Air Data Report 2017

One of the most critical responsibilities of the Air Quality Division is monitoring Oklahoma's Air Quality.

This report makes monitoring information available to the public in a consistent form that helps Oklahomans become more aware of the air they breathe.

Criteria Pollutants

This report covers the seven criteria pollutants associated with the National Ambient Air Quality Standards (NAAQS).

CO - Carbon Monoxide

NO_2 - Nitrogen Dioxide

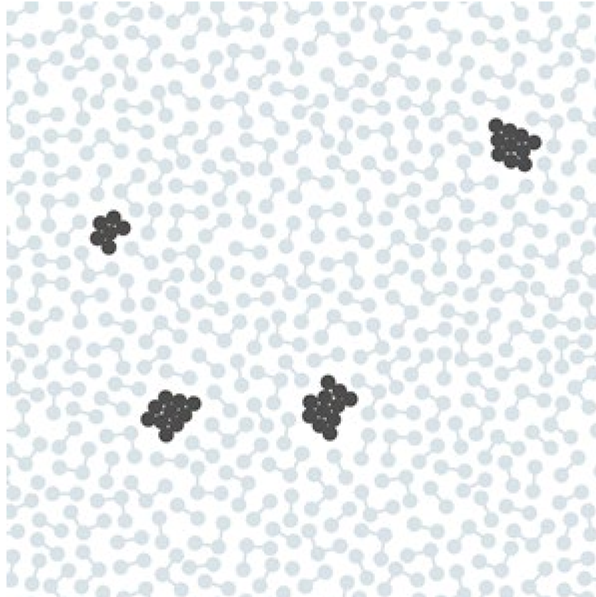
O_3 - Ozone

Pb - Lead

PM10 - Particulate Matter

PM2.5 - Fine Particulate Matter

SO_2 - Sulfur Dioxide



DEQ Air Quality Monitoring

The monitoring unit measures criteria air pollutant concentrations at several sites across Oklahoma. This report includes data from 30 sites.

National Ambient Air Quality Standards (NAAQS)

The Clean Air Act requires EPA to set ambient air quality standards for pollutants considered harmful to public health and the environment. They are called “criteria pollutants” because of the criteria developed to limit their emission. The **primary standards** provide public health protection, and the **secondary standards** provide public welfare protection against poor visibility and damage to crops, vegetation, and buildings.

Each NAAQS defines the maximum permissible concentrations for criteria pollutants. The standards are periodically revised by EPA to take into account new health research. The primary standard must be adequate to protect at-risk groups like children, those with lung diseases, and the elderly.

Pollutant		Standard	Averaging Time	Level	Form
Carbon Monoxide		Primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead		Primary and Secondary	Rolling 3 month average	0.15 μg/m^3	Not to be exceeded
Nitrogen Dioxide		Primary	1-hour	100 ppb	98th percentile (3 yr avg)
		Primary and Secondary	Annual	53 ppb	Annual mean
Ozone		Primary and Secondary	8-hour	0.070 ppm	Annual 4th-highest daily max 8-hr concentration (3 yr avg)
Particulate	PM10	Primary and Secondary	24-hour	150 μg/m^3	Not to be exceeded more than once per year (3 yr avg)
		Primary	Annual	12 μg/m^3	Annual mean (3 yr avg)

Matter	PM2.5	Secondary	Annual	15 μg/m^3	Annual mean (3 yr avg)
		Primary and Secondary	24-hour	35 μg/m^3	98th percentile (3 yr avg)
Sulfur Dioxide		Primary	1-hour	75 ppb	99th percentile of 1-hour daily max concentrations (3 yr avg)
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

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CO - Carbon Monoxide

Carbon Monoxide (CO) is a colorless, odorless gas product of incomplete combustion. Complete combustion of hydrocarbon fuels, like wood and petroleum, forms water and carbon dioxide in the presence of oxygen. Insufficient oxygen produces toxic intermediates like carbon monoxide.

Catalytic converters reduce tail pipe CO emissions.

In the human body, CO reduces the oxygen-carrying capacity of the blood. Hemoglobin is the part of blood that carries oxygen. When carbon monoxide enters the bloodstream, it binds with a higher affinity to hemoglobin than oxygen. Even a small amount of carbon monoxide can displace needed oxygen and kill.

Most CO emissions come from mobile sources like cars and trucks. Manufacturers reduce mobile emissions by adding control devices like catalytic converters, which use platinum and other catalysts to convert toxic pollutants like CO into less toxic chemicals. In effect, the catalysts complete the combustion process.

There are two primary standards for carbon monoxide: one for an 8-hour average concentration of 9 parts per million (ppm) and another for a 1-hour average of 35 ppm. Oklahoma is in attainment with both standards.

