Dearborn (Lawrenceburg Township Only)	04/05/2005	Redesignated to Attainment on 12/23/2011
Dubois	04/05/2005	Redesignated to Attainment on 10/27/2011
Floyd	04/05/2005	Pending Redesignation
Gibson (Montgomery Township Only)	04/05/2005	Redesignated to Attainment on 10/27/2011
Hamilton	04/05/2005	Pending Redesignation
Hendricks	04/05/2005	Pending Redesignation
Jefferson (Madison Township Only)	04/05/2005	Pending Redesignation
Johnson	04/05/2005	Pending Redesignation
Lake	04/05/2005	Redesignated to Attainment on 2/6/2012
Marion	04/05/2005	Pending Redesignation
Morgan	04/05/2005	Pending Redesignation
Pike (Washington Township Only)	04/05/2005	Redesignated to Attainment on 10/27/2011
Porter	04/05/2005	Redesignated to Attainment on 2/6/2012
Spencer (Ohio Township Only)	04/05/2005	Redesignated to Attainment on 10/27/2011
Vanderburgh	04/05/2005	Redesignated to Attainment on 10/27/2011
Warrick	04/05/2005	Redesignated to Attainment on 10/27/2011
Note: The primary and secondary annual $PM_{2.5}$ standards are the same.		

*As of May 2012

Lead Designations and Redesignations

In January 1992, U.S. EPA designated areas under the primary and secondary 1978 lead standards of 1.5 µg/m^3 and classified them as attainment, nonattainment, or unclassifiable based on monitoring data. Part of one county was identified as being in violation of the primary and secondary lead standards in Indiana. The area was reclassified to attainment with a maintenance plan in July 2000. Table 7 lists the current attainment status for the primary and secondary 1978 lead standards.

Table 7: Lead Designations

County	Date Classified as Nonattainment for the Primary and Secondary Lead Standards	Status of Area
Marion (Part of Franklin and Wayne Townships Only)	1/6/1992	Redesignated to Attainment on 7/10/2000
Note: The primary and secondary lead standards were the same.		

In December 2010, U.S. EPA designated areas under the revised primary and secondary 2008 lead standards of 0.15 µg/m^3 and classified them as attainment, nonattainment, or unclassifiable based on monitoring data. Part of a city in one county in Indiana was identified as being in violation of the revised primary and secondary 2008 lead standards. Table 8 lists the current attainment status for the revised primary and secondary 2008 lead standards.

Table 8: Revised Lead Designations

County	Date Classified as Nonattainment for the Revised Primary and Secondary Lead Standard	Status of Area
Delaware (Part of the City of Muncie, Indiana)	12/31/2010	Currently Nonattainment
Note: The primary and secondary lead standards are the same.		

Nitrogen Dioxide Designations and Redesignations

No areas in Indiana have ever been designated nonattainment for the annual NO_2 standard and all areas continue to meet the federal standard based on measured air quality. U.S. EPA is in the process of designating areas for the 1-hour NO_2 standard. All areas in Indiana currently meet the 1-hour NO_2 standard, so all counties should be designated attainment or unclassifiable.

Ozone Designations and Redesignations

In November 1990, U.S. EPA designated seven counties in Indiana under the primary and secondary 1-hour ozone standards of 0.12 ppm and classified them as attainment or nonattainment. Vanderburgh County was designated nonattainment under the primary and secondary 1-hour ozone standards of 0.12 ppm in January 1992. By 2001, six of the eight counties were redesignated to attainment. In June 2005, U.S. EPA revoked the primary and secondary 1-hour ozone standards after the primary and secondary 8-hour ozone standards became effective. Lake and Porter counties were still designated nonattainment for the primary and secondary 1-hour ozone standards at the time the primary and secondary 8-hour ozone standards were established. These counties were not reclassified to attainment prior to the 1-hour standard being revoked in 2005. The U.S. EPA issued a finding of attainment in 2009 and the reclassification to attainment under the 8-hour standard in 2010 addressed this gap for the 1-hour standard. Table 9 lists the current attainment status for the primary and secondary 1-hour ozone standards.

