

WASHOE COUNTY HEALTH DISTRICT

ENHANCING QUALITY OF LIFE

2012-21 Washoe County, Nevada Air Quality Trends Report

June 1, 2022



Public Health
Prevent. Promote. Protect.

**WASHOE COUNTY
HEALTH DISTRICT**
ENHANCING QUALITY OF LIFE



VISION

A healthy community

MISSION

**To protect and enhance the well-being and quality of life
for all in Washoe County.**

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Acronyms and Abbreviations

AQI	Air Quality Index
AQMD	Washoe County Health District - Air Quality Management Division
AQS	Air Quality System
BAM	Beta Attenuation Monitor
CFR	Code of Federal Regulations
CBSA	Core-Based Statistical Area
CO	Carbon Monoxide
EPA	U.S. Environmental Protection Agency
GAL	Galletti
HA 87	Hydrographic Area 87
HC	Hydrocarbons
HNO ₂	Nitrous Acid
HNO ₃	Nitric Acid
INC	Incline
LEM	Lemmon Valley
µg/m ³	Micrograms per cubic meter
NAAQS	National Ambient Air Quality Standards
NCore	National Core Multi-Pollutant Monitoring Station
NO ₂	Nitrogen Dioxide
NO _x	Oxides of Nitrogen
NO _y	Reactive Oxides of Nitrogen
O ₃	Ozone
PLM	Plumb-Kit
PM	Particulate Matter
PM _{2.5}	Particulate Matter less than or equal to 2.5 microns in aerodynamic diameter
PM ₁₀	Particulate Matter less than or equal to 10 microns in aerodynamic diameter
PM _{coarse}	PM ₁₀ minus PM _{2.5}
ppb	Parts per billion
ppm	Parts per million
REN	Reno4
RNO	Reno3
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Station
SO ₂	Sulfur Dioxide
SO ₃	Sulfur Trioxide
SO _x	Oxides of Sulfur
SPK	Sparks
SPM	Special Purpose Monitoring
SPS	Spanish Springs
SRN	South Reno
STN	Speciation Trends Network
TOL	Toll
USG	Unhealthy for Sensitive Groups
VOC	Volatile Organic Compounds

Introduction

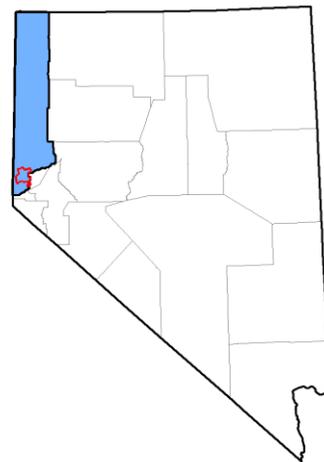
Washoe County is in the northwest portion of Nevada and bounded by California, Oregon, and the Nevada counties of Humboldt, Pershing, Storey, Churchill, Lyon, and Carson City (Figure 1). The Truckee Meadows is approximately 200 square miles in size and situated in the southern portion of Washoe County. It is geographically identified as Hydrographic Area 87 (HA 87) as defined by the State of Nevada Division of Water Resources. Most of Washoe County's urban population lives in the Truckee Meadows. Anthropogenic activities, such as automobile use and residential wood combustion, are also concentrated here.

The U.S. Environmental Protection Agency (EPA) has set health and welfare based National Ambient Air Quality Standards (NAAQS) for the following pollutants: ozone (O_3), particulate matter less than or equal to 2.5 microns in aerodynamic diameter ($PM_{2.5}$), particulate matter less than or equal to 10 microns in aerodynamic diameter (PM_{10}), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead (Pb).

The mission of the Washoe County Health District, Air Quality Management Division (AQMD) Monitoring Program is "To monitor and assure the scientific accuracy of the ambient air quality data collected for the determination of compliance with the National Ambient Air Quality Standards (NAAQS) as defined by the EPA". The AQMD has established a monitoring network throughout Washoe County to collect ambient air data. The network is reviewed annually to ensure it reflects the actual air quality of the county and that it is measuring for the pollutants of highest concern.

This document summarizes the ambient air data collected between 2012 and 2021 from the AQMD's monitoring network. These data were submitted to the EPA's Air Quality System (AQS) and are available for public review on EPA's AirData website. Long-term monitoring data can reveal trends in ambient air pollution and the subsequent need for control strategies.

Figure 1
Washoe County, Nevada



Pollutants

The following describes the six NAAQS criteria pollutants, their primary sources, and associated health effects.

Ozone (O₃)

Ozone is a gas composed of three oxygen atoms. It is not usually emitted directly into the air, but, at ground-level, it is created by a chemical reaction between oxides of nitrogen (NO_x) and volatile organic compounds (VOC) in the presence of sunlight. Ozone has the same chemical structure whether it occurs miles above the earth or at ground-level and can be “good” or “bad”, depending on its location in the atmosphere. “Good” O₃ occurs naturally in the stratosphere approximately 10 to 30 miles above the earth and forms a layer that protects life on earth from the sun’s harmful rays.

In the lower atmosphere, ground-level O₃ is considered “bad”. Breathing ground-level O₃ can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma. Ground-level O₃ can also reduce lung function and inflame the linings of the lungs. Repeated exposure may permanently scar lung tissue. People with lung disease, children, older adults, and physically active people may be affected when O₃ levels are unhealthy. Numerous scientific studies have linked ground-level O₃ exposure to a variety of problems including airway irritation, coughing, and pain when taking a deep breath; wheezing and breathing difficulties during exercise or outdoor activities; inflammation, which is much like a sunburn on the skin; aggravation of asthma and increased susceptibility to respiratory illnesses like pneumonia and bronchitis; and permanent lung damage with repeated exposures.

Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents as well as natural sources emit NO_x and VOC that help form O₃. Ground-level O₃ is the primary constituent of smog. Sunlight and hot weather cause ground-level O₃ to form in harmful concentrations. As a result, it is known as a summertime air pollutant. Many urban areas tend to have high levels of “bad” O₃, but even rural areas are also subject to increased O₃ levels because wind carries O₃ and pollutants that form it hundreds of miles away from their original sources.

Particulate Matter (PM₁₀, PM_{2.5}, and PM_{coarse})

Particulate matter, also known as particle pollution or PM, is a complex mixture of extremely small particles and liquid droplets. Particle pollution is made up of several components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

The size of particles is directly linked to their potential for causing health problems. Of concern are particles that are 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. EPA groups particle pollution into two categories:

- “Inhalable coarse particles” (PM₁₀ and PM_{coarse}), such as those found near roadways and dusty industries, are between 2.5 and 10 micrometers in diameter.
- “Fine particles” (PM_{2.5}), such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller. These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industries, and automobiles react in the air.

Particle pollution, especially fine particles, contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious health problems. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including irritation of the airways, coughing, difficulty breathing, decreased lung function, aggravated asthma, development of chronic bronchitis, irregular heartbeat, nonfatal heart attacks, and premature death in people with heart or lung disease.

People with heart or lung diseases, children and older adults are the most likely to be affected by particle pollution exposure. However, even healthy people may experience temporary symptoms from exposure to elevated levels of particle pollution.

Carbon Monoxide (CO)

Carbon monoxide is a colorless, odorless gas that is formed when carbon in fuel is not burned completely. It is a byproduct of incomplete combustion found in exhaust of on-road vehicles, non-road engines and vehicles (such as construction equipment and boats) and in industrial processes, residential wood burning, and natural sources such as wildfires. Higher concentrations generally occur in areas with heavy traffic congestion. Typically, the highest ambient levels of CO typically occur during the colder months of the year when temperature inversions are more frequent. The air pollution becomes trapped near the ground beneath a layer of warm air.

Carbon monoxide can cause harmful health effects by reducing oxygen delivery to the body’s organs (i.e., heart and brain) and tissues. The health threat from lower levels of CO is most serious for those who suffer from heart disease, like angina, clogged arteries, or congestive heart failure. For a person with heart disease, a single exposure to low levels of CO may cause chest pain and a reduced ability to exercise. Repeated exposures may contribute to other cardiovascular effects. Even healthy people can be affected by high levels of CO. Exposure to high levels can result in vision problems, reduced ability to work or learn, reduced manual dexterity, and difficulty performing complex tasks. At extremely high levels, CO is poisonous and can cause death.

Nitrogen Dioxide (NO₂)

Nitrogen dioxide is one of a group of highly reactive gasses known as “oxides of nitrogen”, or “nitrogen oxides (NO_x)”. Other nitrogen oxides include nitrous acid (HNO₂) and nitric acid (HNO₃). While EPA’s NAAQS covers this entire group of NO_x, NO₂ is the component of greatest interest and the indicator for the larger group of NO_x. Nitrogen dioxide forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. In addition to contributing to the formation of ground-level O₃ and fine particle pollution, NO₂ is linked with several adverse effects on the respiratory system.

Current scientific evidence links short-term NO₂ exposures, ranging from 30 minutes to 24 hours, with adverse respiratory effects including airway inflammation in healthy people and increased respiratory symptoms in people with asthma. Also, studies show a connection between breathing elevated short-term NO₂ concentrations and increased visits to emergency rooms and hospital admissions for respiratory issues, especially asthma.

NO₂ concentrations in vehicles and near roadways are appreciably higher than those measured at monitors in the current network. In fact, in-vehicle concentrations can be 2 to 3 times higher than measured at nearby area-wide monitors. Near-roadway (within about 50 meters) concentrations of NO₂ have been measured to be approximately 30 to 100% higher than concentrations away from roadways.

Individuals who spend time on or near major roadways can experience short-term NO₂ exposures considerably higher than measured by the current network. Approximately 16% of US housing units (approximately 48 million people) are located within 300 feet of a major highway, railroad, or airport. NO₂ exposure concentrations near roadways are of particular concern for susceptible individuals, including people with asthma, children, and the elderly.

NO_x reacts with ammonia, moisture, and other compounds to form small particles. These small particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature death. Ozone is formed when NO_x and VOC react in the presence of heat and sunlight. Children, the elderly, people with lung diseases such as asthma, and people who work or exercise outdoors are at risk for adverse effects from O₃. These include reduction in lung function and increased respiratory symptoms as well as respiratory-related emergency room visits, hospital admissions, and possibly premature deaths.

Emissions that lead to the formation of NO₂ generally also lead to the formation of other NO_x. Emissions control measures leading to reductions in NO₂ can generally be expected to reduce population exposures to all gaseous NO_x. This may have the important co-benefit of reducing the formation of O₃ and fine particles, both of which pose significant public health threats.

Sulfur Dioxide (SO₂)

Sulfur dioxide is one of a group of highly reactive gasses known as “oxides of sulfur”. The largest sources of SO₂ emissions are from fossil fuel combustion at power plants (66%) and other industrial facilities (29%). Smaller sources of SO₂ emissions include industrial processes such as extracting metal from ore, and the burning of high sulfur-containing fuels by locomotives, large ships, and non-road equipment. SO₂ is linked with a number of adverse effects on the respiratory system.

Current scientific evidence links short-term exposures to SO₂, ranging from 5 minutes to 24 hours, with an array of adverse respiratory effects including bronchoconstriction and increased asthma symptoms. These effects are particularly important for asthmatics at elevated ventilation rates (i.e., while exercising or playing). Studies also show a connection between short-term exposure and increased visits to emergency rooms and hospital admissions for respiratory illnesses, particularly in at-risk populations including children, the elderly, and asthmatics.

EPA’s SO₂ NAAQS is designed to protect against exposure to the entire group of sulfur oxides (SO_x). SO₂ is the component of greatest concern and is used as the indicator for the larger group of SO_x. Other gaseous sulfur oxides (i.e., sulfur trioxide (SO₃)) are found in the atmosphere at concentrations much lower than SO₂.

Emissions leading to high concentrations of SO₂ generally also lead to the formation of other SO_x. Control measures that reduce SO₂ can generally be expected to reduce people’s exposures to all gaseous SO_x. This may have the important co-benefit of reducing the formation of fine sulfate particles, which pose significant public health threats.

SO_x can react with other compounds in the atmosphere to form small particles. These particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature death. EPA’s PM NAAQS are designed to provide protection against these health effects.

Lead (Pb)

Lead is a metal found naturally in the environment as well as in manufactured products. The major sources of Pb emissions have historically been motor vehicles (such as cars and trucks) and industrial sources. As a result of EPA’s efforts to remove Pb from gasoline, ambient Pb levels decreased 99% between 1980 and 2017. Today, elevated levels of Pb in air are usually found near lead smelters, waste incinerators, utilities, lead-acid battery manufacturers, and can be found in emissions of non-road mobile sources such as piston-propelled aircraft.

In addition to exposure to Pb in air, other major exposure pathways include ingestion of Pb in drinking water and lead-contaminated food as well as incidental ingestion of lead-contaminated soil and dust. Lead-based paint remains a major exposure pathway in older homes.