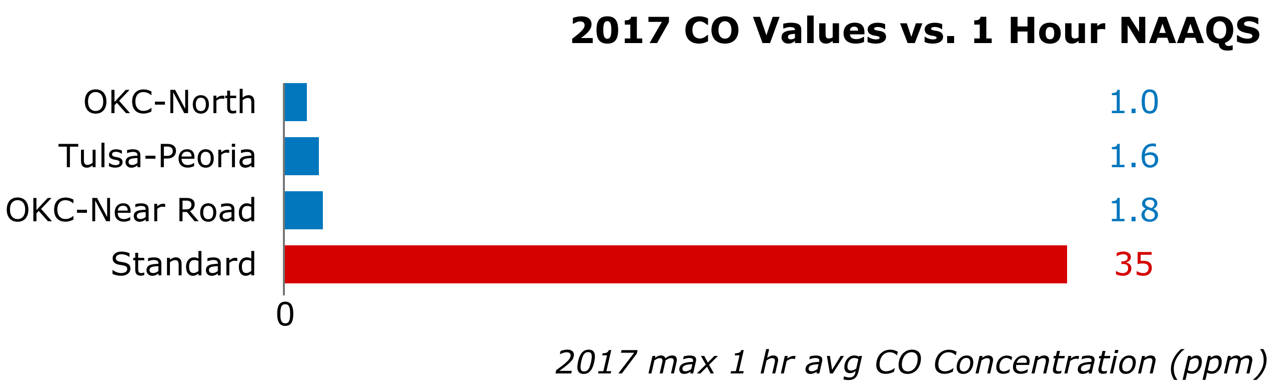
CO Monitoring Sites

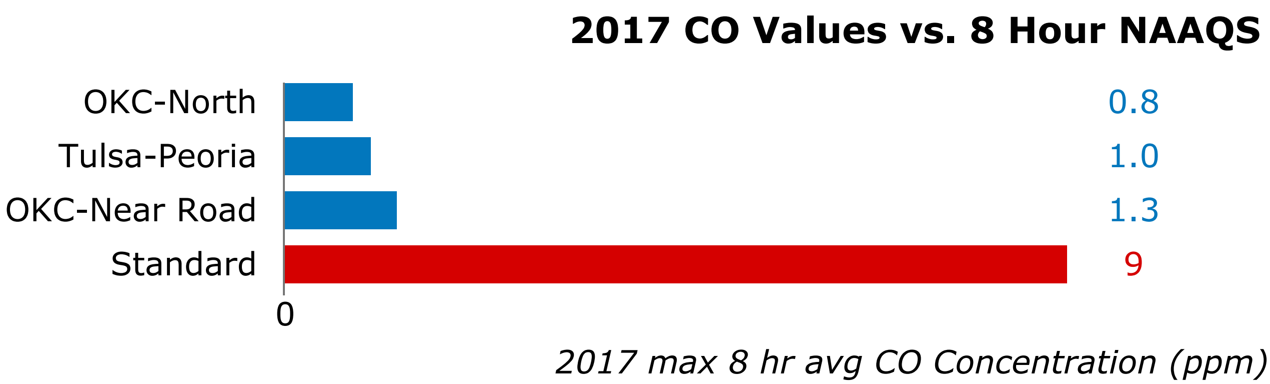
The CO network consists of three monitors: two in Oklahoma City and one in Tulsa. The CO monitors continuously sample air using a gas filter correlation method. The monitors report hourly values to determine compliance with the standards. Current

data may be accessed here.

CO Data

Oklahoma has exceedingly good air quality with CO values well below the NAAQS. CO levels have decreased from a national (8-hour) average of 8.9 ppm in 1980 to less than 2 ppm. Improved fuel burning efficiency of mobile sources will continue to be the major force in attainment of these standards.





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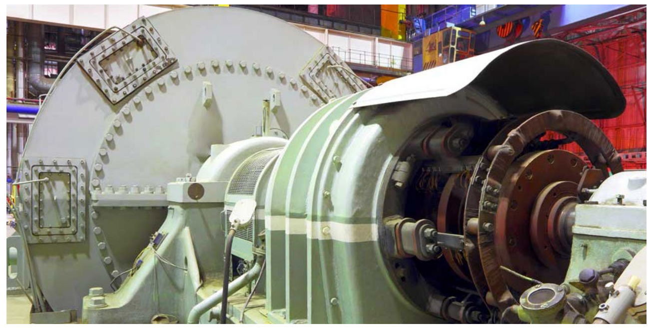
NO_2 - Nitrogen Dioxide

Nitrogen Dioxide (NO_2) is one of a group of highly reactive gases known as “nitrogen oxides” (**NO_X**). There are many nitrogen oxides, but for regulatory purposes NO_X is the sum of nitric oxide (NO) and nitrogen dioxide (NO_2). Nitrogen oxides are combustion products and can come from engines and boilers.



Operating turbines with lower peak temperatures and the time fuel spends inside helps reduces NO_X emissions.

Nitrogen is abundant as N_2 in ambient air and is a constituent in varying forms in fuels. Nitrogen emissions can be controlled before, during, and after combustion. Pre-treatment removes nitrogen from fuels. Specialized low-NO_X burners use a controlled mix of air and fuel to minimize NO_X during combustion. Post-combustion treatment uses a catalyst to return nitrogen to a non-toxic form (N_2), the same as in ambient air.

NO and NO_2 are the two main constituents of NO_X and exist in a daytime equilibrium. NO can react with atmospheric oxygen to form NO_2, while solar radiation can breakdown NO_2 to again form NO and oxygen. The oxygen released from NO_2 can react with diatomic oxygen (O_2) to form ozone (O_3), so NO_X is one precursor to ozone pollution.

There are two federal standards for nitrogen dioxide: a 1-hour 100 parts per billion (ppb) primary standard and a 53 ppb annual mean primary/secondary standard. Oklahoma is in attainment with both standards.

NO_2 Monitoring Sites

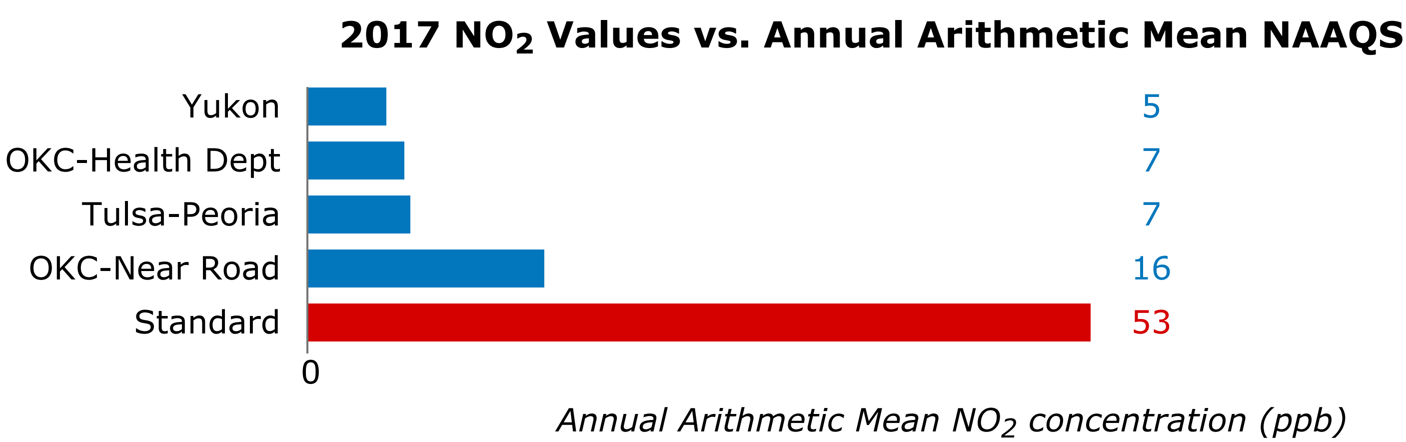
The division monitors NO_2 at three sites in Oklahoma City and one site in Tulsa. The OKC Near Road monitor is next to the I-44 highway and Will Rogers Park so it can measure NO_X

