

# Glossary

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**acid-neutralizing capacity (ANC):**

A simple measure of stream water "sensitivity" is ANC or the ability to buffer incoming acids. When acid deposition falls on stream watersheds that are located on bedrock that is resistant to weathering, then we will see a decrease in the ANC in the stream water, along with a decrease in pH.

**acidic deposition:**

Also known as "acid rain" or "acid precipitation," wet and/or dry deposition of acidic materials to water or land surfaces. The pH of rain is considered acid when it is lower than about 5.2 on the pH scale. The chemicals found in acidic deposition include nitrate, sulfate, and ammonium.

**acidic:**

When we refer to stream reaches that have become "acidic," we mean that the ANC is less than or equal to zero.

**aerosol:**

An aerosol is a solid or liquid particle suspended in a gas. In this report the term "aerosol" is used interchangeably with "particulate."

**AIRS:**

The acronym for Aerometric Information Retrieval System, the national air quality and emissions database maintained by EPA and the air regulatory agencies of the individual states.

 **$B_{\text{abs}}$ :**

Absorption coefficient. A measure of light absorption in the atmosphere by particles and gases.

**base cations:**

Positively charged ions that may be leached into lakes and streams by acids. Examples of base cations are calcium, magnesium, potassium, and sodium.

 **$B_{\text{ext}}$ :**

Extinction coefficient. Measured directly by a transmissometer. Can be reconstructed from nephelometer and aerosol data.  $B_{\text{ext}}$  is equal to the sum of  $B_{\text{scat}}$  and  $B_{\text{abs}}$ .

 **$B_{\text{scat}}$ :**

Scattering coefficient. Measured directly by a nephelometer, the scattering coefficient includes scattering due to particles and atmospheric gases (Rayleigh scattering).

**CAA:**

The acronym for the federal Clean Air Act, including all of its amendments.

**chronic acidification:**

This means that the ANC of the streams is lost over the long term and the pH drops as a consequence of the addition of sulfuric acid and nitric acid to watersheds.

**Class I areas:**

National parks and wilderness areas managed by the National Park Service, U.S. Fish and Wildlife Service and the USDA Forest Service and defined by the Clean Air Act Amendments of 1977 as having "special protection" from effects of air pollution. These federal lands have been defined as having "air-quality related values" (AQRVs), such as water quality, native vegetation, ecosystem integrity, and visibility, that need protection from air pollution.

**coarse particles:**

Particles between 2.5 and 10 microns. Coarse particles are mostly composed of soils. The sum of the masses of coarse and fine particles (all particles smaller than 10 microns) is called PM10 (EPA "respirable particle mass").

**deciview (dv):**

A haziness index designed to be linear with respect to human perception of visibility. A 1 - 2 dv change in haziness corresponds to a small, visibly perceptible change in scene appearance. Higher deciview values indicate more extinction and a corresponding decrease in visual range.

**dry deposition:**

Also known as dryfall, includes the gases and particles deposited from the atmosphere to water and land surfaces. This dryfall can include acidifying compounds, such as nitric acid vapor, nitrate and sulfate particles, and acidic gases.

**episodic acidification:**

Episodes are hydrologic events accompanied by rapid increases in stream flow. These events or episodes are driven by rainfall and snowmelt and can result in rapid loss of acid-neutralizing capacity and depression in pH. Other chemical changes that may affect fish populations during episodes include increases in aluminum concentrations and decrease in calcium concentrations during these flow increases.

**Episodic Response Program:**

Research program sponsored by the Environmental Protection Agency under the NAPAP program to determine the frequency, severity, and effects of acidic episodes in streams in the Adirondacks, Catskills, and Appalachian Plateau of western Pennsylvania.

**exceedence of standard:**

A situation where the stated maximum concentration in a standard such as NAAQS is exceeded without triggering a "violation" of that standard. For example, the NAAQS-Ozone 24-hour standard of 120 parts per billion is expected to be exceeded no more than once per year.

**extinction coefficient:**

The atmospheric extinction coefficient,  $B_{ext}$  (loosely referred to as just "extinction"), represents the ability of the atmosphere to absorb and scatter light. In this report, extinction coefficient is provided in inverse megameters ( $Mm^{-1}$ ). Conversions between  $Mm^{-1}$  and other commonly used units of extinction coefficient are:

$$1,000 Mm^{-1} = 1 km^{-1}$$

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Extinction coefficient measurements can be converted to SVR or deciview values.