Once taken into the body, Pb distributes throughout the body in the blood and is accumulated in the bones. Depending on the level of exposure, Pb can adversely affect the nervous system, kidney function, immune system, reproductive and developmental systems, and the cardiovascular system. Lead exposure also affects the oxygen carrying capacity of the blood. The effects most encountered in current populations are neurological effects in children and cardiovascular effects (i.e., high blood pressure and heart disease) in adults. Infants and young children are especially sensitive to even low levels of Pb, which may contribute to behavioral problems, learning deficits, and lowered IQ.

National Ambient Air Quality Standards

The Clean Air Act requires the EPA to establish NAAQS for pollutants considered harmful to public health and the environment. Two types of NAAQS have been established: primary and secondary standards. Primary standards set limits to protect public health, especially that of sensitive populations such as asthmatics, children, and seniors. Secondary standards set limits to protect public welfare, including protections against decreased visibility, damage to animals, crops, and buildings.

The EPA has set NAAQS for seven principal pollutants, which are called “criteria” pollutants. They are listed in Title 40 of the Code of Federal Regulations (CFR) Part 50 and summarized in Table 1 below. The units of measure for the standards are parts per million (ppm), part per billion (ppb), or micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$).

Table 1
National Ambient Air Quality Standards (as of December 31, 2021)

Pollutant	Primary Standard		Secondary Standard		Form
	Averaging Time	Level	Averaging Time	Level	
O ₃	8-hour	0.070 ppm	Same as primary		Fourth highest daily maximum concentration, averaged over 3 years
PM _{2.5}	24-hour	35 $\mu\text{g}/\text{m}^3$	Same as primary		98 th percentile of daily max, averaged over 3 years
	Annual	12.0 $\mu\text{g}/\text{m}^3$	Annual	15.0 $\mu\text{g}/\text{m}^3$	Annual mean, averaged over 3 years
PM ₁₀	24-hour	150 $\mu\text{g}/\text{m}^3$	Same as primary		Not to be exceeded more than once per year on average over 3 years
CO	1-hour	35 ppm	None		Not to be exceeded more than once per year
	8-hour	9 ppm	None		
NO ₂	1-hour	100 ppb	None		98 th percentile, averaged over 3 years
	Annual	53 ppb	Same as primary		Annual Mean
SO ₂	1-hour	75 ppb	3-hour	0.5 ppm	1 st : 99 th percentile of daily maximum concentration, averaged over 3 years
					2 nd : not to be exceeded more than once per year
Pb	Rolling 3-month average	0.15 $\mu\text{g}/\text{m}^3$	Same as primary		Not to be exceeded

Current Design Values and Attainment Status

Table 2 summarizes Washoe County’s current design values. Design values are the statistic used to compare ambient air monitoring data against the NAAQS to determine designations for each NAAQS. Designations are also codified in [40 CFR 81.329](#).

Table 2
Design Values and Attainment Status (as of December 31, 2021)

NAAQS		Design Value	Designations	
Pollutant (Averaging Time)	Level		Unclassifiable/ Attainment, or Maintenance	Non-Attainment (classification)
O ₃ (8-hour)	0.070 ppm	0.072 ppm	All HA’s	---
PM _{2.5} (24-hour)	35 µg/m ³	61 µg/m ³	All HA’s	---
PM _{2.5} (Annual)	12.0 µg/m ³	9.7 µg/m ³	All HA’s	---
PM ₁₀ (24-hour)	150 µg/m ³	4.0 Expected Exceedances	All HA’s ¹	---
CO (1-hour)	35 ppm	2.4 ppm	All HA’s	---
CO (8-hour)	9 ppm	2.1 ppm	All HA’s ²	---
NO ₂ (1-hour)	100 ppb	47 ppb	All HA’s	---
NO ₂ (Annual Mean)	53 ppb	12 ppb	All HA’s	---
SO ₂ (1-hour)	75 ppb	3 ppb	All HA’s	---
Pb (Rolling 3-month average)	0.15 µg/m ³	n/a	All HA’s	---

¹ Maintenance Area for PM₁₀ (1st 10-year maintenance plan expires January 6, 2026) [80 FR 76232](#)

² Maintenance Area for CO (2nd 10 year maintenance plan expires October 31, 2026) [81 FR 59490](#)

Ambient Air Monitoring Network

The AQMD began monitoring ambient air quality in Washoe County in the 1960's, and the monitoring network has grown and evolved since that time. This trends report provides a summary of data collected from ambient air monitoring sites in Washoe County that the AQMD operated and maintained between 2012 and 2021 to measure O₃, PM_{2.5}, PM₁₀, CO, NO₂, and SO₂. Due to the Reno, NV Core-Based Statistical Area (CBSA) population being under 500,000 as required by 40 CFR 58, Appendix D, Section 3(b) and not exceeding airport and non-airport emissions limits in 40 CFR 58, Appendix D, Section 4.5(a), there is no Pb monitoring in Washoe County.

Each monitoring site is classified into one of two major categories - SLAMS (State and Local Air Monitoring Station) and SPM (Special Purpose Monitoring). SLAMS consist of a network of monitoring stations, the size and distribution of which is largely determined by the monitoring requirements for NAAQS comparison. SLAMS in the AQMD's network can be further classified as NCore (National Core monitoring network) or STN (Speciation Trends Network).

The AQMD's monitoring stations are sited in accordance with 40 CFR 58 and utilize equipment designated as reference or equivalent methods.¹ In addition, the network is reviewed annually² to ensure it meets the monitoring objectives defined in 40 CFR 58, Appendix D. Ambient air monitoring data are collected, quality assured,³ and recorded in AQS. Appendix A of this document provides a detailed summary of the ambient air monitoring data for 2021. All data summarized in Appendix A has been provided by reports retrieved from AQS. The data provided by AQS reports were certified on April 26, 2022. Figure 2 displays the ambient air monitoring sites operated between 2012 and 2021. For specific details regarding the ambient air monitoring network, refer to the AQMD's "2021 Ambient Air Monitoring Network Plan" and "2020 Ambient Air Monitoring Network Assessment".

¹ 40 CFR 53.

² 40 CFR 58.10.

³ 40 CFR 58.

Figure 2
 Washoe County Ambient Air Monitoring Sites (2012-2021)

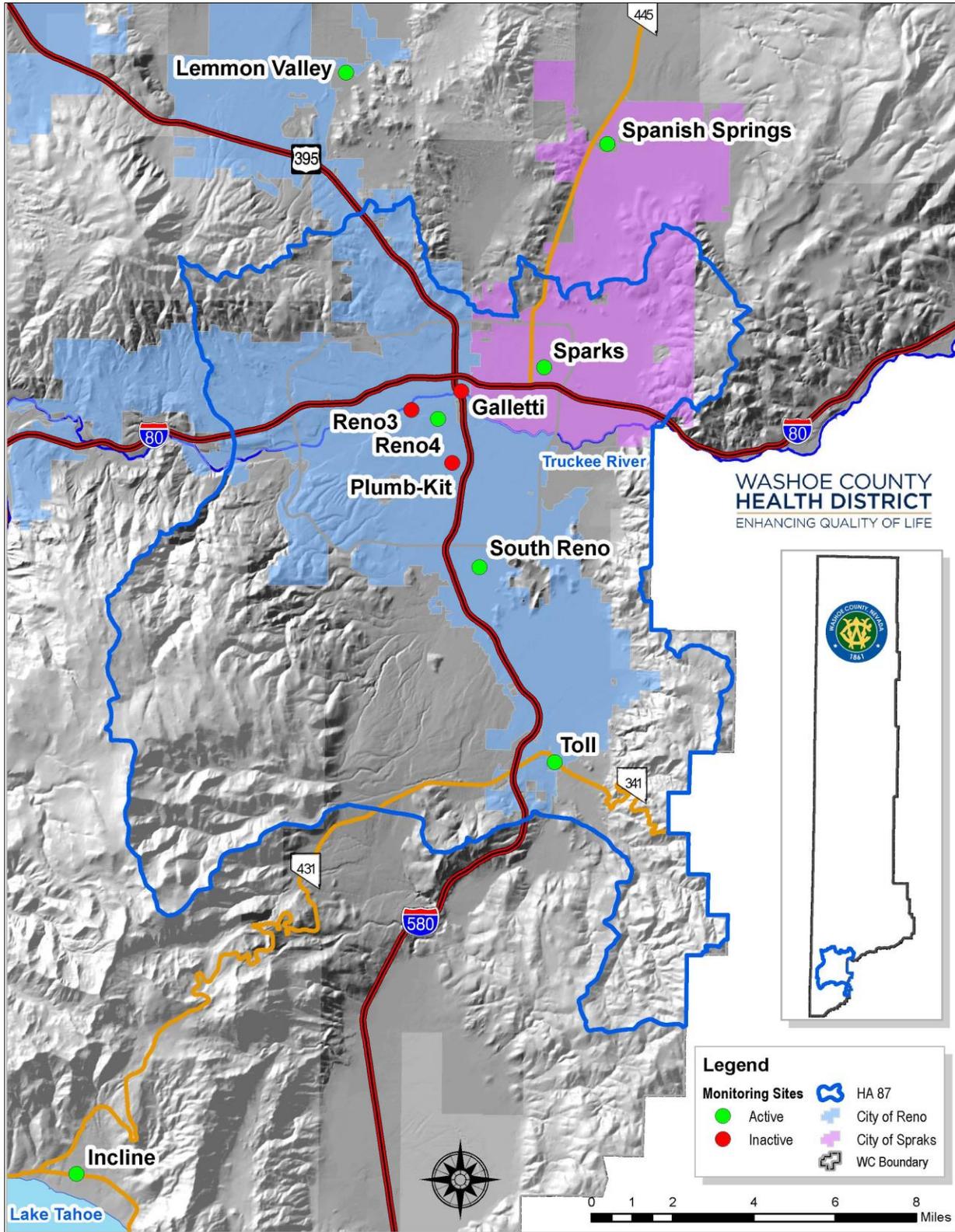


Table 3 Monitoring Stations in Operation and Pollutants Monitored in 2021

Network Type Site	O ₃	CO	Trace CO	Trace NO	NO ₂	NO _x	Trace NOy	Trace SO ₂	PM ₁₀ (manual)	PM ₁₀ (continuous)	PM _{2.5} (manual)	PM _{2.5} (continuous)	PM _{coarse} (manual)	PM _{coarse} (continuous)	PM _{2.5} Speciation	Meteorology
SLAMS																
Incline	✓															
Lemmon Valley	✓															
South Reno	✓															✓
Spanish Springs	✓									✓		✓		✓		✓
Sparks	✓	✓								✓		✓		✓		
Toll	✓									✓		✓		✓		✓
NCore																
Reno4	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Speciation Trends																
Reno4															✓	

Monitoring Stations in Operation and Pollutants Monitored Prior to 2021

Ambient air monitoring data have been collected in Washoe County since the 1963. A complete historical list of monitoring stations and pollutants monitored is included in Appendix B.

A Review of 2021

January continued the green burn code streak. The streak came to an end on February 7 with the first yellow, which was last recorded on January 3, 2018. That is a record, 398 consecutive green burn codes. The 2020-21 burn code season ended with 119 green burn codes. After a warm and dry January, weather returned in February, but it was not enough to get back to average for the Sierra snowpack. The highest 24-hour average for $PM_{2.5}$ during the burn code season was $20.7 \mu\text{g}/\text{m}^3$ on January 24 at Sparks.

An unusual, springtime ozone event was observed on April 29 with high ozone concentrations across Northern Nevada including the highest springtime 8-hour average for ozone of 0.071 ppm.

The first wildfire to impact Washoe County was the Petrilla Fire on June 16. The Beckwourth Complex started at the end of June and affected our air quality through July. August had numerous other fires including the Dixie and Caldor Fires, which resulted in the worst air quality Reno/Sparks has ever monitored. Eight of the top 10 worst days in Washoe County for $PM_{2.5}$ occurred between July 25 and August 25 due to these two wildfires. The highest 24-hour averages for $PM_{2.5}$ and PM_{10} during the summer was 241.6 and $319 \mu\text{g}/\text{m}^3$, respectively, on August 23 at Toll. These were the highest $PM_{2.5}$ and PM_{10} 24-hour averages ever monitored. Elevated ozone caused by wildfire smoke occurred throughout this period. The highest 8-hour average of 0.092 ppm happened on August 23 at Spanish Springs. This was the highest 8-hour average since the 2008 wildfire season.