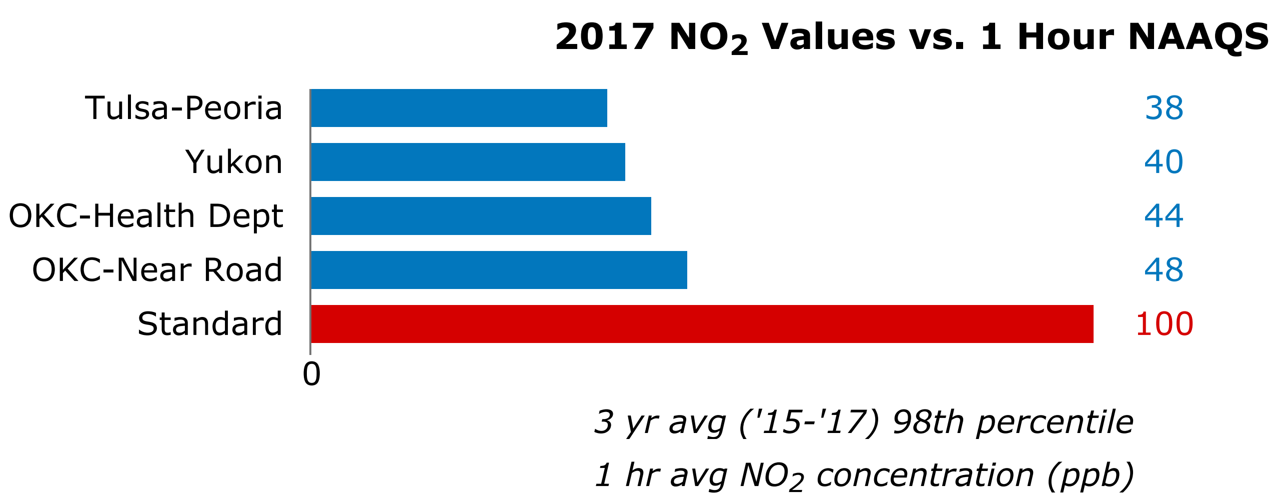
emissions from mobile sources like cars and trucks. All NO_2 measurements are made using a chemiluminescent (light-producing chemical reaction) method. Monitors report hourly values. All three sites meet the NO_2 standard. Current data may be accessed here.

2017 NO_2 Data

NO_2 concentrations continue to decrease as a result of a number of mobile source regulations for light- and heavy-duty vehicles. Implementation of these regulations is staggered over multiple years for manufacturers to design cleaner burning engines. Current air quality monitoring data does not reflect all the benefits of vehicles that meet these strict NO_X standards because many older vehicles remain. These reductions are even more significant because NO_X is a precursor to ozone, another air pollutant.

The 100 ppb standard is measured based on the 98th percentile of 1-hour daily maximum concentrations, averaged over three years. The 53 ppb standard is an annual mean. The OKC Near Road NO_2 monitor was added in March 2015.





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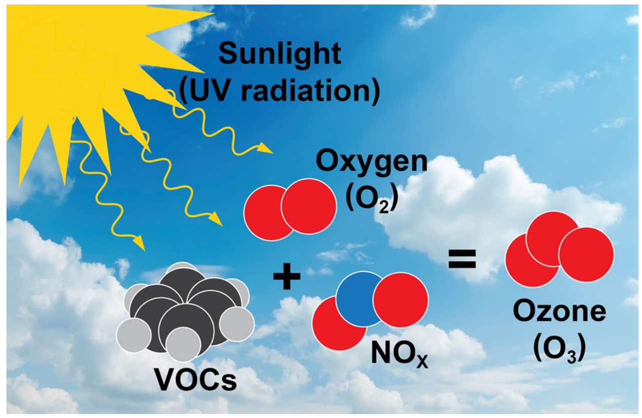
O_3 - Ozone



Ozone forms in the atmosphere through chemical reactions between oxygen, precursor pollutants like VOCs and NO_X, and sunlight.

Ozone (O_3) is a gas composed of three oxygen atoms, unlike the diatomic oxygen (O_2) we must breathe. Ozone is not usually emitted directly into the air. At ground-level, ozone is created by chemical reactions between diatomic oxygen (O_2), nitrogen oxides (NO_X) and volatile organic compounds (VOCs) in the presence of sunlight. NO_X and VOCs come from motor vehicle exhaust, industrial emissions, gasoline vapors, chemical solvents, and some natural sources.

Ozone can be "good" or "bad" depending on its location in the atmosphere. The natural ozone layer in the upper atmosphere absorbs most of the sun's damaging ultraviolet radiation. Ground-level ozone in the lower atmosphere is considered "bad." Many urban areas tend to have high levels of "bad" ozone, but even rural areas can have high ozone because wind carries it and its precursor pollutants hundreds of miles away from their original sources.

There is one primary and one secondary federal standard for ozone. Several Oklahoma sites are close to exceeding the standard.

Ozone Monitoring Sites

The division monitors ozone at 14 sites across the state. These locations report data hourly and are the basis of the Air Quality Health Advisory program. Current data may be accessed here.

Ozone and Your Health

Ozone is a serious air quality problem in many parts of the United States. Even at low levels, ozone can cause negative health effects. People with lung diseases, children, older adults, and people who are active outdoors may be particularly sensitive to ozone. Numerous scientific studies have linked ozone pollution exposure to a variety of problems, including:

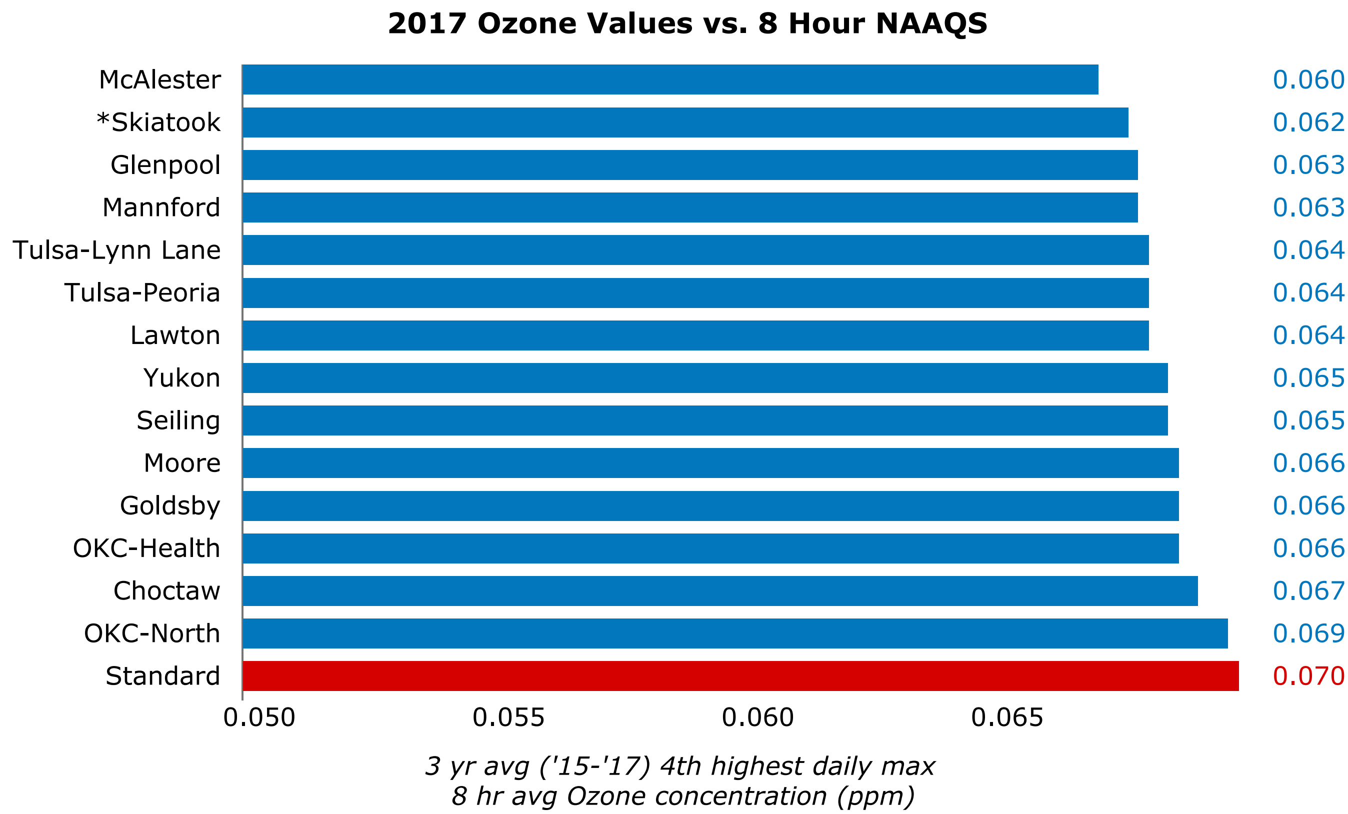
- respiratory system irritation

aggravated asthma
- decreased lung function
- increased susceptibility to infection
- coughing or difficult breathing
- permanent lung damage

2017 Ozone Data

Primary and Secondary Ozone Standard = 0.070 parts per million (8-hour average)

To compare to the standard, 8-hour average concentrations are tracked, and the fourth-highest daily maximum is averaged across three consecutive years.



***Incomplete data set (less than three years of data)**

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Pb - Lead

Lead (Pb) is a soft, dense metal found naturally in the environment and in manufactured products, from ancient plumbing pipes ("Pb" comes from the Latin *plumbum*) to modern applications like paints and anti-knock fuel additives. The major sources of lead air emissions have historically been motor vehicles (such as cars and trucks) and industrial sources.

"Leaded gasoline" contained tetraethyl lead as a fuel additive. From the 1970s, leaded fuel was phased out due to health concerns and the "poisoning" (deactivation) of catalytic converters.

Lead is a highly poisonous metal, interfering with many body processes such as development of the nervous system, in part by inhibiting the body's natural antioxidants. Lead's neurotoxicity is a serious concern for children, causing permanent learning and behavior disorders, anemia, and, in severe cases, seizures and death. Lead also accumulates in our bodies, stored along with calcium in bone. Pregnant women are at risk due to their bones releasing calcium with lead for the fetus, which reduces growth and increases the risk of premature birth.

As a result of federal regulatory efforts to remove lead from motor vehicle gasoline, nationwide lead emissions decreased by 99.6 percent (220,000 tons) from 1970 to 2011, and the average monitored lead concentration has decreased by 92 percent from 1980 to 2013. Today the highest levels of lead in air are usually found near lead smelters, absent in Oklahoma. Major sources of lead emissions to the air today are ore and metals processing and leaded aviation gasoline. For lead, there is one combined primary and secondary federal standard of 0.15 micrograms per cubic meter (μg/m³) measured on a 3-month rolling average.

Lead Monitoring Sites

The division monitors lead at two sites:

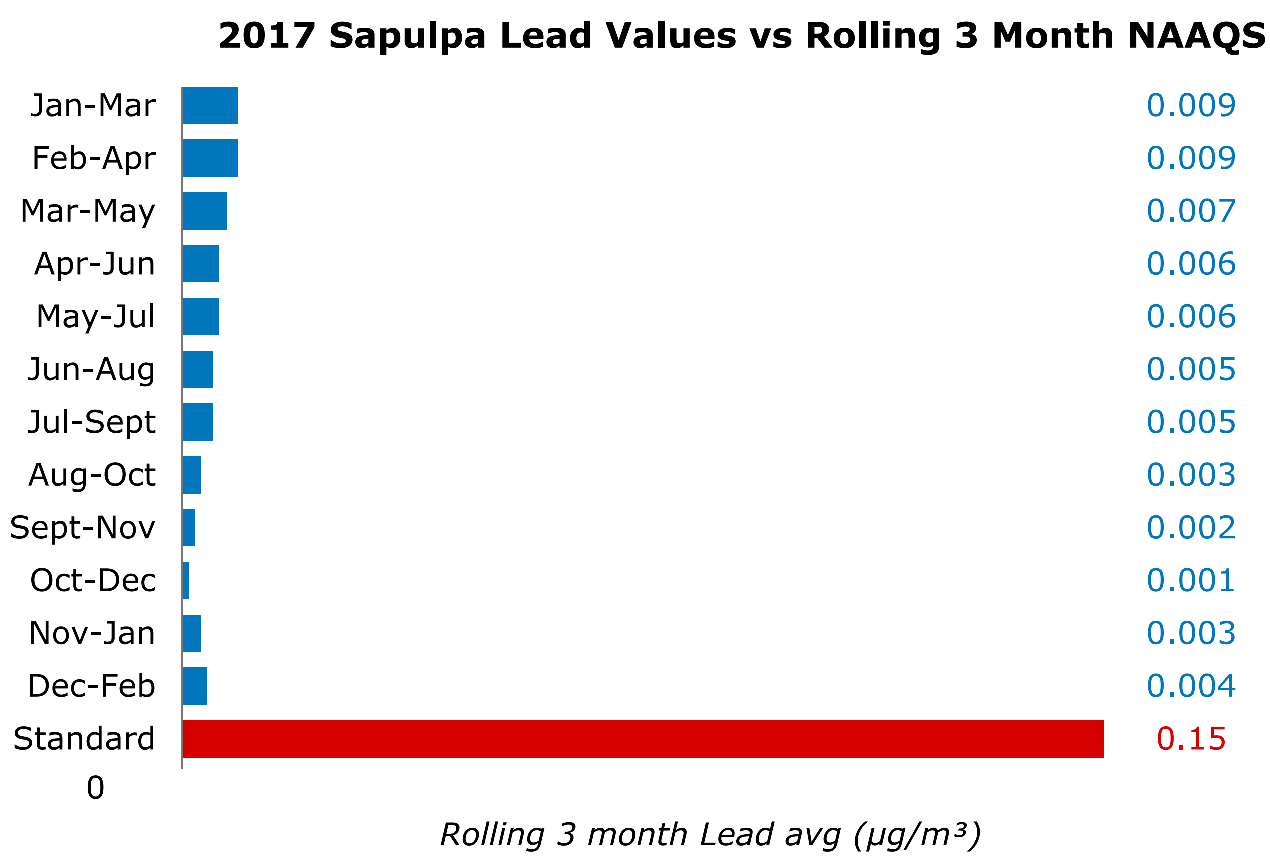
one in Sapulpa and one in Savanna. To measure lead, an air sampler pulls air for 24 hours across a glass fiber filter on a 6-day schedule. Samples are sent to an independent lab for analysis.