Table 9: 1-Hour Ozone Designations

County	Date Classified as Nonattainment for the Primary and Secondary 1-Hour Ozone Standards	Status of Area
Allen	3/3/1978	Redesignated to Attainment on 5/4/1984
Clark	3/3/1978 11/15/1990	Redesignated to Attainment on 11/23/2001
Elkhart	10/5/1978 11/15/1990	Redesignated to Attainment on 11/30/1994
Floyd	3/3/1978 11/15/1990	Redesignated to Attainment on 11/23/2001

Lake	3/3/1978 11/15/1990	All SIP obligations for the 1-hour standard were met prior to the standard being revoked on June 15, 2005. Finding of attainment was issued on January 29, 2009 and the area was effectively redesignated to attainment under the standard on May 11, 2010.
Marion	3/3/1978 11/15/1990	Redesignated to Attainment on 11/30/1994
Porter	3/3/1978 11/15/1990	All SIP obligations for the 1-hour standard were met prior to the standard being revoked on June 15, 2005. Finding of attainment was issued on January 29, 2009 and the area was effectively redesignated to attainment under the standard on May 11, 2010.
St. Joseph	3/3/1978 11/15/1990	Redesignated to Attainment on 11/30/1994
Vanderburgh	3/3/1978 1/6/1992	Redesignated to Attainment on 4/14/1982 Redesignated to Attainment on 12/9/1997
Note: The primary and secondary 1-hour ozone standards were the same. Designations made in 1978 were for "photochemical oxidants" which was later changed to "ozone."		

In June 2004, U.S. EPA designated areas under the new primary and secondary 8-hour ozone standards of 0.08 ppm and classified them as attainment, nonattainment, or unclassifiable based on data collected from 2001 through 2003. In U.S. EPA's initial announcement, 23 counties and one township in Indiana were identified as being in violation of the new primary and secondary 8-hour ozone standard. By 2010, all areas of Indiana had been reclassified to attainment with a maintenance plan. Table 10 lists the current attainment status for the primary and secondary 8-hour ozone standards.

Table 10: 8-Hour Ozone Designations

County	Date Classified as Nonattainment for the Primary and Secondary 8-Hour Ozone Standards	Status of Area
Allen	6/15/2004	Redesignated to Attainment on 2/12/2007
Boone	6/15/2004	Redesignated to Attainment on 10/19/2007
Clark	6/15/2004	Redesignated to Attainment on 7/19/2007
Dearborn-Lawrenceburg Township Only	6/15/2004	Redesignated to Attainment on 5/11/2010
Delaware	6/15/2004	Redesignated to Attainment on 1/3/2006
Elkhart	6/15/2004	Redesignated to Attainment on 7/19/2007
Floyd	6/15/2004	Redesignated to Attainment on 7/19/2007
Greene	6/15/2004	Redesignated to Attainment on 12/29/2005
Hamilton	6/15/2004	Redesignated to Attainment on 10/19/2007
Hancock	6/15/2004	Redesignated to Attainment on 10/19/2007
Hendricks	6/15/2004	Redesignated to Attainment on 10/19/2007
Jackson	6/15/2004	Redesignated to Attainment on 12/29/2005
Johnson	6/15/2004	Redesignated to Attainment on 10/19/2007
Lake	6/15/2004	Redesignated to Attainment on 5/11/2010
LaPorte	6/15/2004	Redesignated to Attainment on 7/19/2007
Madison	6/15/2004	Redesignated to Attainment on 10/19/2007
Marion	6/15/2004	Redesignated to Attainment on 10/19/2007
Morgan	6/15/2004	Redesignated to Attainment on 10/19/2007
Porter	6/15/2004	Redesignated to Attainment on 5/11/2010

St. Joseph	6/15/2004	Redesignated to Attainment on 7/19/2007
Shelby	6/15/2004	Redesignated to Attainment on 10/19/2007
Vanderburgh	6/15/2004	Redesignated to Attainment on 1/30/2006
Vigo	6/15/2004	Redesignated to Attainment on 2/6/2006
Warrick	6/15/2004	Redesignated to Attainment on 1/30/2006
Note: The primary and secondary 8-hour ozone standards were the same.		