Figure 4
AirNow Fire and Smoke Map
on August 31

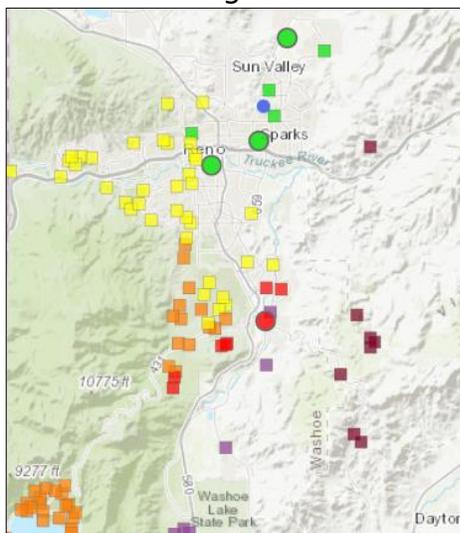


Figure 3
Satellite Image of Caldor and Dixie Fires
on August 30



A yellow burn code was issued on November 14. This was the first time in 7 years that a yellow was issued in November. Active weather returned in December resulting in green burn codes until the end of the year. By the end of the year, the average annual temperature was the 6th warmest on record for Reno.

Table 4 summarizes NAAQS exceedances in 2021 by pollutant, averaging period, and dates.

Table 4
2021 NAAQS Exceedances Summary

Pollutant	Averaging Period	Exceedance Dates
O ₃	8-hour	Apr: 29 Jun: 16 Jul: 15-17, 24-26 Aug: 6-8, 11-12, 14, 16, 20-26 Sep: 2, 25-26
PM _{2.5}	24-hour	Jul: 23-26 Aug: 6-12, 14, 15-17, 20-26, 27, 29, 31 Sep: 1, 4
PM ₁₀	24-hour	Jul: 24-26, Aug: 6-7, 16-17, 20-26
CO	1-hour	None
	8-hour	None
NO ₂	1-hour	None
SO ₂	1-hour	None
	3-hour	None
Pb	Rolling 3-month	Not required to monitor based on population size and lack of significant Pb sources.

2021 Air Quality Index Summaries

The Air Quality Index (AQI) is an index for reporting daily air quality that has been established by the EPA. It informs the public how clean or polluted the air is, and what associated health effects might be a concern. The AQI is reported to the public via EnviroFlash, social media (Facebook and Twitter), AirNow.gov, and the AQMD's air quality hotline ((775) 785-4110). The email, social media, and hotline are updated daily, and more often during air pollution episodes. The next six figures are pollutant-specific and summarize Washoe County's air quality for the previous year by pollutant, month, and AQI categories. The highest NAAQS average pollutant throughout our network is the AQI for that day. Months with less AQIs than days for NO₂ and SO₂ are due to not meeting data completeness requirements for the AQI averaging time due to invalid data.

Figure 5
Monthly AQI Summary for All Pollutants (2021)

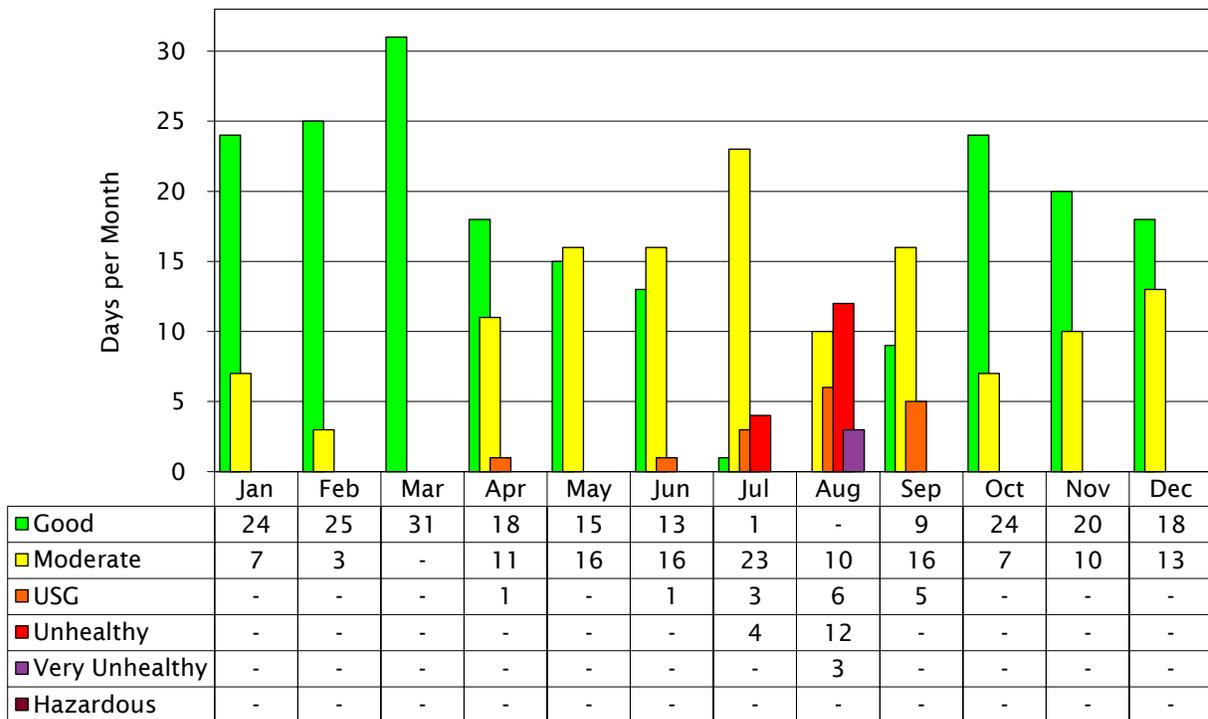


Figure 6
Monthly AQI Summary of O₃ (2021)

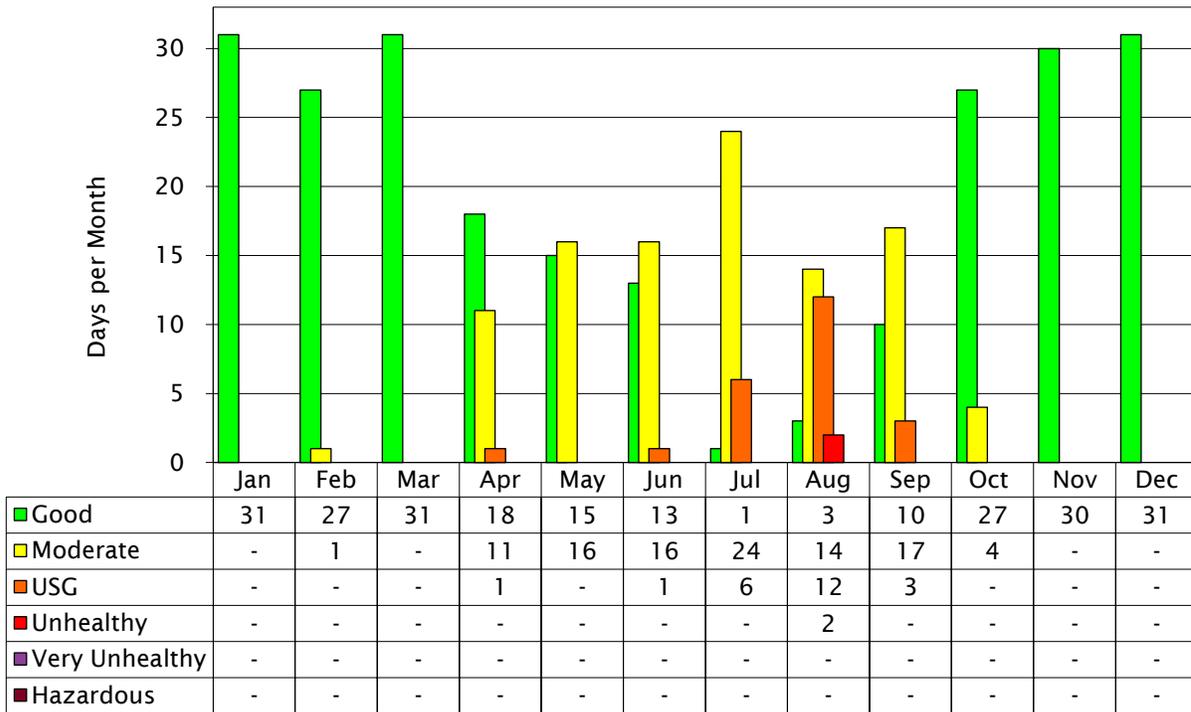


Figure 7
Monthly AQI Summary of PM_{2.5} (2021)

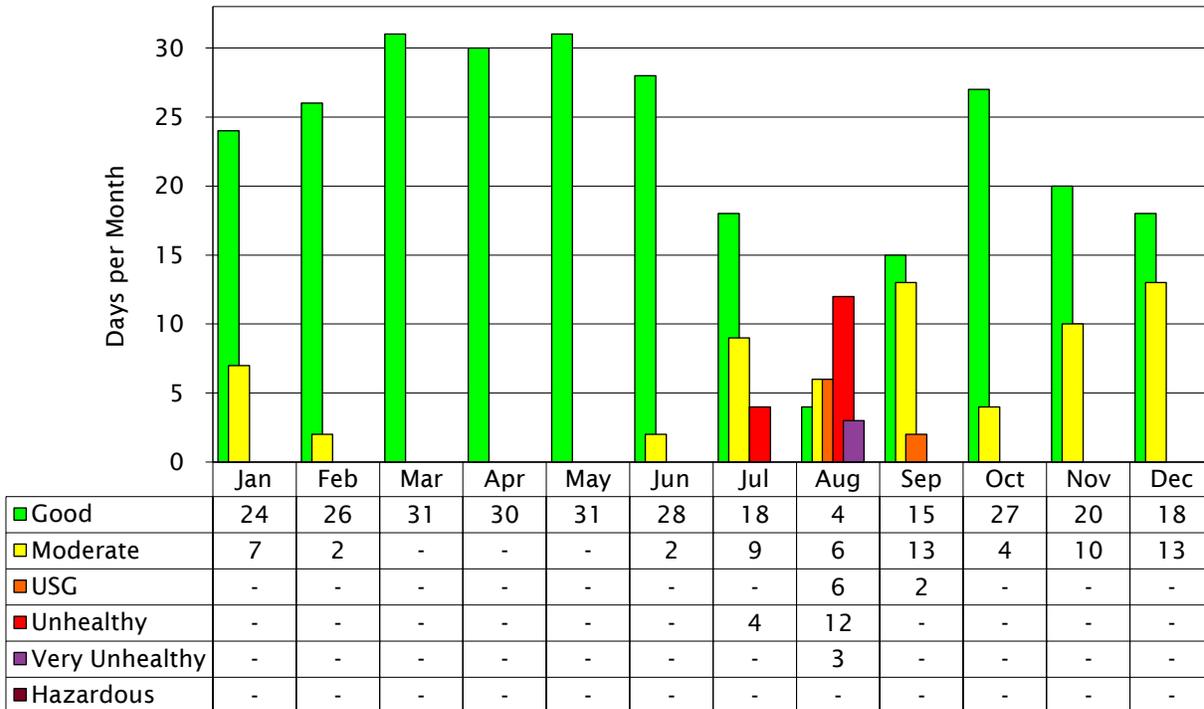


Figure 8
Monthly AQI Summary of PM₁₀ (2021)

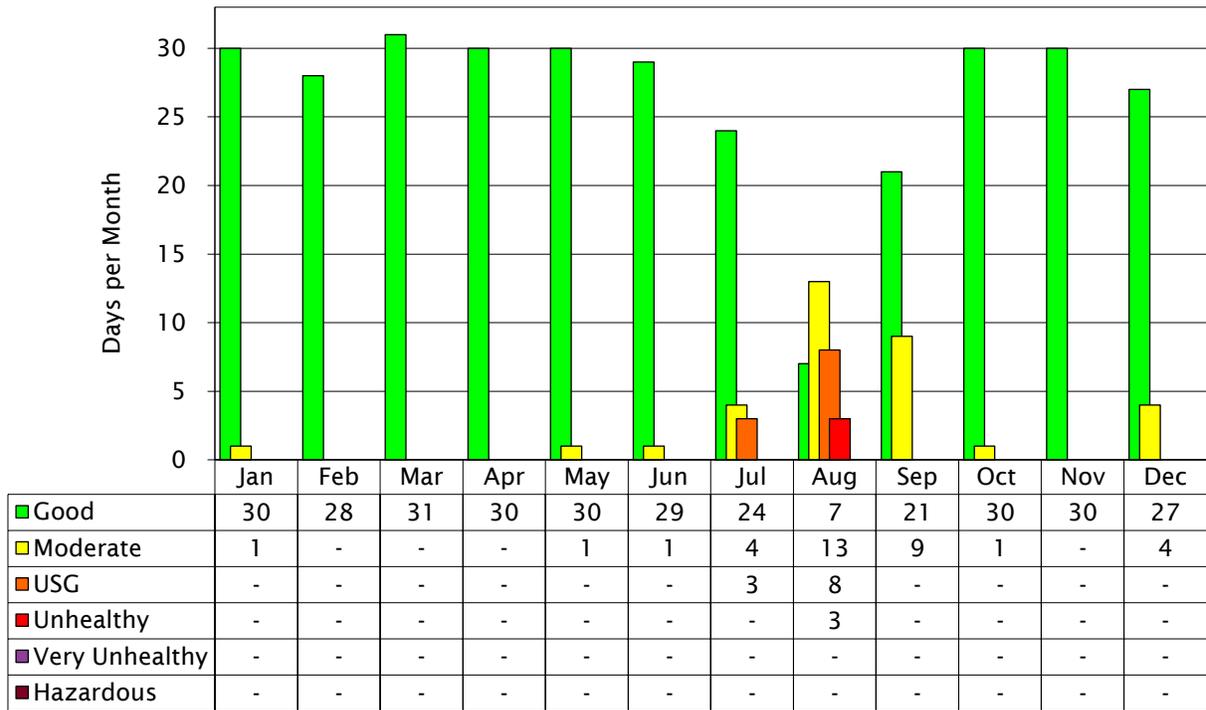


Figure 9
Monthly AQI Summary of CO (2021)