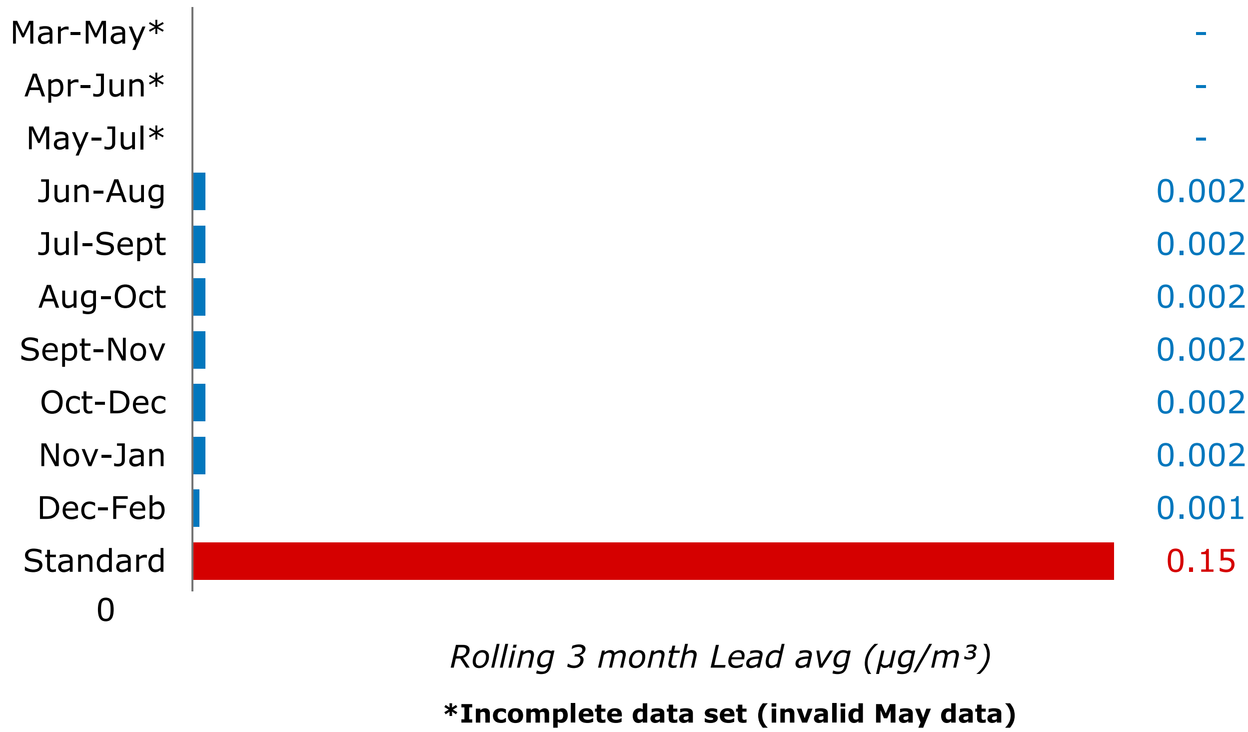
Most monitored lead values are so low that they are under the minimum detection limit, which itself is well below the standard and not a health concern.

2017 Lead Data

Primary/Secondary Lead Standard = 0.15 µg/m³ (Rolling 3-month avg)

The primary and secondary standards are measured as total suspended particles (TSP) collected on a filter. Monitored lead concentrations in Oklahoma are well below the standards.




Mar-May*
-
Apr-Jun*
-
May-Jul*
-
Jun-Aug
0.002
Jul-Sept
0.002
Aug-Oct
0.002
Sept-Nov
0.002
Oct-Dec
0.002
Nov-Jan
0.002
Dec-Feb
0.001
Standard
0.15
0
Rolling 3 month Lead avg (µg/m³)
*Incomplete data set (invalid May data)

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Intro CO NO_2 O_3 Pb PM10 PM2.5 SO_2 AQD Home

PM10 - Particulate Matter

Rock crushers often spray water to control PM emissions.

Particulate matter (PM) is a complex mixture of extremely small particles and liquid droplets. PM is made up of a number of components, including acids such as nitrates and sulfates, organic chemicals, metals, soil, and dust. Sources of particulate matter include construction sites, gravel/dirt roads, smokestacks, and fires. Many particles form in the atmosphere via chemical reactions of other pollutants like sulfur dioxide and nitrogen oxides, which are emitted from combustion sources like power plants and automobiles.

Particle size is directly linked to health risk. The National Ambient Air Quality Standards (NAAQS) address particles that are 10 micrometers (µm) in diameter (**PM10**) or smaller because those particles pass through the throat and nose and can enter the lungs. The particles promote inflammation, induce coagulation, and oxidative stress. Long-term exposure contributes to more heart attacks and increased mortality rates. Different fire conditions produce different PM emissions, including toxic chemicals and volatile organic compounds (VOCs). Particles larger than 10 µm settle quickly and affect their immediate surroundings, while air currents transport smaller particles long distances, sometimes hundreds of miles.

Exposure to particulate matter can damage lung and heart function by irritating the airways and causing irregular heartbeats. PM settling on the ground or water contributes to acid rain damage and soil nutrient depletion. PM also reduces visibility (haze), which degrades scenic areas and can obscure transportation routes (e.g. wildfire smoke passing over a road).

There is one primary and secondary standard for PM10, and both standards have the same limit. Oklahoma is in attainment with both standards.