Sulfur Dioxide (SO_2) Designations and Redesignations

In March and October 1978, U.S. EPA designated areas under the primary 24-hour SO_2 health standard of 0.14 ppm and classified them as attainment, nonattainment, or unclassifiable based on monitoring data. Two whole counties and three parts of other counties were identified as being in violation of the primary 24-hour SO_2 standard. In September 1990, Lawrence, Warren, and Washington Townships in Marion County were redesignated from nonattainment to cannot be classified based on clean ambient data. The remaining portion of Marion County remained designated nonattainment. By the year 2005, all areas in Indiana had been reclassified to attainment with a maintenance plan. Table 11 below lists the current attainment status for the primary 24-hour SO_2 standard. All areas of Indiana meet both the primary annual SO_2 standard and the secondary SO_2 standard. U.S. EPA is in the process of designating areas as attainment, nonattainment, or unclassifiable under the new 1-hour SO_2 standard of 75 ppb. Designations under the new 1-hour SO_2 standard are scheduled to be finalized by June 2012.

Table 11: 24-Hour SO_2 Designations

County	Date Classified as Nonattainment for the Primary and Secondary 24-Hour SO_2 Standards	Status of Area
Lake (Northern Part of Lake County Only)	3/3/1978 10/5/1978	Redesignated to Attainment on 10/26/2005
LaPorte (Northern Part of LaPorte County Only)	3/3/1978 10/5/1978	Redesignated to Attainment on 1/14/1997
Marion	3/3/1978 10/5/1978	Lawrence, Warren, and Washington Townships Redesignated to Unclassifiable, the Remaining Portion of Marion County Remained Designated Nonattainment on 9/18/1990 Entire County Redesignated to Attainment on 1/14/1997
Vigo	3/3/1978 10/5/1978	Redesignated to Attainment on 1/14/1997
Wayne (Boston, Center, Franklin, Wayne, and Webster Townships Only)	3/3/1978 10/5/1978	Redesignated to Attainment on 1/14/1997
Note: The primary and secondary 24-hour SO_2 standards were the same.		

Improvements in Air Quality

Indiana's air quality has improved significantly over the last 30 years. The majority of air quality improvements in Indiana have stemmed from the national and regional rules outlined below. The programs mentioned below have been or are being implemented and have reduced monitored ambient air quality values across Indiana. Specific local controls are outlined in the regional pages of the report.

National Controls

Acid Rain Program

Congress created the Acid Rain Program under Title IV of the 1990 CAA. The overall goal of the program is to achieve significant environmental and public health benefits through reduction in emissions of SO_2 and NO_x, the primary causes of acid rain. To achieve this goal at the lowest cost to the public, this program employs both traditional and innovative, market-based approaches to controlling air pollution. Specifically, the program seeks to limit, or "cap," SO_2 emissions from power plants at 8.95 million tons annually starting in 2010, authorizes those plants to trade SO_2 allowances, and while not establishing a NO_x trading program, reduces NO_x emission rates. In addition, the program encourages energy efficiency and pollution prevention.