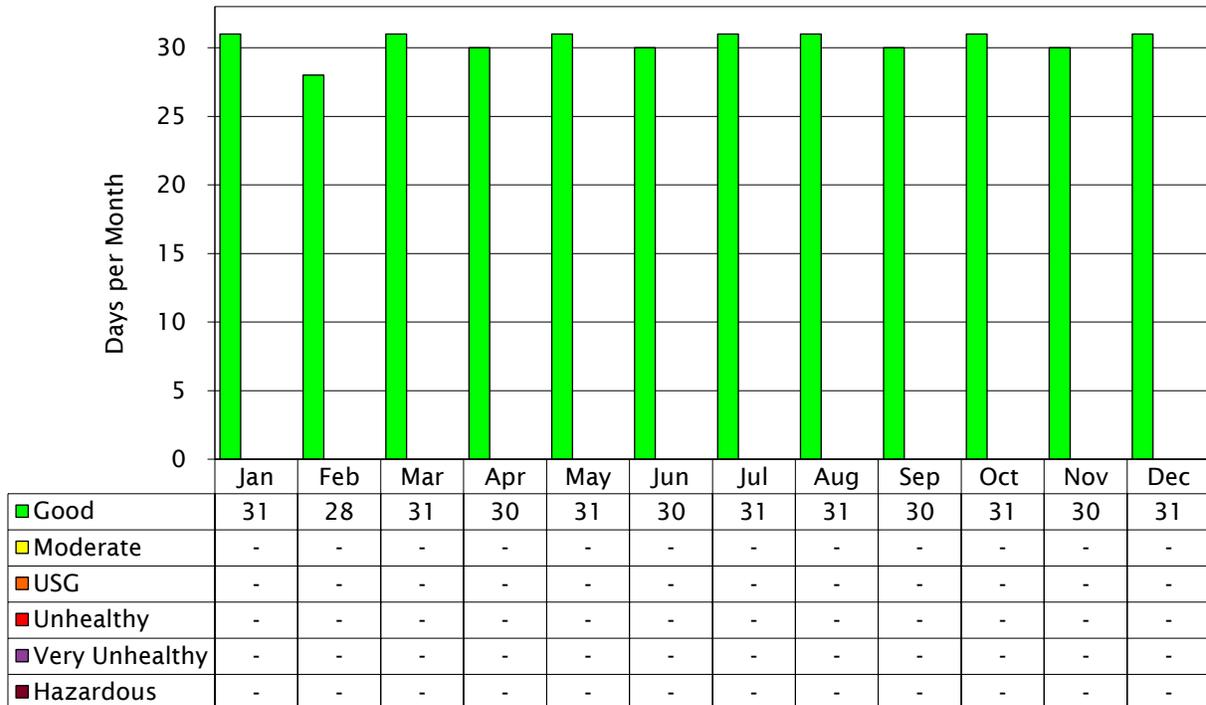


Figure 10
Monthly AQI Summary of NO₂ (2021)

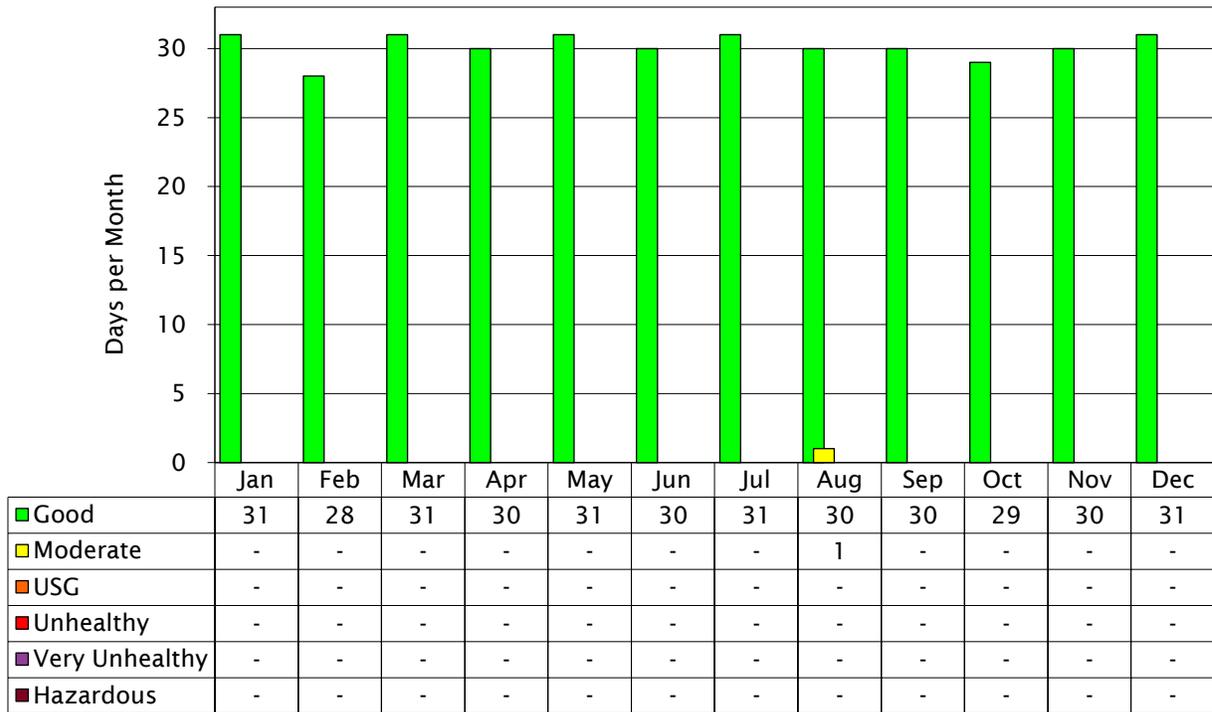
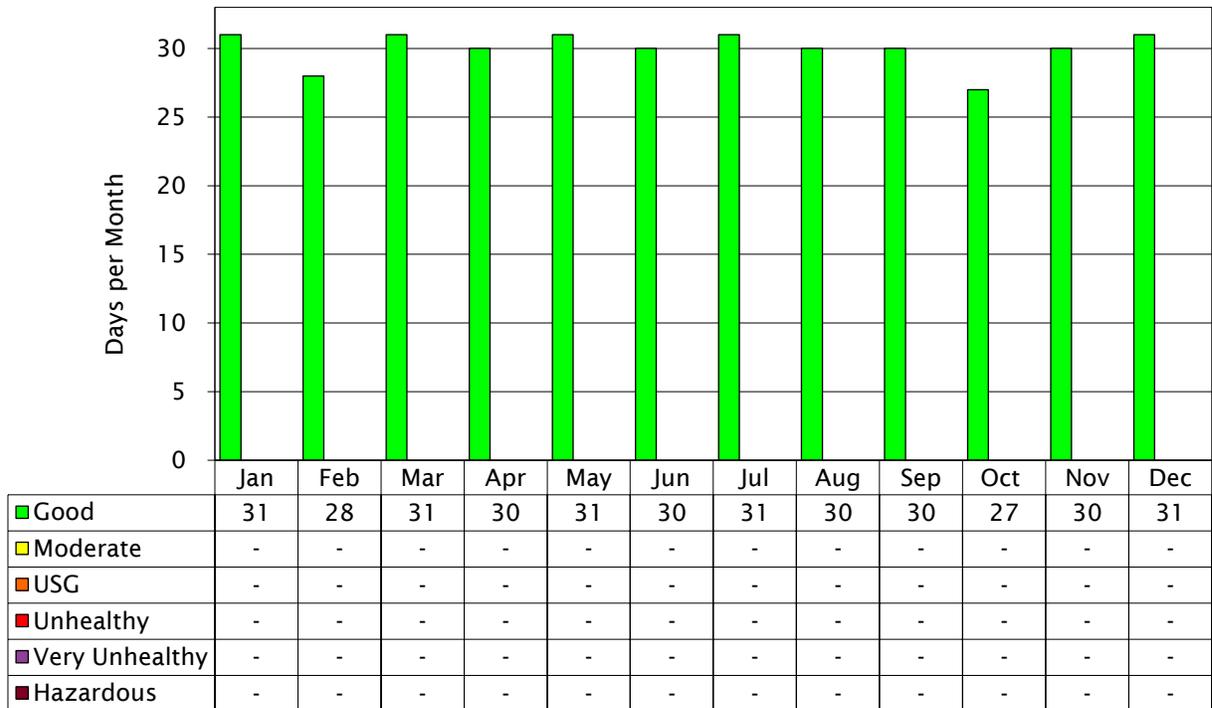


Figure 11
Monthly AQI Summary of SO₂ (2021)

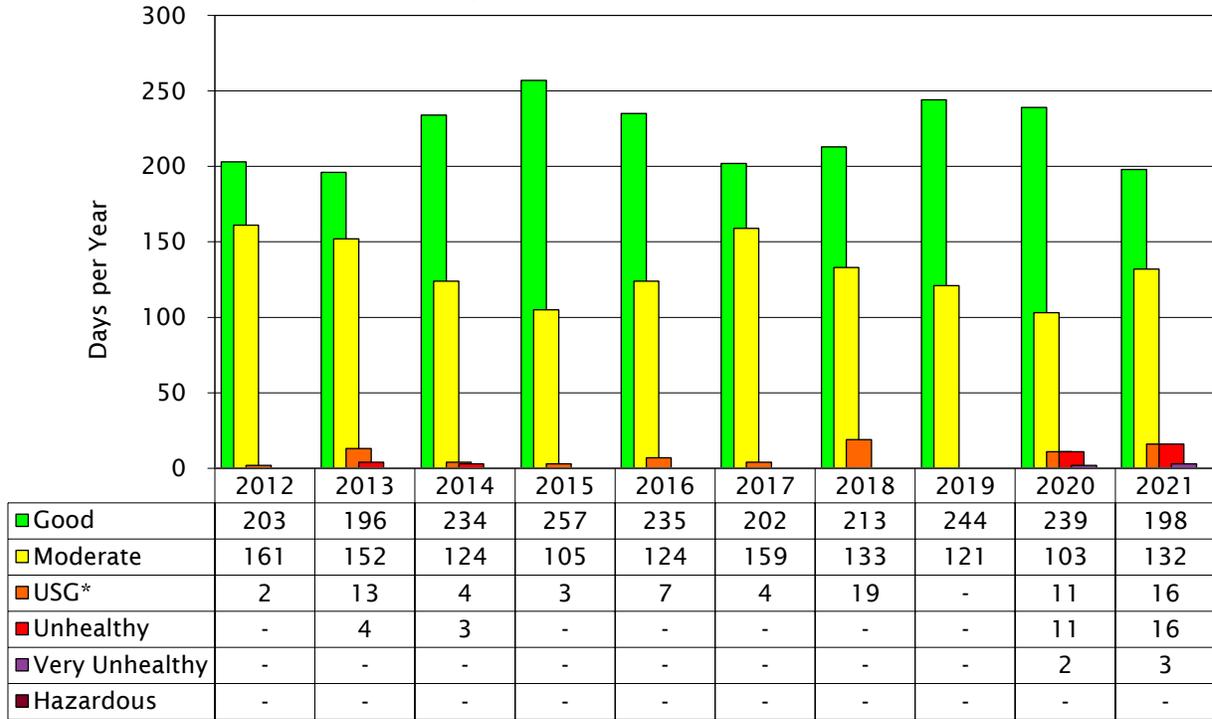


Ten-Year Air Quality Trend

Air Quality Index

Figure 12 summarizes the ten-year trend in AQI between 2012 and 2021. A NAAQS revision in 2015 resulted in changes to AQI category ranges and the number of days per year within those ranges.

