



## Air Quality Monitoring

### Introduction

Shenandoah National Park is one of only 49 Class I air areas managed by the National Park Service under the Clean Air Act. Clean air contributes to the ecological health of the park's flora and fauna, and is critical for visitor health and the preservation of the parks extensive vistas. The air quality program encompasses a wide range of activities that are dedicated to measuring levels of air pollution. In cooperation with the National Park Service Air Resource Division, park staff members have established a sophisticated air quality monitoring station near Big Meadows to measure air quality in Shenandoah National Park. The park's air quality monitoring program has three primary components: visibility, atmospheric deposition, and ozone monitoring. In addition, meteorological monitoring is conducted to aid in interpreting measured air pollution levels.

### Status & Trends

Shenandoah NP has seen improvements in air quality attributed largely to the 1990 amendments to the Clean Air Act. While most of the data still warrant significant concern, most trends are improving.

Visibility is a measure of how far we can see varied scenes in detail and color. Visibility is impaired by particles in the atmosphere. These particles come from both natural and human caused sources (such as dust and power plants) and they scatter and absorb light, creating a haze that obscures scenery. Shenandoah provides an array of views that are often obscured by haze. The haziest days usually occur during the summer month and clearest days in the winter.

The Clean Air Act visibility goal to return visibility to "natural conditions" in Class I areas requires improvement on the 20% of haziest days and no degradation on the 20% cleanest days. The ARD recommends a benchmark for good visibility of <2 dv above natural conditions on average visibility days. The deciview (dv) metric measures visibility changes as perceived by the human eye and is used by the air regulatory community to track visibility progress.

Ammonium sulfate particles are responsible for most of the haze in the Shenandoah region. Ammonium nitrate and organic carbon particles are the next largest contributors to haze.

The current visibility condition at the park warrants significant concern but is showing an improving trend. The haziest days are becoming clearer and the clearest days while slowly improving are gently approaching natural conditions. While conditions are improving they still have a way to go to real natural conditions.

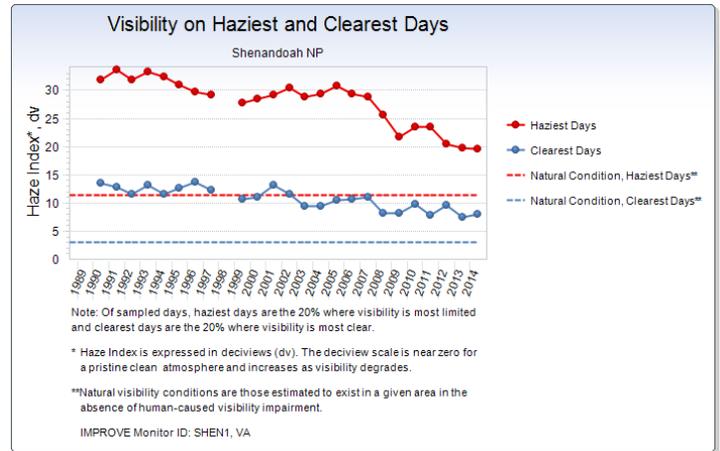


Table 4. Visibility from 1990-2014

Atmospheric deposition includes nitrogen, sulfur, and mercury deposition. Sulfur and nitrogen compounds in air pollution can cause acidification (acid rain) when deposited on ecosystems. This can lead to changes in soil and water chemistry that can alter biodiversity and reproduction. The National Park Service ARD recommends a nitrogen or sulfur wet deposition of less than 1 kg/ha/yr as a condition to protect sensitive ecosystems.

Current nitrogen deposition is estimated at 4.9 kg/ha/yr and is primarily made up of wet nitrates and wet ammonium, with small amounts of dry nitric acid and dry ammonium ion. Wet nitrogen deposition warrants significant concern with an unchanging trend.

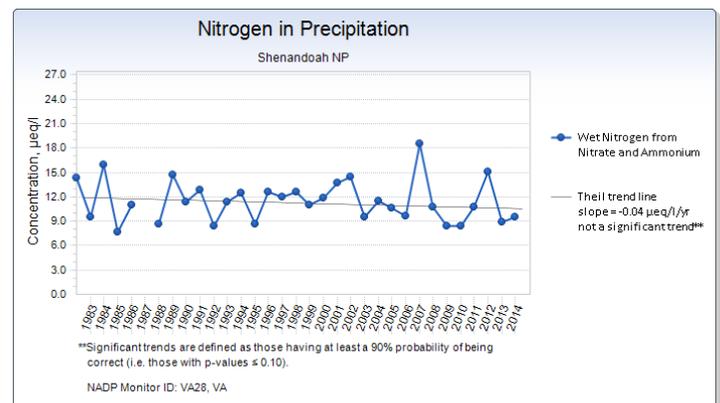


Table 2. Nitrogen Wet Deposition from 1982–2014

Current sulfur deposition is around 3.4 kg/ha/yr, down significantly from earlier in the decade, and is primarily made up of wet sulfate deposition. Wet sulfur deposition warrants significant concern with an improving trend.