PM10 Monitoring Sites

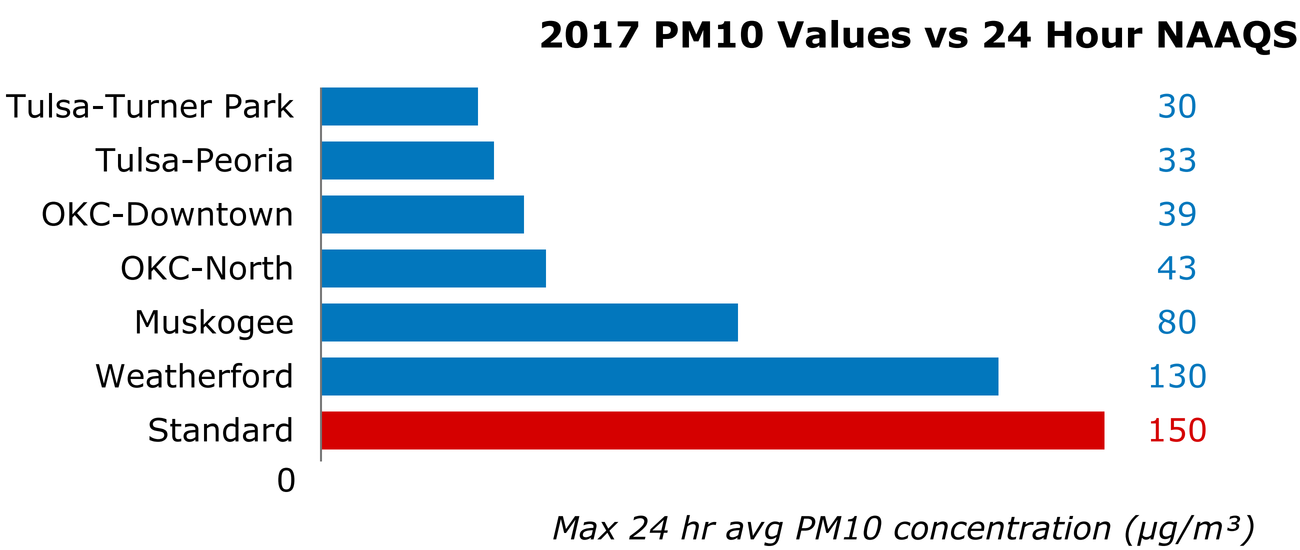
The division monitors PM10 at six sites using a combination of continuous and filter-based samplers. One method takes continuous air samples and reports PM10 values every hour. Other samplers pull air for 24 hours across a filter medium and are then analyzed to produce a 24-hour value comparable to the standard. High values are usually the result of emissions from nearby sources exacerbated by dry windy conditions.

Data collected at the state's continuous PM10 sites may be accessed by clicking here. Data from the filter-based method are not available in real-time.

2017 PM10 Data

Primary and Secondary PM10 Standard = 150 (μg/m³) (24-hour)

The NAAQS states the limit cannot be exceeded more than once per year over an average of 3 years. 2017 and the past two years (2015 and 2016) had no exceedances of 150 μg/m³.



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PM2.5 - Fine Particulate Matter

Particulate matter (PM) , is a complex mixture of extremely small particles and liquid droplets. **PM2.5**, or **fine particulate matter**, is defined as particles 2.5 micrometers in diameter or smaller. Fine particles are constituents in smoke and haze. They can be directly emitted from sources like fires, or they can form when gases emitted from power plants, industries and automobiles react in the air.

Wildfire smoke includes high amounts of PM. Prescribed fires help reduce fuel available for wildfires and can be managed to minimize smoke impacts. Photo courtesy of John Weir, Oklahoma State University.

Small particles less than 2.5 micrometers in diameter pose the greatest health risks because they travel farther and embed deeper into the lungs than large particles. Some fine particles even enter the bloodstream. PM2.5 exposure can affect both the lungs and heart. Numerous scientific studies have linked particle pollution to a variety of health problems, including:

- irritation of the respiratory system
- aggravated asthma
- coughing or difficulty breathing
- decreased lung function
- irregular heartbeat
- nonfatal heart attacks

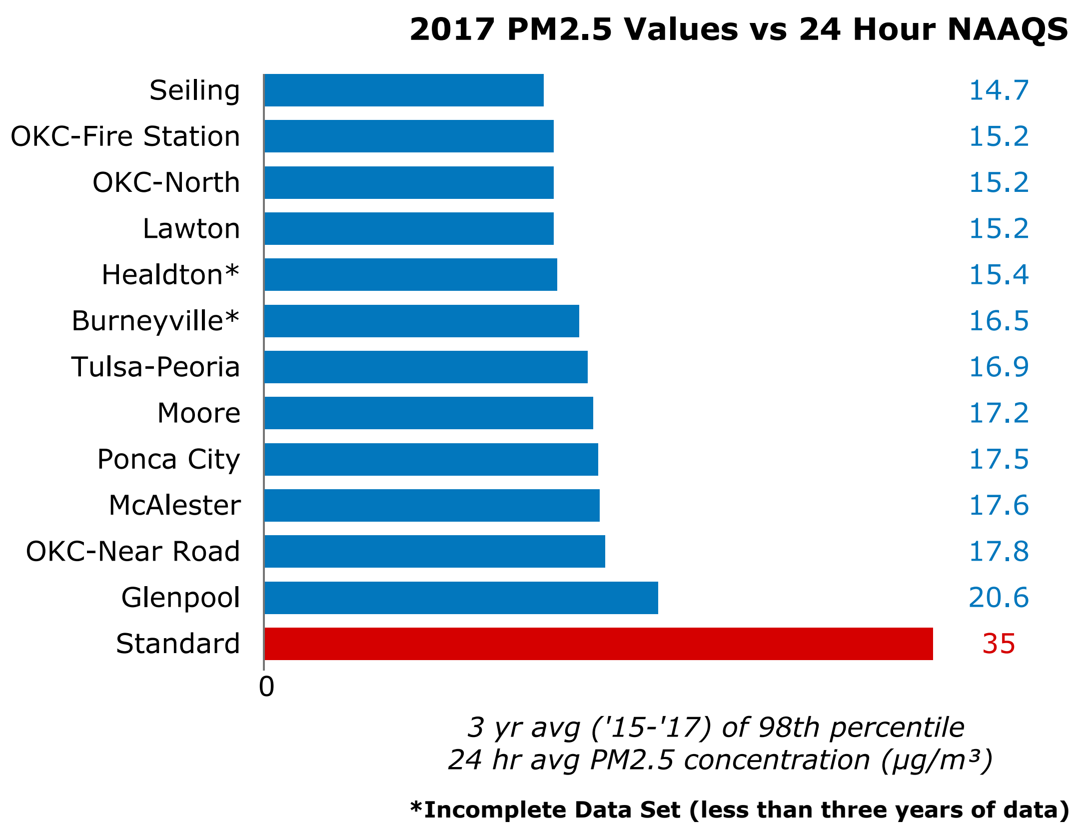
Though the purpose of the primary air quality standards is to protect public health, particulate matter, especially PM2.5, is believed to play a role in visibility. The emission and transport of particulate matter as it relates to visibility remain on the state and national agenda. There are four federal standards for PM2.5: identical primary and secondary standards for short term (24-hr) values, and separate annual primary and secondary standards. Oklahoma is in attainment with all PM2.5 standards.