The conversion from  $B_{ext}$  to SVR is:

$$SVR \text{ (in km)} = \frac{3910}{[B_{ext} - B_{Rayleigh \text{ at Site}} + 10] \text{ (in } Mm^{-1})}$$

The conversion from  $B_{ext}$  to haziness index is:

$$\text{Haziness (in } dv) = 10 \ln [B_{ext} \text{ (in } Mm^{-1})/10 Mm^{-1}]$$

**fine particles:**

Particles smaller than 2.5 microns ( $PM_{2.5}$ ). Fine particles are responsible for most atmospheric particle-induced extinction.

**forest management burning:**

See "prescribed burn."

**growing season:**

That portion of the year during which plants normally initiate, continue, and cease active biomass accumulation. In the SAA area, this season typically begins in early April and ends in mid-October.

**light extinction:**

The absorption and scattering of light.

**loadings:**

Reflect both the concentrations of chemicals in precipitation and the total amount of wet deposition that falls during the year. These values can be used to estimate total loading of pollutants to ecosystems (in kilograms/hectare/year). Total loading of such chemicals as hydrogen ion, sulfate, and nitrate would ideally include wet and dry deposition.

 **$Mm^{-1}$ :**

Inverse megameter. A unit of extinction related to SVR and  $dv$  by the equations above. Higher extinction coefficients correspond to lower SVR values and higher deciview values.

**NAAQS:**

The acronym for the National Ambient Air Quality Standards, established and maintained by EPA under Authority of the Clean Air Act.

**National Stream Survey (NSS):**

This was a water chemistry survey of stream reaches located in suspected sensitive regions of the southeastern United States sponsored by the Environmental Protection Agency during spring 1986. This survey allowed researchers to identify areas of the Southern Appalachian Assessment region that had stream reaches that had already acidified, and those that are sensitive to acidification.

**National Acid Precipitation Assessment Program (NAPAP):**

The ten-year (1980-1990), interagency research program designed to investigate acid deposition and its effects nationwide. The products of this program are the series of State of the Science and Technology documents that summarize what we know about the severity of acid deposition and the resources it affects.

**National Atmospheric Deposition Program (NADP):**

A national network of about 200 sites where wet deposition is collected weekly and sent to the Central Analytical Laboratory in Illinois for chemical analysis. This network has operated since 1977 and is funded by seven federal agencies, and numerous cooperators in agencies, universities, and industry. This network of predominately rural sites is designed to represent broad, regional patterns of deposition.

**nephelometer:**

A tool that allows accurate measurement of the atmospheric scattering coefficient ( $B_{scat}$ ) of ambient air by directly measuring the light scattered by aerosols and gases in a sampled air volume.

**nitric oxide:**

A gas formed under high temperature and/or high pressure during combustion in furnaces and internal combustion engines. The nitric oxide is converted to nitrogen dioxide in the presence of oxygen.

**nitrogen oxides:**

A designation of all the oxides of nitrogen which includes nitrogen dioxide, nitric oxide, and nitrous oxide, all of which are precursors in the formation of atmospheric ozone.

**nitrogen dioxide:**

A brown-colored gas produced as a result of nitric oxide combining with oxygen in the atmosphere. Nitrogen dioxide is used as the basis in mass calculations for NAAQS. Nitrogen dioxide can be converted to nitric acid and nitrates can be transported to water bodies or land as either wet or dry deposition.

**nitrogen saturation:**

This is a situation in watershed soils when there is an excess supply of nitrogen that cannot be used by biota. This excess nitrogen is then leached into surface waters and exported from the watershed. This condition can be caused by nitrate and ammonium in deposition, and by changes in nutrient cycling due to forest maturation and insect infestation.

**non-attainment area:**

For NAAQS, where the pattern of "violations of standard" is sufficient to require remedial action; a boundary is determined around the location of the violations. The area within that boundary is designated to be in non-attainment of the particular NAAQS standard and an enforceable plan is developed to prevent additional violations.

**optical monitoring:**

Optical monitoring refers to directly measuring the behavior of light in the ambient atmosphere.

**orographically-enhanced deposition:**

When moisture-laden air masses encounter upland areas, such as the Southern Appalachian mountains, the effect is to increase wet deposition on slopes and mountain tops. These upland areas also intersect clouds, resulting in increased deposition of cloudwater and chemicals in these areas.

**ozone:**

In the context of this paper, ozone refers to ground level or ozone that occurs in the atmosphere near the earth surface, where it may cause injury on plants and animals. Ozone is an air-quality parameter for which a standard is maintained within NAAQS.

**pH:**

The negative logarithm of hydrogen ion activity. The pH scale goes from 1 (most acidic) to 14 (most alkaline). The difference of one pH unit indicates a ten-fold change in hydrogen ion activity. pH is a quantitative measure of the acidity of a lake or stream.

**PM:**

The acronym for airborne "particulate matter," an air quality parameter for which standards are maintained within NAAQS.