Figure 12
AQI Trend (2012-2021)



* Unhealthy for Sensitive Groups

Notes

2015: 8-hour O₃ NAAQS strengthened from 0.075 to 0.070 ppm.

Burn Code Season

The Burn Code program has been in place since 1987. It begins November 1 and ends on the last day of February. During this wintertime period, the burn code curtails PM₁₀, PM_{2.5}, and CO emissions from residential and commercial solid fuel burning devices such as wood stoves, pellet stoves, fireplaces, and residential open burning.

Green: Issued when PM_{2.5} levels are low and are not expected to be approaching the 24-hour PM_{2.5} NAAQS. It is legal for residents and businesses to use their solid fuel burning device.

Yellow: Issued when PM_{2.5} levels are approaching the 24-hour PM_{2.5} NAAQS. It is legal for residents and businesses to use their solid fuel burning device, but it is encouraged to reduce or stop burning.

Red: Issued when PM_{2.5} levels are above or expected to be above the PM_{2.5} NAAQS. Under an Emergency Episode Stage 1, it is illegal for residents to use their solid fuel burning device, except residents that have a sole source exemption, and for residents to conduct open burning. Under an Emergency Episode Stage 2, it is illegal for the previously mention activities and for businesses to burn solid fuel.

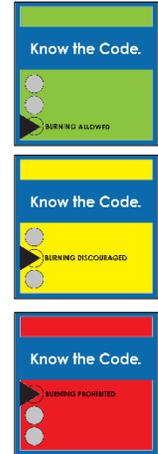
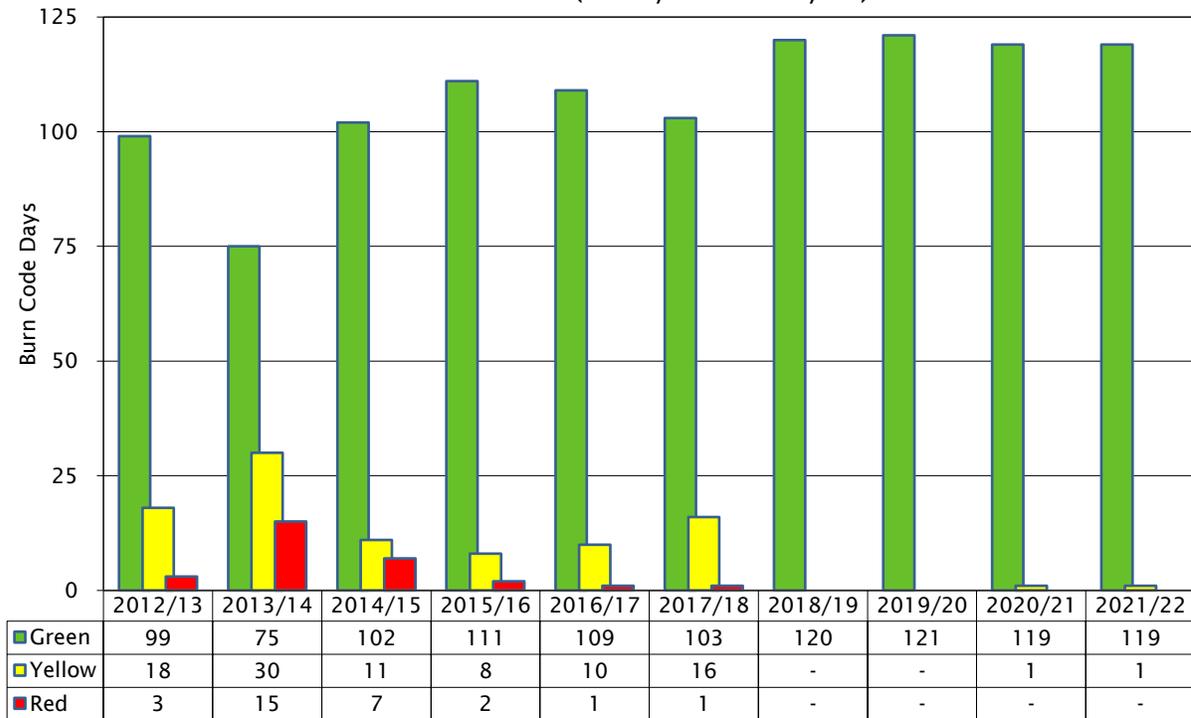


Figure 13
Burn Code Seasons (2012/13 - 2021/22)



Design Values

The following section contains data that the AQMD has flagged as “exceptional” due to events such as wildfires and high winds. The design values will include these “exceptional” data until EPA determines concurrence with AQMD’s exceptional events demonstrations. Ozone exceptional events for the Reno3 monitoring station in 2015 and 2016 were concurred by EPA Region 9 on May 30, 2017.⁴

⁴ “Exceptional Events Document Ozone - Washoe, NV.” (www.epa.gov/air-quality-analysis/exceptional-events-documents-ozone-washoe-nv), EPA.gov. United States Environmental Protection Agency, 9 June 2017. Web. 03 May 2022

O₃ (8-hour) Design Values

NAAQS Level: 0.070 ppm

Design Value (2019-21): 0.072 ppm (LEM)

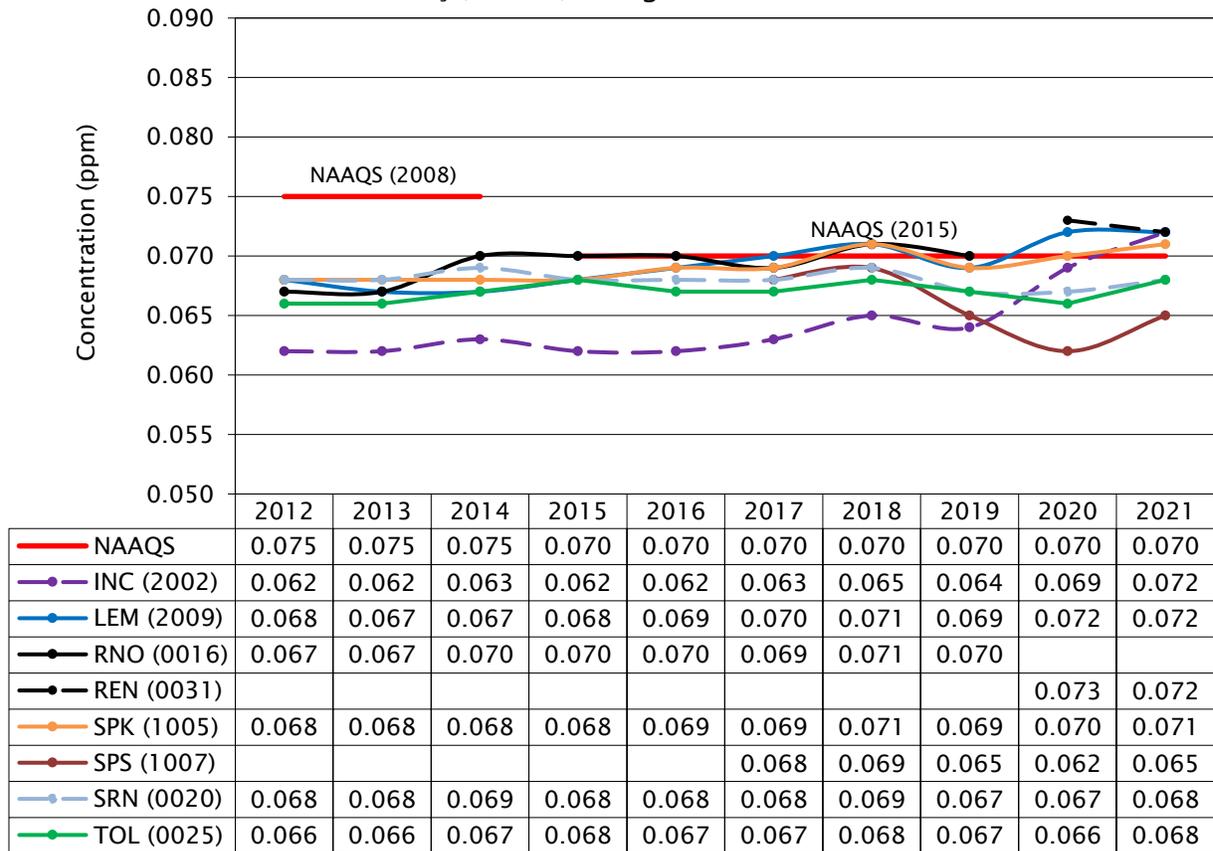
Current Designation: Attainment/Unclassifiable (Entire County)

2021 Exceedances: 25

2021 First High: 0.092 ppm (Aug 23 - SPS)

2021 Fourth High: 0.080 ppm (Aug 22 - SPK)

Figure 14
O₃ (8-hour) Design Values



PM_{2.5} (24-hour) Design Values

NAAQS Level: 35 µg/m³

Design Value (2019-21): 61 µg/m³ (SPK)

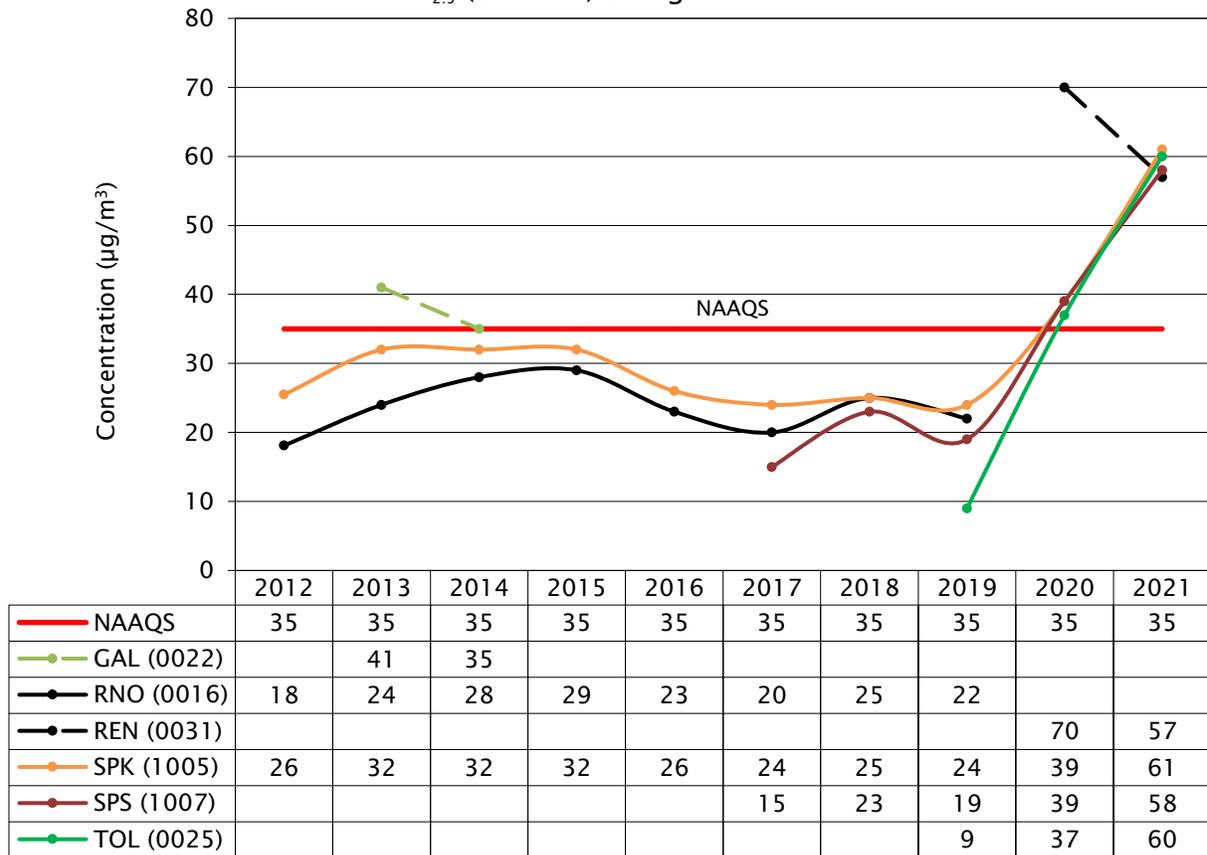
Current Designation: Attainment/Unclassifiable (Entire County)

2021 Exceedances: 27

2021 First High: 241.6 µg/m³ (Aug 23 - TOL)

2021 98th Percentile: 104.7 µg/m³ (Aug 06 - TOL)