Tier II Emission Standards for Vehicles and Gasoline Sulfur Standards

In February 2000, U.S. EPA finalized a federal rule to significantly reduce emissions from cars and light duty trucks, including sport utility vehicles (SUVs). This rule required automakers to produce cleaner cars, and refineries to make cleaner, lower sulfur gasoline. This rule was phased in between 2004 and 2009 and resulted in a 77% decrease in NO_x emissions from passenger cars, an 86% decrease from smaller SUVs, light duty trucks, and minivans, and a 65% decrease from larger SUVs, vans, and heavier duty trucks. This rule also resulted in a 12% decrease in VOC emissions from passenger cars, an 18% decrease from smaller SUVs, light duty trucks, and minivans, and a 15% decrease from larger SUVs, vans, and heavier duty trucks.

Heavy-Duty Diesel Engines

In July 2000, U.S. EPA issued a final rule for Highway Heavy-Duty Engines, a program that includes low-sulfur diesel fuel standards. This rule applies to heavy-duty gasoline and diesel trucks and buses. This rule was phased in from 2004 through 2007 and resulted in a 40% decrease in NO_x emissions from diesel trucks and buses.

Clean Air Nonroad Diesel Rule

In May 2004, U.S. EPA issued the Clean Air Nonroad Diesel Rule. This rule applies to diesel engines used in industries such as construction, agriculture, and mining. It also contains a cleaner fuel standard similar to the highway diesel program. The engine standards for nonroad engines took effect in 2008 and resulted in a 90% decrease in SO_2 emissions from nonroad diesel engines. Sulfur levels were also reduced in nonroad diesel fuel by 99.5% from approximately 3,000 ppm to 15 ppm.

Nonroad Spark-Ignition Engines and Recreational Engine Standards

This standard, effective in July 2003, regulates NO_x, VOCs, and CO for groups of previously unregulated nonroad engines. This standard applies to all new engines sold in the United States and imported after the standards went into effect. The standard applies to large spark-ignition engines (forklifts and airport ground service equipment), recreational vehicles (off-highway motorcycles and all terrain vehicles), and recreational marine diesel engines. When all of the nonroad spark-ignition engines and recreational engine standards are fully implemented, an overall 72% reduction in VOC, 80% reduction in NO_x, and 56% reduction in CO emissions are expected by 2020.

Regional Controls

Nitrogen Oxides Rule

On October 27, 1998, U.S. EPA established the NO_x SIP Call, which required 22 states to adopt rules that would result in significant emission reductions from large EGUs, industrial boilers, and cement kilns in the eastern United States. The Indiana rule was adopted in 2001 at 326 Indiana Administrative Code (IAC) 10-1. Beginning in 2004, this rule accounted for a reduction of approximately 31% of all NO_x emissions statewide compared to previous uncontrolled years.

Twenty-one other states also adopted these rules. The result is that significant reductions have occurred within Indiana and regionally due to the number of affected units within the region. The historical trend charts show that air quality has improved due to the decreased emissions resulting from this program.

On April 21, 2004, U.S. EPA published Phase II of the NO_x SIP Call that established a budget for large (emissions of greater than one ton per day) stationary internal combustion engines. In Indiana, the rule decreased NO_x emissions statewide from natural gas compressor stations by 4,263 tons during May through September. The Indiana Phase II NO_x SIP Call rule became effective in 2006, and implementation began in 2007 (326 IAC 10-4).

Clean Air Interstate Rule (CAIR)

On May 12, 2005, U.S. EPA published the following regulation: "Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (CAIR); Revisions to Acid Rain Program; Revisions to the NO_x SIP Call; Final Rule". This rule established the requirement for states to adopt rules limiting the emissions of NO_x and SO_2 and provided a model rule for the states to use in developing their rules in order to meet federal requirements. The purpose of CAIR was to reduce interstate transport of $PM_{2.5}$, SO_2 and ozone precursors (NO_x).

CAIR applied to any stationary, fossil fuel-fired boiler or stationary, fossil fuel-fired combustion turbine, or a generator with a nameplate capacity of more than 25 megawatt electrical (MWe) producing electricity for sale. This rule provided annual state caps for NO_x and SO_2 in two phases, with Phase I caps for NO_x and SO_2 starting in 2009 and 2010, respectively. Phase II caps were to become effective in 2015. U.S. EPA allowed limits to be met through a cap and trade program if a state chose to participate in the program.