**PM2.5:**

The acronym for that portion of PM that has an aerodynamic diameter of 2.5 microns or less.

**PM10:**

The acronym for that portion of PM that has an aerodynamic diameter of 10 microns or less.

**precursor:**

A substance or condition whose presence generally precedes the formation of another, more notable, condition or substance.

**prescribed burn:**

A wildland fire whose progress has been controlled by a combination of strategies, including: construction of artificial fire breaks, selection of natural firebreaks and burnout of vulnerable fuels within the fire control line. A wildfire may be declared a controlled burn if ignition occurs within an area for which an approved burning plan exists and weather conditions fall within the acceptable range. While a forest management burn is referred to as a prescribed burn in the planning stage, the same project may be referred to as a controlled burn in the implementation stage.

**Rayleigh scattering:**

Light scattering (principally blue light) by atmospheric gases. Perfectly clean air (100 percent Rayleigh scattering) would correspond to an SVR of 391 km at an elevation of 5000 feet, which is the theoretically maximum for an SVR. Rayleigh scattering also corresponds to  $B_{\text{ext}} = 10 \text{ Mm}^{-1}$ , and is defined as 0 deciview.

**scattering efficiency:**

The relative ability of aerosols and gases to scatter light. A higher scattering efficiency means more light scattering per unit mass or number of particles, this in turn means poorer visibility. In general, fine particles (diameter less than 2.5 microns) are efficient scatterers of visible light.

**scene monitoring:**

Scene monitoring is the monitoring of a specific vista or target. Optical and aerosol monitoring measure an abstract but easily quantifiable parameter of the atmosphere. Scene monitoring captures the effects of all atmospheric parameters simultaneously, but in an inherently difficult manner to quantify. It is, for example, difficult to determine quantitatively which of two photographs represent "better" visibility conditions. Scene monitoring is generally done to help relate quantitative data in a "user-friendly" format.

**sight path:**

The path between an observer (or piece of monitoring equipment) and a target on the landscape.

**standard visual range (SVR):**

Visual range is the furthest distance that a human observer can resolve a large dark target under the prevalent atmospheric conditions. Standard visual range is visual range standardized to Rayleigh scattering at an elevation of 5000 feet ( $10 \text{ Mm}^{-1}$ ).

**stream reach:**

Or stream segment is that part of the stream channel between two stream tributary confluences. This term is often used to refer to a length of stream with uniform physical and morphological characteristics.

**sulfate adsorption:**

The process by which sulfate is chemically exchanged or adsorbed onto positively charged sites on the soil matrix; under some conditions this process is reversible, and the sulfate may be desorbed and enter stream waters.

**sulfur dioxide:**

A colorless gas produced by industrial processes, especially the burning of fossil fuels, such as coal and oil. Most  $\text{SO}_x$  emissions come from large power plants, refineries, and smelters. This gas is transformed in the atmosphere to sulfate particles and sulfuric acid, which can be transported to surface waters and soils in wetfall or dryfall. The form of sulfur that provides the basis of emission mass calculations for NAAQS.

**SAMI (The Southern Appalachian Mountain Initiative):**

A consortium of government agencies, industry and environmental groups, formed to investigate the status of air quality and its effects in the highland regions of the southeastern United States. The objective of this regional cooperative is to determine the current and future impacts of regional air pollutants, such as ozone and acid deposition, and to recommend regional air management strategies to control the formation of these pollutants.

**transmissometer:**

An instrument designed to continuously and directly measure light transmission properties of the atmosphere along a selected sight path. Total light extinction is measured by integrating light scattering and absorption properties of the atmosphere.

**TSP:**

The acronym for total suspended particulates, that portion of PM that is captured by a PM sampler which does not attempt to discriminate according to particle size.

**violation of standard:**

A regulatory situation, i.e. NAAQS, where the pattern of "exceedences of standard" is greater than the frequency allowable under that standard.

**VTSSS (Virginia Trout Stream Sensitivity Survey):**

Survey of the water chemistry of 344 native brook trout streams in western Virginia carried out by researchers from the University of Virginia in partnership with the Virginia Department of Game and Inland Fisheries, USDA Forest Service, National Park Service, and Trout Unlimited.

**wet deposition:**

Also known as precipitation, includes chemicals and water collected as rain, snow, sleet and hail, along with "occult" deposition (fog and cloudwater). Chemicals measured in wet deposition when assessing the impact of acidic materials include hydrogen ion, sulfate, nitrate, ammonium, and base cations.

**wildfire:**

Any wildland fire that requires a suppression response. A controlled burn may be declared a wildfire if part of it escapes from the control line or if weather conditions deteriorate and become unacceptable, as described in the burning plan.

**W126:**

Statistically weighted function to describe ozone exposures for a predefined time period.