Figure 15
PM_{2.5} (24-hour) Design Values



PM_{2.5} (Annual) Design Values

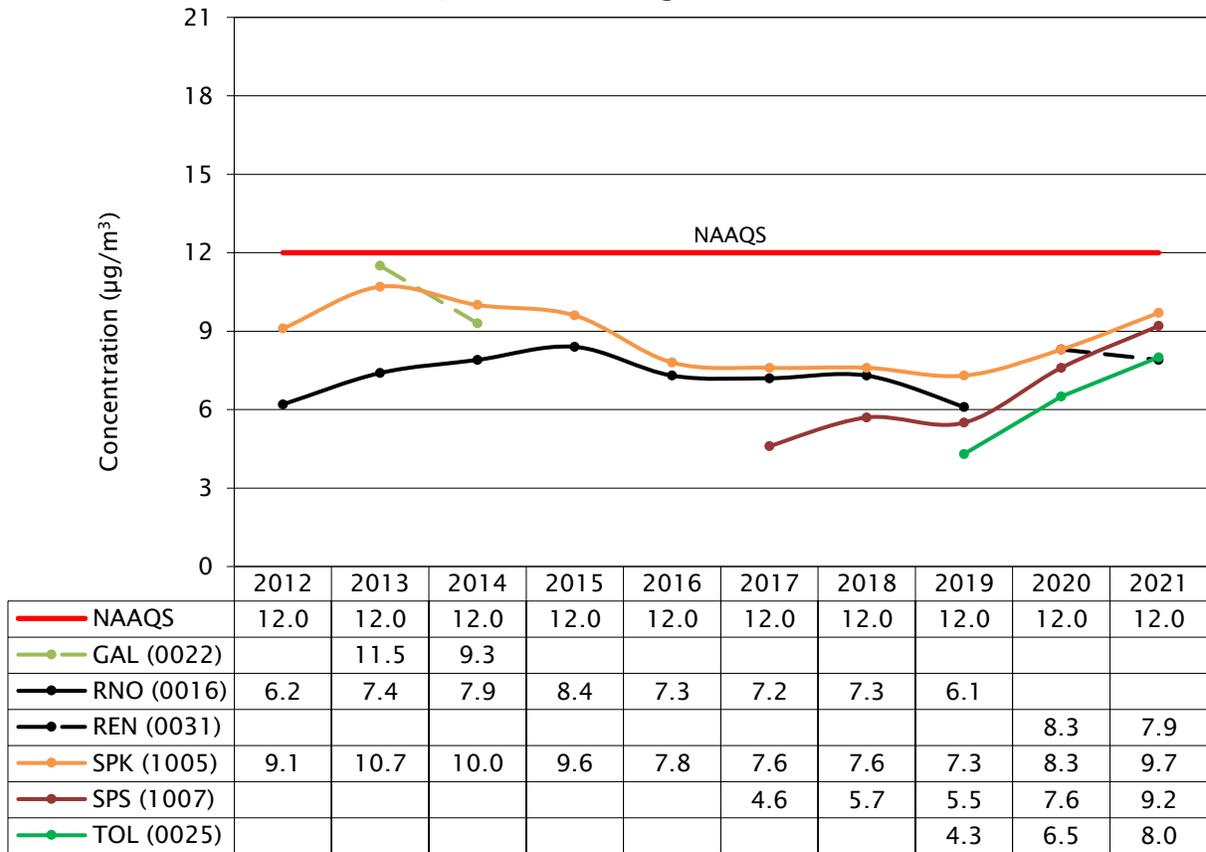
NAAQS Level: 12.0 µg/m³

Design Value (2019-21): 9.7 µg/m³ (SPK)

Current Designation: Attainment/Unclassifiable (Entire County)

2021 Annual Weighted Mean: 12.4µg/m³ (REN)

Figure 16
PM_{2.5} (Annual) Design Values



PM₁₀ (24-hour) First Highs

NAAQS Level: 150 µg/m³

Design Value (2019-21): 4.0 expected exceedances (TOL)

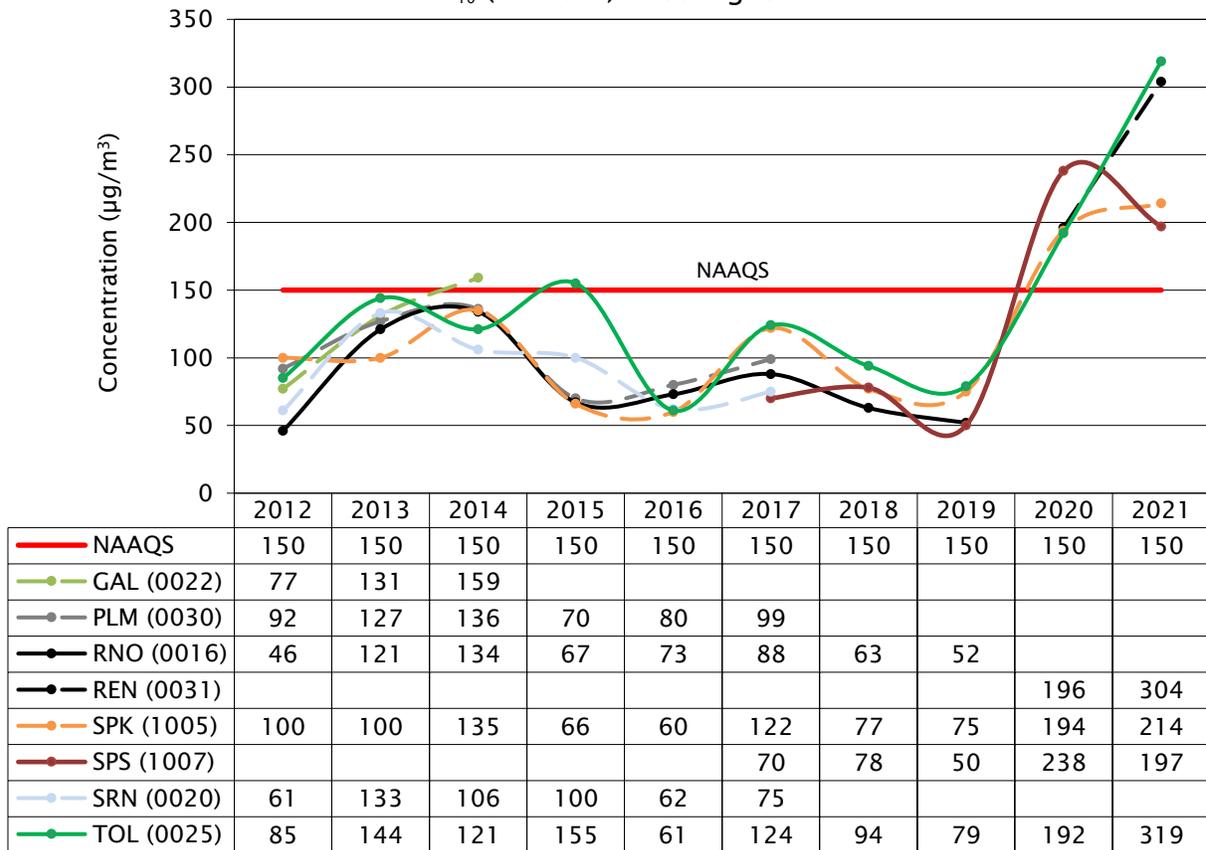
Current Designation: Attainment (HA 87); Attainment/Unclassifiable (Remainder of County)

2021 Exceedances: 14

2021 Expected Exceedances: 4.0

2021 First High: 319 µg/m³ (Aug 23 - TOL)

Figure 17
PM₁₀ (24-hour) First Highs



CO (8-hour) Design Values

NAAQS Level: 9 ppm

Design Value (2020-21): 2.1 ppm (REN)

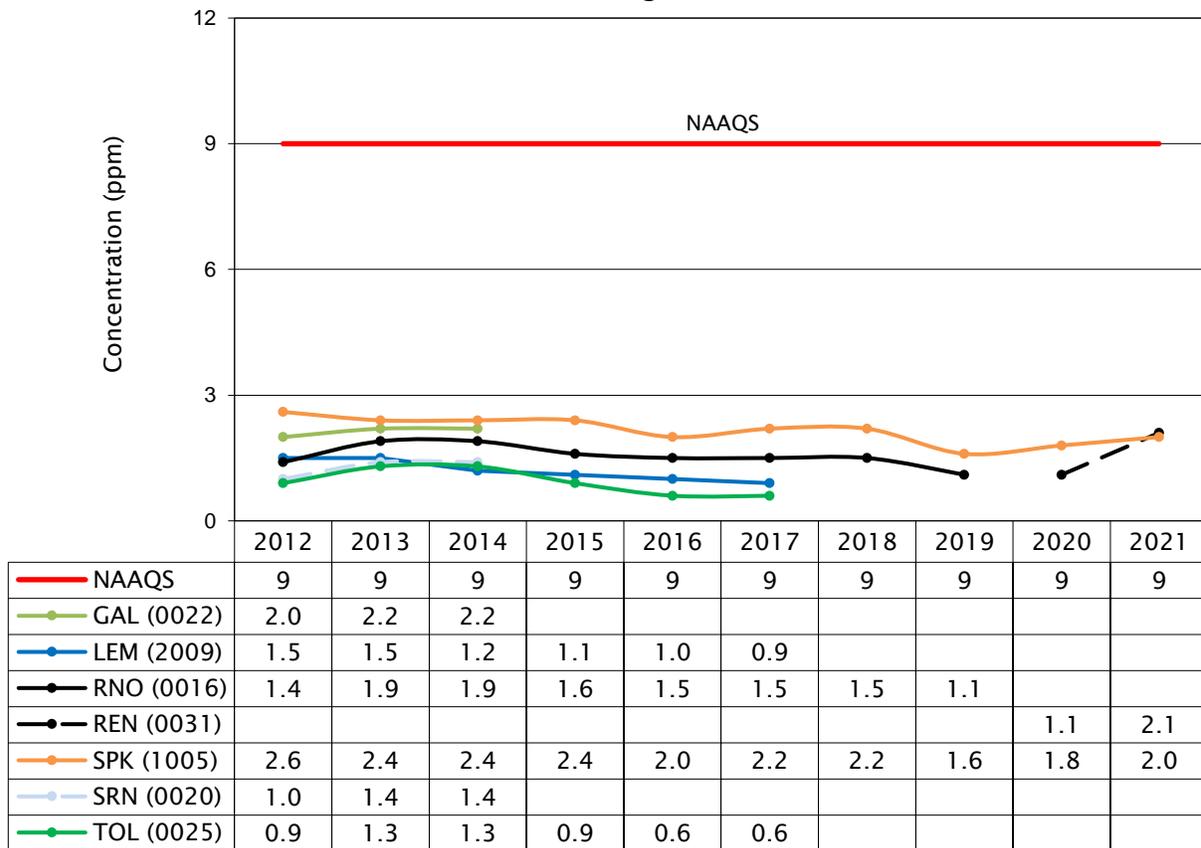
Current Designation: Attainment (HA 87); Attainment/Unclassifiable (Remainder of County)

2021 Exceedances: 0

2021 First High: 2.1 ppm (Aug 21 - REN)

2021 Second High: 2.1 ppm (Aug 22 - REN)

Figure 18
CO (8-hour) Design Values



CO (1-hour) Design Values

NAAQS Level: 35 ppm

Design Value (2020-21): 2.4 ppm (REN)