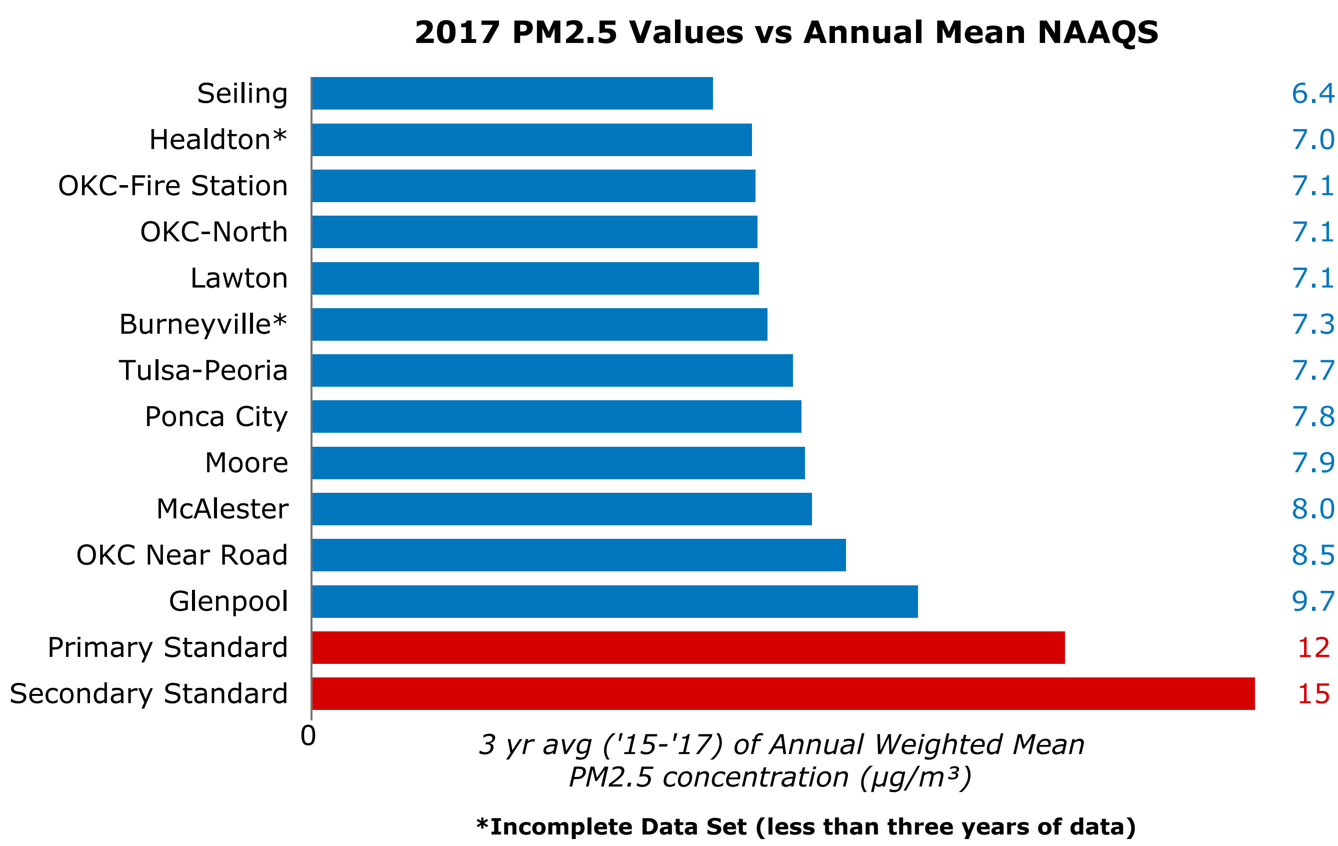
PM2.5 Monitoring Sites

The division monitored PM2.5 at twelve locations in both highly populated areas and areas of specific concern. Two monitors are at special purpose sites: the Burneyville monitor stopped collection in 2015, while the Healdton monitor started in 2016. PM2.5 is monitored with two methods: a filter-based method (24-hr sampling on a Teflon filter taken on a daily, 3-day, or 6-day schedule) and a continuous sampling method (hourly reports). Current data may be accessed here.

2017 PM2.5 Data

Primary and Secondary PM2.5 24-hour standards: 35 µg/m^3 (3 yr avg)
Primary Annual Arithmetic Mean PM2.5 standard: 12 µg/m^3 (3 yr avg)
Secondary Annual Arithmetic Average PM2.5 standard: 15 µg/m^3 (3 yr avg)





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SO_2 - Sulfur Dioxide

Lime injection into exhaust gas helps absorb SO_2 before release from tall stacks.

Sulfur dioxide (SO_2) is one of a group of highly reactive gases known as oxides of sulfur. The largest source of emissions is fossil fuel combustion at power plants and other industrial facilities. Sulfur is a natural constituent of both petroleum and coal deposits. Smaller SO_2 sources include industrial processes such as extracting metal from ore and the burning of high-sulfur fuels by locomotives, large ships, and non-road equipment.

Hydrogen sulfide (H_2S) is a poisonous sulfur compound and present at high concentrations in “sour” petroleum wells. Burning sour gas converts the H_2S into SO_2. H_2S can be removed from petroleum to meet low-sulfur fuel standards. Likewise, SO_2 limits for coal-burning facilities created an incentive to mine low-sulfur coal.

Sulfur dioxide has a strong odor at high levels and is easily absorbed when we breathe. SO_2 irritates the lungs, activates nerve reflexes, and causes injury to airway mucous membranes, which affects breathing. People with asthma can experience increased airway resistance when exercising under SO_2 concentrations of less than 0.1 ppm (100 ppb).

SO_2 is the major cause of acid rain because it dissolves in and acidifies atmospheric water. Acid rain damages buildings and statues by corroding minerals in limestone and marble. Acid rain also lowers the pH of (acidifies) forests, lakes, and streams, which harms aquatic wildlife.

There are two standards in place for sulfur dioxide: a primary 1-hour standard to protect human health, and a secondary 3-hour standard to protect the environment and property. Oklahoma is in attainment with both standards.