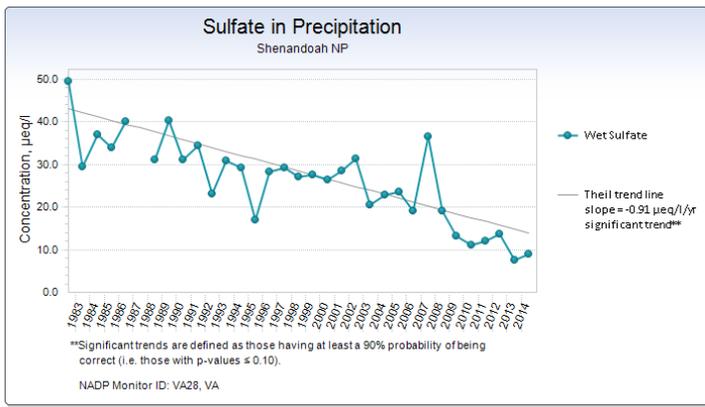


Table 3. Sulfur Wet Deposition from 1982–2014

Mercury is present in all types (wet and dry) of deposition and is in a class of chemicals called persistent bioaccumulative toxins. Mercury is a health concern due to its neurotoxicity. Various landscape factors can influence the uptake of mercury in the ecosystem, for this reason mercury condition is based on estimated wet mercury deposition and predicted levels of methylmercury in surface waters. The 2012–2014 estimated wet mercury deposition is high at the park, ranging from 6.5–10.0 µg/m<sup>2</sup>/yr. The predicted methylmercury concentration in park surface waters is low, estimated at 0.04 ng/L. Wet deposition and predicted methylmercury ratings are combined to determine the warrants moderate concern condition.

Ozone, a colorless gas, can harm both humans and plants at ground level. Health risks from ozone are measured using the 4<sup>th</sup>-highest daily maximum 8-hour ozone concentration in parts per billion (ppb). Vegetation impacts are measured using W126 indices that relate plant response to ozone exposure. Ozone concentrations have shown a slow but steady decline since the late 1990's. Ozone advisories are issued when ozone concentrations exceed the current human health standard of 70 ppb. Only one ozone advisory has been issued in the last four years.

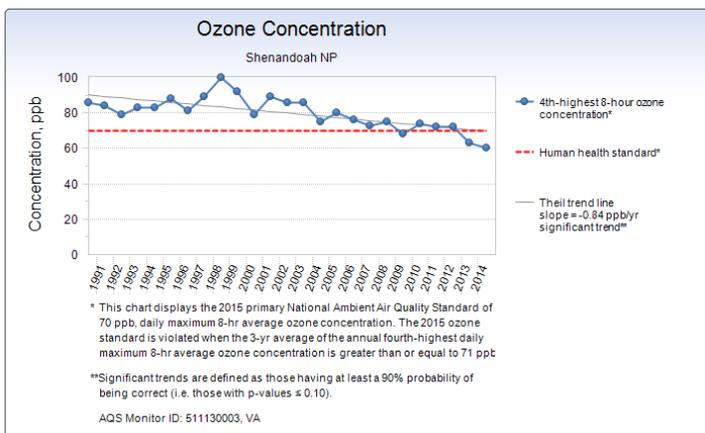


Table 1. Ozone Concentrations from 1990–2014

Shenandoah NP currently meets the National Ambient Air Quality Standards (NAAQS) set by the EPA at 70 ppb. However, the park does not meet the benchmarks set by the National Park Service Air Resource Division (ARD) which has established more stringent benchmarks with a concentration of 65 ppb and a W126 metric of 7 ppm-hrs to “perpetuate the best possible air quality in parks”

(2006 NPS Management Policy, Section 4.7.1). Ozone levels at Shenandoah warrant moderate concern with an improving trend for both human health and vegetation effects.

## Summary

Spectacular views to the East and West overlooking the Shenandoah Valley and Piedmont Plateau were one of the primary reasons for Shenandoah’s creation along with providing for outstanding recreational opportunities. Visitors enjoy the scenic wonders of the park through wildlife viewing, fishing, hiking, camping, and numerous scenic overlooks. Air quality at Shenandoah has been a significant concern over the past four decades and the park and its partners have made tremendous strides in reducing air pollution. Most parameters including ozone, sulfur, and visibility are showing improving trends while nitrogen is neither improving nor declining. Changes in regulations in the Clean Air Act have helped clean up the air. There is still plenty of work that needs to be done but we are headed in the right direction.

Air Quality Summary: Shenandoah NP	
Indicator	Condition/Trend
Ozone – Human; Vegetation Health	↑ ↑
Visibility	↑
Nitrogen Wet Deposition	↔
Sulfur Wet Deposition	↑
Toxics/Mercury Deposition	○

Condition Status		Confidence Assessment	
●	Indicator is in Good Condition	○	High
●	Warrants Moderate Concern	○	Medium
●	Warrants Significant Concern	○	Low

Table 5. Shenandoah National Park Air Quality Conditions and Trends

## More Information

Jalyn Cummings | [Jalyn\\_Cummings@nps.gov](mailto:Jalyn_Cummings@nps.gov) | 540-999-3500 ext. 3497

Liz Garcia | [Liz\\_Garcia@nps.gov](mailto:Liz_Garcia@nps.gov) | 540-999-3500 ext.3499

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