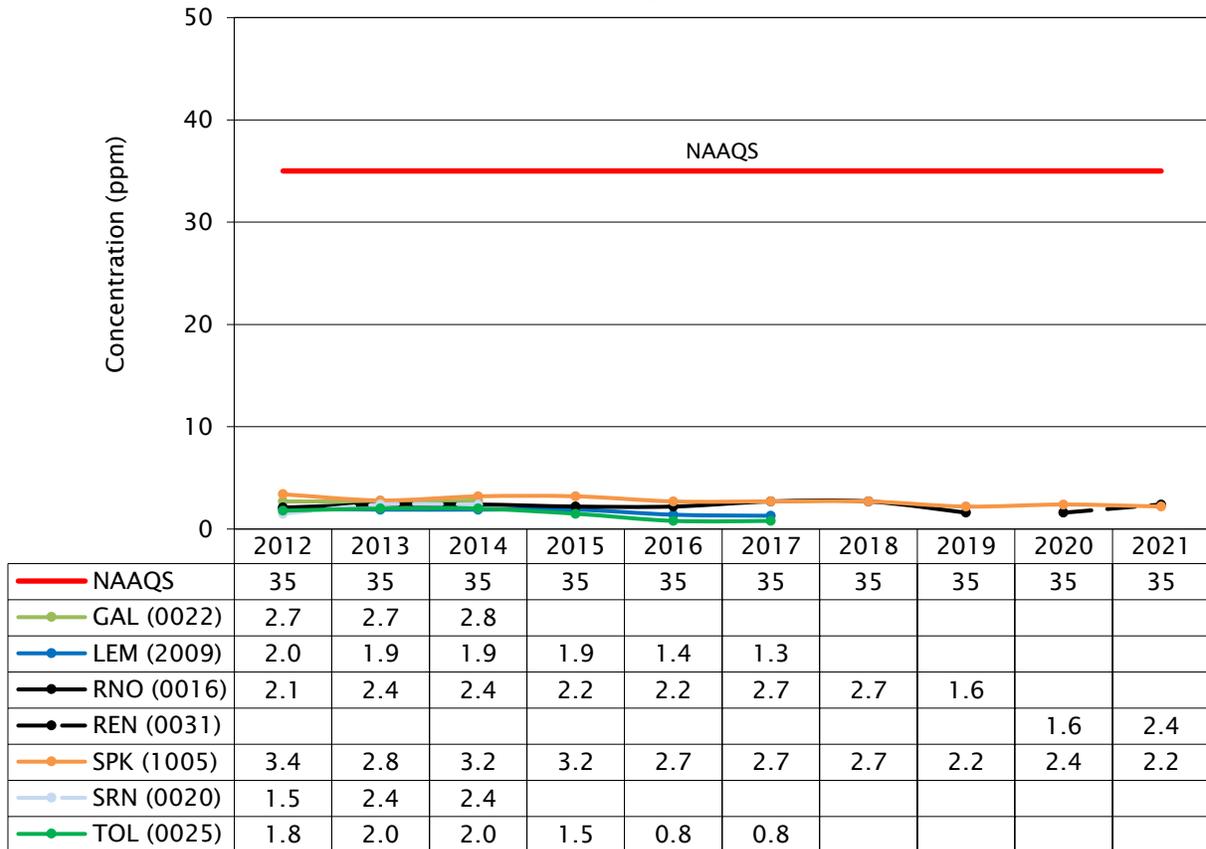
Current Designation: Attainment/Unclassifiable (Entire County)

2021 Exceedances: 0

2021 First High: 2.4 ppm (Aug 21 - REN)

2021 Second High: 2.4 ppm (Aug 22 - REN)

Figure 19
CO (1-hour) Design Values



NO₂ (1-hour) Design Values

NAAQS Level: 100 ppb

Design Value (2019-21): 47 ppb (REN)

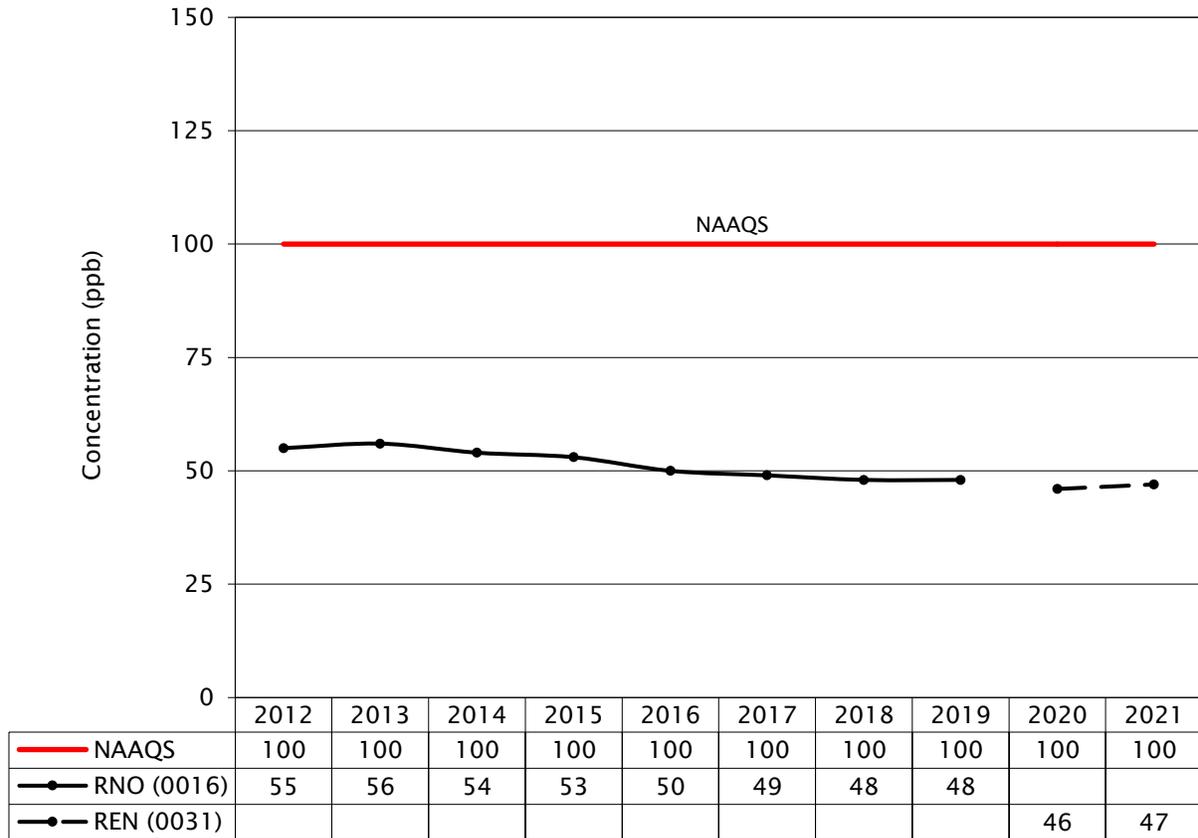
Current Designation: Attainment/Unclassifiable (Entire County)

2021 Exceedances: 0

2021 First High: 54.6 ppb (Aug 31 - REN)

2021 98th Percentile: 47.1 ppb (Jan 06 - REN)

Figure 20
NO₂ (1-hour) Design Values



NO₂ (Annual) Design Values

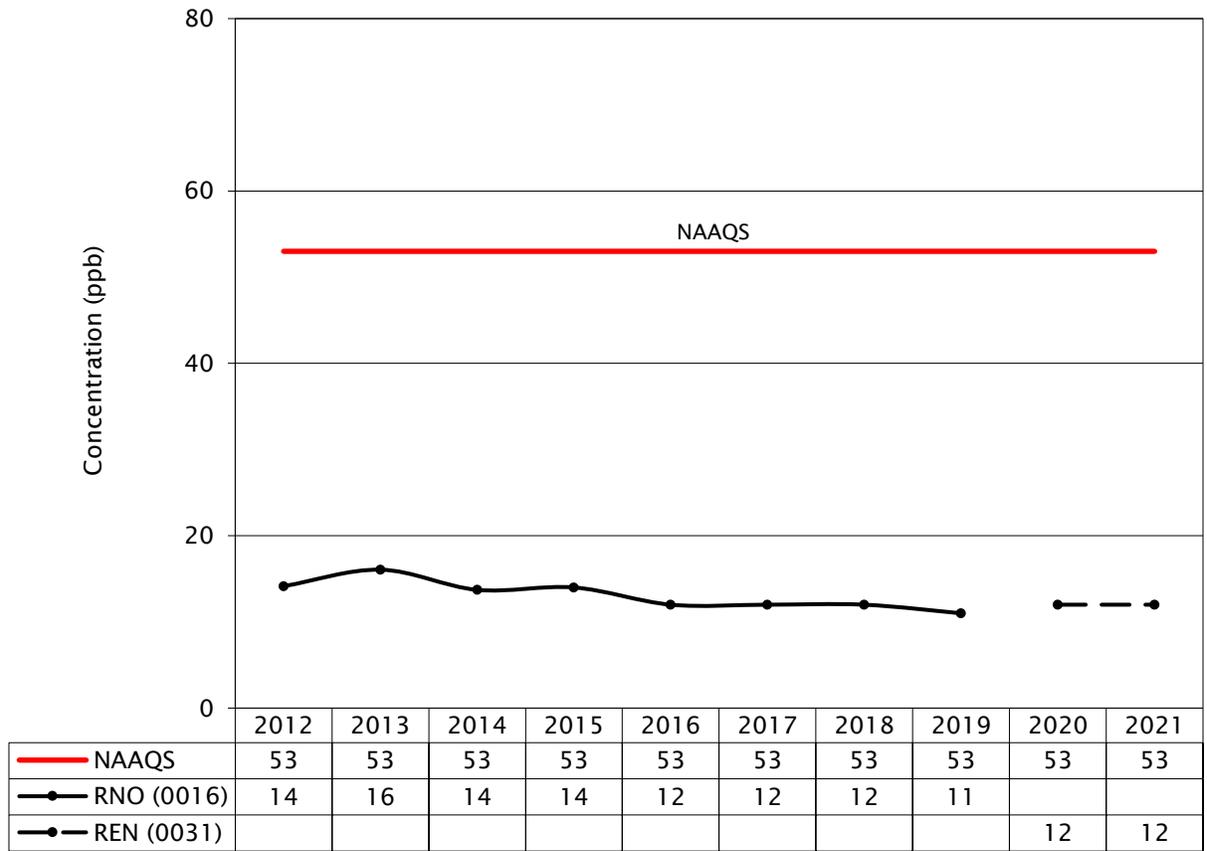
NAAQS Level: 53 ppb

Design Value (2021): 12 ppb (REN)

Current Designation: Attainment/Unclassifiable (Entire County)

2021 Annual Mean: 11.7 ppb (REN)

Figure 21
NO₂ (Annual) Design Values



SO₂ (1-hour) Design Values

NAAQS Level: 75 ppb

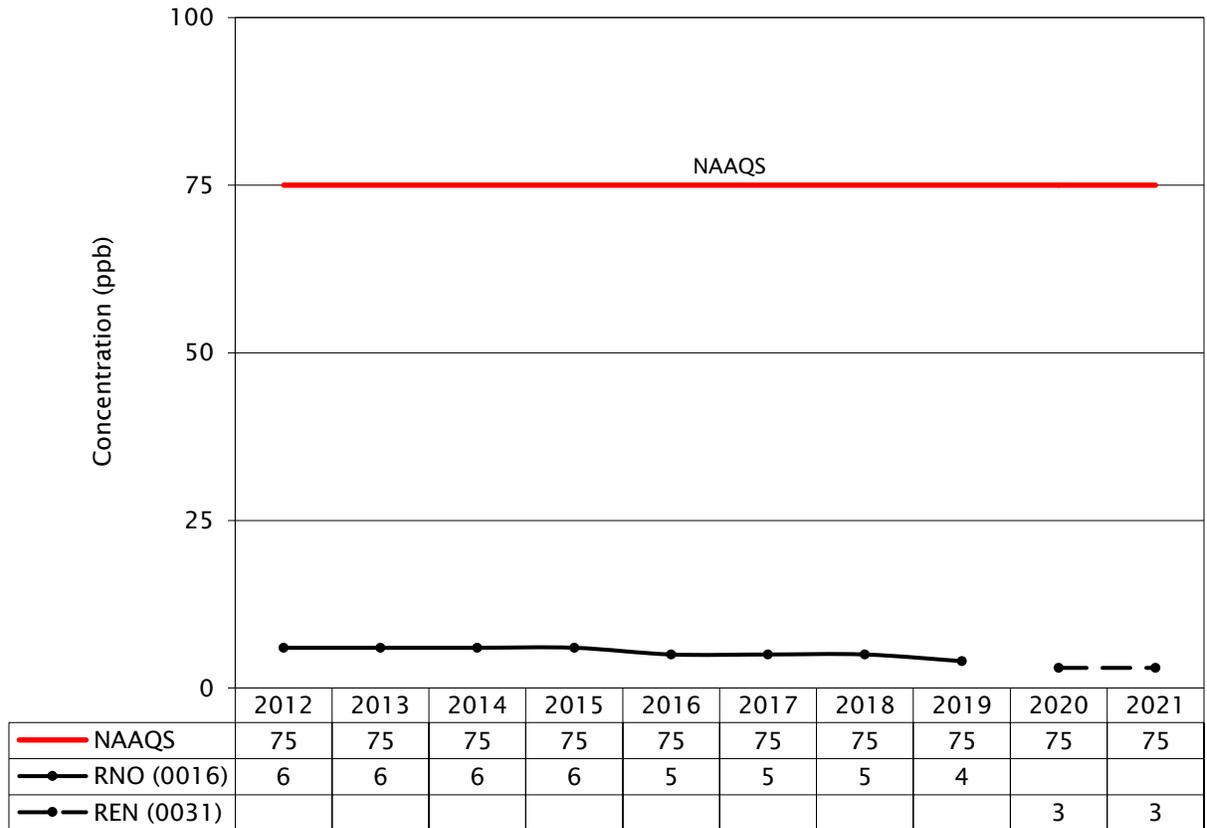
Design Value (2019-21): 3 ppb (REN)

Current Designations: Attainment/Unclassifiable (Entire County)

2021 First High: 3.6 ppb (Jan 06 - REN)

2021 99th Percentile: 3.1 ppb (Jan 21 - REN)