SO_2 Monitoring Sites

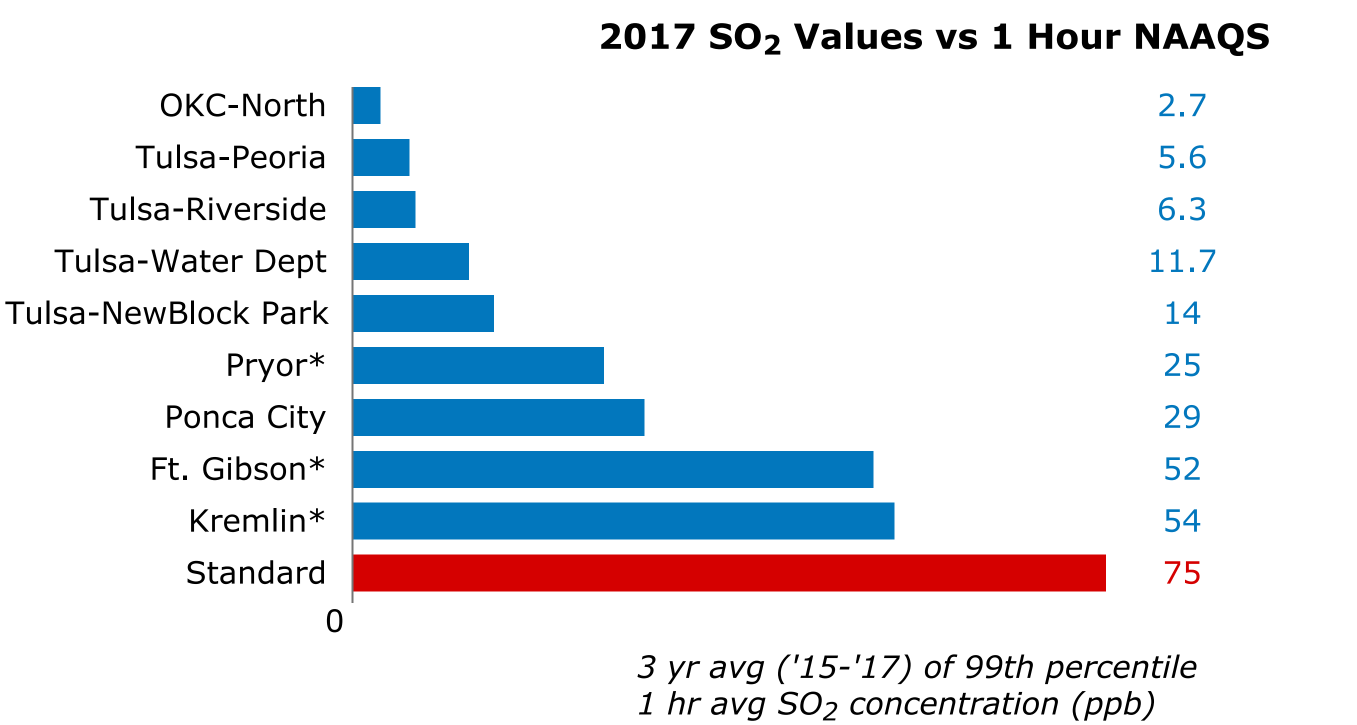
The division monitors for sulfur dioxide at nine sites in the state. The monitors measure SO_2 via pulsed fluorescence and report SO_2 concentrations on an hourly basis. The values are then used to determine compliance with the standard. Current data may be accessed here.

2017 SO_2 Data

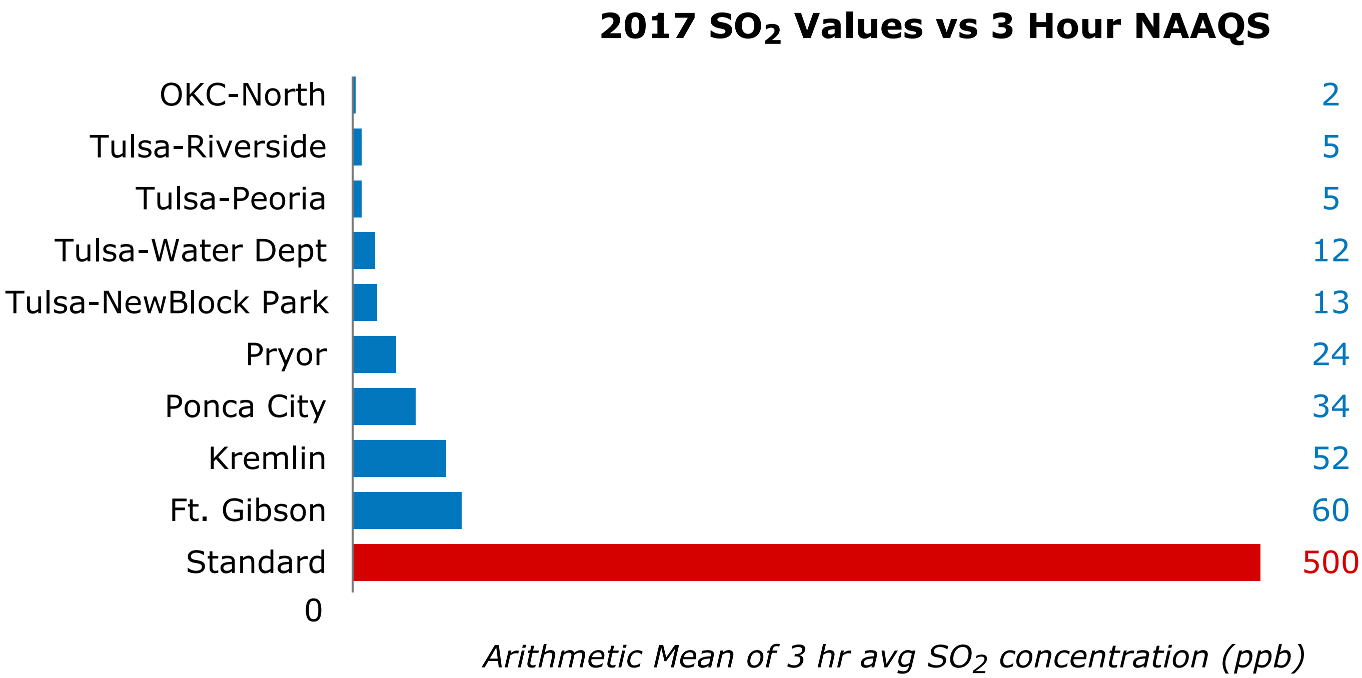
Primary SO_2 1-hour standard: 0.075 ppm (=75 ppb)

Secondary SO_2 3-hour standard: 0.5 ppm

To attain the primary standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within the area must not exceed 75 ppb. The secondary standard is not to be exceeded more than once per year.



***Does not have 3 years of data to compare against standard**


2017 SO_2 Values vs 3 Hour NAAQS
OKC-North
Tulsa-Riverside
Tulsa-Peoria
Tulsa-Water Dept
Tulsa-NewBlock Park
Pryor
Ponca City
Kremlin
Ft. Gibson
Standard
0
2
5
5
12
13
24
34
52
60
500
Arithmetic Mean of 3 hr avg SO_2 concentration (ppb)