In response to U.S. EPA's rulemaking, Indiana adopted a state rule in 2006 based on the model federal rule (326 IAC 24-1). Indiana's rule included annual and seasonal NO_x trading programs, and an annual SO_2 trading program. This rule required compliance effective January 1, 2009.

SO_2 emissions from power plants in the 28 eastern states and the District of Columbia (D.C.) covered by CAIR were to be cut by 4.3 million tons from 2003 levels by 2010 and 5.4 million tons from 2003 levels by 2015. NO_x emissions were to be cut by 1.7 million tons by 2009 and reduced by an additional 1.3 million tons by 2015. The D.C. Circuit court's vacatur of CAIR in July 2008 and subsequent remand without vacatur of CAIR in December 2008, directed U.S. EPA to revise or replace CAIR in order to address the deficiencies identified by the court. As of May 2012, CAIR remains in effect.

Cross-State Air Pollution Rule (CSAPR)

On August 8, 2011, U.S. EPA established a final rule that helps states reduce air pollution and meet CAA standards. The Cross-State Air Pollution Rule (CSAPR) replaces U.S. EPA's 2005 CAIR, and responds to the court's concerns.

CSAPR requires 27 states in the eastern half of the United States to significantly reduce power plant emissions that cross state lines and contribute to ground-level ozone and fine particle pollution in other states.

On December 30, 2011, the U.S. Court of Appeals for the D.C. Circuit stayed CSAPR prior to implementation pending resolution of a challenge to the rule. The court ordered U.S. EPA to continue the administration of CAIR pending resolution of the current appeal. This required U.S. EPA to reinstate 2012 CAIR allowances which had been removed from the allowance tracking system as part of the transition to CSPAR. The federal rule is on hold pending resolution of the litigation.

Reasonably Available Control Technology (RACT) and other State VOC Rules

As required by Section 172 of the CAA, Indiana has promulgated several rules requiring Reasonably Available Control Technology (RACT) for emissions of VOCs since the mid 1990's. In addition, other statewide rules for controlling VOCs have also been promulgated. The Indiana rules are found in 326 IAC 8. The following is a listing of statewide rules that assist with the reduction of VOCs in the state:

326 IAC 8-1-6	Best Available Control Technology for Non-Specific Sources
326 IAC 8-2	Surface Coating Emission Limitations
326 IAC 8-3	Organic Solvent Degreasing Operations
326 IAC 8-4	Petroleum Sources
326 IAC 8-5	Miscellaneous Operation
326 IAC 8-6	Organic Solvent Emission Limitations
326 IAC 8-8.1	Municipal Solid Waste Landfills
326 IAC 8-10	Automobile Refinishing
326 IAC 8-14	Architectural and Industrial Maintenance Coatings
326 IAC 8-15	Standards for Consumer and Commercial Products

State Emission Reduction Initiatives

Outdoor Hydronic Heater Rule

Rule 326 IAC 4-3, effective May 18, 2011, regulates the use of outdoor hydronic heaters (also referred to as outdoor wood boilers or outdoor wood furnaces) designed to burn wood or other approved renewable solid fuels and establishes a particulate emission limit for new units. The rule also includes a fuel use restriction, stack height requirements, and a limited summertime operating ban for existing units.

Reinforced Plastic Composites Fabricating and Boat Manufacturing Industries Rule

Rules 326 IAC 20-48, effective August 23, 2004 and 326 IAC 20-56, effective April 1, 2006, regulate styrene emissions from the boat manufacturing and fiberglass reinforced plastic industries. The state rules implement the federal NESHAP for each of these source categories with additional requirements that were carried over from the Indiana state styrene rule (326 IAC 20-25) adopted in 2000 and now repealed.