Figure 22
SO₂ (1-hour) Design Values



Appendix A

Detailed Summary of Ambient Air Monitoring Data

Exceedances highlighted in Yellow

Violations highlighted in Red

NAAQS Exceedances (2019 - 2021)

Pollutant	Averaging Period	Exceedance Dates		
		2019	2020	2021
O ₃	8-hour	None	Aug: 20-25, 30 Sep: 14-17	Apr: 29 Jun: 16 Jul: 15-17, 24-26 Aug: 6-8, 11-12, 14, 16, 20-26 Sep: 2, 25-26
PM _{2.5}	24-hour	None	Aug: 16, 19-23, 25, 27-30 Sep: 3, 7, 11-17, 30 Oct: 1	Jul: 23-26 Aug: 6-12, 14, 15-17, 20-26, 27, 29, 31 Sep: 1, 4
PM ₁₀	24-hour	None	Sep: 8, 11-13, 15-16	Jul: 24-26, Aug: 6-7, 16-17, 20-26
CO	1-hour	None	None	None
CO	8-hour	None	None	None
NO ₂	1-hour	None	None	None
SO ₂	1-hour	None	None	None
Pb	Rolling 3-month	n/a - Pb was not monitored		

Ozone (O₃)

8-Hour Ozone Averages (ppm) (2021)

Rank	INC (2002)		LEM (2009)		REN (0031)		SRN (0020)		SPK (1005)		SPS (1007)		TOL (0025)	
	Value	Date												
1	0.081	08/22	0.091	08/23	0.086	08/23	0.086	08/23	0.088	08/23	0.092	08/23	0.081	08/24
2	0.079	08/08	0.083	08/07	0.083	08/07	0.082	08/07	0.086	08/07	0.085	08/07	0.080	08/21
3	0.079	08/21	0.079	07/25	0.079	07/24	0.081	08/24	0.080	07/25	0.079	08/08	0.079	08/22
4	0.078	08/07	0.077	08/22	0.077	07/25	0.079	07/24	0.080	08/22	0.078	07/25	0.078	08/23
5	0.078	08/23	0.075	07/16	0.077	08/22	0.079	08/08	0.077	08/08	0.078	08/24	0.077	08/08
6	0.078	08/24	0.074	07/15	0.076	07/26	0.079	08/22	0.077	08/24	0.077	08/22	0.076	07/24
7	0.076	08/25	0.074	07/24	0.076	08/06	0.078	07/26	0.076	07/24	0.074	07/15	0.076	07/25
8	0.074	06/16	0.074	08/20	0.076	08/24	0.076	07/25	0.074	08/26	0.074	07/16	0.076	08/07
9	0.073	09/26	0.074	08/24	0.075	08/08	0.076	08/06	0.073	07/15	0.073	08/20	0.075	08/25
10	0.072	07/16	0.073	08/21	0.073	07/15	0.076	08/21	0.073	07/16	0.072	07/24	0.074	07/15

4th High 8-Hour Ozone Averages (2019-2021) and Design Values (ppm)

Year	INC (2002)		LEM (2009)		RNO (0016)		REN (0031)		SRN (0020)		SPK (1005)		SPS (1007)		TOL (0025)	
	Value	Date														
2019	0.060	06/24	0.061	06/18	0.066	06/18	n/a	n/a	0.060	06/18	0.063	08/04	0.057	05/03	0.061	09/15
2020	0.078	09/17	0.079	09/15	n/a	n/a	0.073	08/23	0.066	08/21	0.072	08/22	0.061	08/18	0.066	08/02
2021	0.078	08/07	0.077	08/22	n/a	n/a	0.077	07/25	0.079	07/24	0.080	08/22	0.078	07/25	0.078	08/23
DV*	0.072		0.072		n/a		0.072		0.068		0.071		0.065		0.068	

* Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years.

24-Hour PM_{2.5} Averages (µg/m³)
(2021)

Rank	REN (0031)		SPK (1005)		SPS (1007)		TOL (0025)	
	Value (%ile)	Date						
1	220.1	08/23	159.2	08/23	141.4	08/21	241.6	08/23
2	165.5	08/24	137.6	08/21	136.5	07/25	210.5	08/24
3	158.9	08/22	122.2	07/26	135.2	08/23	148.6	08/22
4	140.5	08/07	121.9	08/24	132.4	07/26	201.0	08/25
5	135.8	08/21	120.5	08/07	128.5	07/24	139.3	08/21
6	102.9	08/25	102.3	08/22	120.7	08/07	123.6	08/26
7	102.5	07/26	94.6	08/25	92.8	08/24	121.5	08/20
8	89.3(98)	07/25	94.3(98)	07/25	89.0(98)	08/25	104.7(98)	08/06
9	84.9	08/06	91.2	07/24	86.6	08/16	95.6	08/17
10	82.9	08/16	82.2	08/16	83.8	08/20	95.0	07/25

98th Percentiles of 24-Hour PM_{2.5} Averages (2019-2021)
and Design Values (µg/m³)

Year	RNO (0016)	REN (0031)	SPK (1005)	SPS (1007)	TOL (0025)
2019	11.0	n/a	15.8	10.6	9.3
2020	n/a	69.6	71.4	74.7	64.7
2021	n/a	89.3	94.3	89.0	104.7
Design Value*	n/a	57	61	58	60

* 98th percentile, averaged over 3 years.

Annual PM_{2.5} Means (2019-2021)
and Design Values (µg/m³)

Year	RNO (0016)	REN (0031)	SPK (1005)	SPS (1007)	TOL (0025)
2019	3.0	n/a	6.0	5.1	4.3
2020	n/a	8.3	11.1	10.9	8.7
2021	n/a	12.4	11.9	11.4	10.9
Design Value*	n/a	7.9	9.7	9.2	8.0

* Annual mean, averaged over 3 years.

24-Hour PM₁₀ Averages (µg/m³)
(2021)

Rank	REN (0031)		SPK (1005)		SPS (1007)		TOL (0025)	
	Value	Date	Value	Date	Value	Date	Value	Date
1	304	08/23	214	08/23	197	08/16	319	08/23
2	233	08/24	190	08/21	195	08/21	284	08/24
3	210	08/22	174	07/26	187	07/25	261	08/22
4	200	08/21	168	08/24	187	08/23	211	08/25
5	198	08/07	163	08/07	186	07/26	204	08/21
6	171	07/26	138	08/22	173	07/24	176	08/20
7	164	08/25	136	08/25	162	08/07	174	08/26
8	154	08/16	133	07/25	133	08/25	161	08/17
9	152	08/17	127	08/16	131	08/24	156	08/06
10	136	07/25	126	07/24	130	08/20	145	07/26

24-Hour PM₁₀ Highs (µg/m³)
(2019-2021)

Year	RNO (0016)		REN (0031)		SPK (1005)		SPS (1007)		TOL (0025)	
	Value	Date								
2019	52	11/14	n/a	n/a	75	11/13	50	06/02	79	08/26
2020	n/a	n/a	196	09/08	194	09/08	238	09/13	192	09/08
2021	n/a	n/a	304	08/23	214	08/23	197	08/16	319	08/23

PM₁₀ Expected Exceedances (2019-2021)
and Design Values (expected exceedances)

Year	RNO (0016)	REN (0031)	SPK (1005)	SPS (1007)	TOL (0025)
2019	0	n/a	0	0	0
2020	n/a	1	3	5	3
2021	n/a	7	5	7	9
Design Value*	n/a	2.7	2.7	4.0	4.0

* Expected exceedances averaged over three years.

Carbon Monoxide (CO)

8-Hour CO Averages (ppm) (2021)

Rank	REN (0031)		SPK (1005)	
	Value	Date	Value	Date
1	2.1	08/21	2.1	08/21
2	2.1	08/22	2.0	12/05
3	2.1	08/24	1.8	12/04
4	1.8	08/23	1.7	12/03

2nd High 8-Hour Averages (2020-2021) and Design Values (ppm)

Year	REN (0031)	SPK (1005)
2020	1.1	1.8
2021	2.1	2.0
Design Value*	2.1	2.0

* Highest 2nd high 8-hour average in the last 2 years.

1-Hour CO Averages (ppm) (2021)

Rank	REN (0031)		SPK (1005)	
	Value	Date	Value	Date
1	2.4	08/21	2.2	12/01
2	2.4	08/22	2.2	12/01
3	2.4	08/23	2.2	12/01
4	2.4	08/22	2.1	8/21

2nd High 1-Hour Averages (2020-2021) and Design Values (ppm)

Year	REN (0031)	SPK (1005)
2020	1.6	2.4
2021	2.4	2.2
Design Value*	2.4	2.2

* Highest 2nd high 1-hour average in the last 2 years.

Nitrogen Dioxide (NO₂)

1-Hour NO₂ Averages (ppb) (2021)

Rank	REN (0031)	
	Value (%ile)	Date
1	54.6	08/31
2	53.2	08/25
3	52.0	02/08
4	51.6	08/17
5	51.1	12/02
6	50.2	02/08
7	49.3	08/17
8	47.6	01/21
9	47.2	03/04
10	47.1(98)	01/06

98th Percentiles of 1-Hour NO₂ Averages (2019-2021) and Design Value (ppb)

Year	RNO (0016)	REN (0031)
2019	45.6	n/a
2020	n/a	46.4
2021	n/a	47.1
Design Value*	n/a	47

* 98th percentile, averaged over 3 years

NO₂ Annual Mean (2021) and Design Value (ppb)

	REN(0031)
Annual Mean	11.7
Design Value*	12

* Annual Mean of all 1-hr averages.

Sulfur Dioxide (SO₂)

1-Hour SO₂ Averages (ppb) (2021)

Rank	REN (0031)	
	Value (%ile)	Date
1	3.6	01/06
2	3.5	12/03
3	3.1(99)	01/21
4	2.9	02/26
5	2.7	08/17
6	2.6	01/12
7	2.6	12/05
8	2.5	02/24
9	2.5	11/15
10	2.4	02/08

99th Percentiles of 1-Hour SO₂ Averages (2019-2021) and Design Value (ppb)

Year	RNO (0016)	REN (0031)
	Value	Value
2019	3	n/a
2020	n/a	3
2021	n/a	3
Design Value*	n/a	3

* 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years.

Appendix B

Monitoring Stations in Operation from 1963 to 2021

Monitoring Stations in Operation (2012 - 2021)

AQS Site Name (AQS Site ID)	Ozone	PM _{2.5}	PM ₁₀	TSP	HC	CO	NO ₂	SO ₂	Lead
Incline (32-031-2002)	93-21	99-02	99-02			99-02	99-02		
Lemmon Valley (32-031-2009)	87-21		87			87-16			
Reno3 (32-031-0016)	82-19	99-19	88-19	85-87		83-19	84-19	11-19	
Reno4 (32-031-0031)	20-21	20-21	20-21			20-21	20-21	20-21	
Plumb-Kit (32-031-0030)			06-17						
South Reno (32-031-0020)	88-21		11-17			88-14			
Sparks (32-031-1005)	79-21	12-21	88-21	85-87		80-21			
Galletti (32-031-0022)		13-14	88-14			88-14			
Toll (32-031-0025)	02-21	19-21	02-21			02-16			
Spanish Springs (32-031-1007)	17-21	17-21	17-21						

Monitoring Stations in Operation (1963 - 2011)

AQS Site Name (AQS Site ID)	Ozone	PM _{2.5}	PM ₁₀	TSP	HC	CO	NO ₂	SO ₂	Lead
Health - Kirman (32-031-0001)				63-89					
Sparks - Greenbrae ES (32-031-0002)			85-90	68-90					
Reno - Cal-Neva (32-031-0003)				68-89					
Reno - Veterans ES (32-031-0004)				68-69					
Reno - Harrah's (32-031-0005)	76-82					72-81	72-85		
Reno - Jesse Beck ES (32-031-0006)				72-89					
Reno - Airport (32-031-0007)				72-89					
Reno - Fairgrounds (32-031-0008)				72-74					
Reno - Fish & Game (32-031-0009)				74-89					
Reno - Kings Row ES (32-031-0010)				77-89					
Reno - Stead (32-031-0011)				77					
Reno - Huffaker ES (32-031-0014)				80-89					
Reno - Center Street (32-031-0015)						82-85	82-90		
Sparks - Fire (32-031-1001)				68-69					
Verdi - ES (32-031-1002)				68-89					
Sparks - Nugget (32-031-1003)				72-80					
Sparks - TMWRF (32-031-1004)				74-89					
Sparks - Victorian (32-031-1006)			88	80-89					
Incline - Pump (32-031-2001)				72-89					
Wadsworth - Fire (32-031-2003)				73-75					
Empire - School (32-031-2005)				76-77					
Reno - Sun Valley (32-031-2006)			88-05	80-89					