



Enjoy the View – Air Quality Assessment

George Washington Memorial Parkway

Natural Resource Report NPS/NRSS/ARD/NRR—2015/939



ON THE COVER

View from the Netherlands Carillon, Washington D.C.
NPS Webcam image

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Air Resources Division

National Park Service
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Abstract

George Washington Memorial Parkway is one of the first National Park Service areas to take up the Call to Action item #38: Enjoy the View. Clean, clear air is critical to the appreciation of scenic views, to human health, and the health of ecosystems. This air quality assessment report presents air pollution effects, sources, monitoring data, and trends relevant to George Washington Memorial Parkway (GWMP) as well as reviews some of the applicable laws, responsibilities, and progress toward clean air goals in the region. Air pollution can harm human health; visibility of scenic views; and ecological resources, including water quality, soils, plants, and animals. Air pollutants of specific concern include ground-level ozone, fine particles, sulfate, nitrate, ammonia, heavy metals (for example, mercury), and toxic organic compounds. While greenhouse gas emissions cause climate change, climate change impacts in GWMP are beyond the scope of this report. Most of the air pollution that impacts NPS areas comes from outside park boundaries. Vehicles using the GWMP are the most immediate sources of air pollution to the area, but GWMP is also downwind from large urban and industrial areas. Despite the progress that has been made in air pollution control, the Washington area has poor air quality at times, and is still not meeting the ozone standard.

Acknowledgments

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Introduction

George Washington Memorial Parkway (GWMP) is one of the first National Park Service (NPS) areas to take up the Call to Action item #38: Enjoy the View. As part of A Call to Action, Enjoy the View advances the vision of the NPS into the next century by engaging parks in collaborative efforts to identify and protect both air quality and scenic views. The goal of the action is to protect clean, clear air and spectacular scenery in National Park areas now and for future generations.

Clean, clear air is critical to the appreciation of scenic views, to human health, and the health of ecosystems. Since the Clean Air Act of 1970, great progress has been made toward improving air quality nationwide. However, most parks—including George Washington Memorial Parkway—still experience air quality impairment that mars scenic views. The ecosystem impacts of air pollution are not fully understood, and important work remains before we can reach clean air goals.

With our second century approaching, the realm of potential impacts to scenic views and clean air is evolving and we need to be responsive. Air quality assessment reports, like this one, and Visual Resource Inventories are critical components of Enjoy the View. These efforts will establish a baseline of air quality and scenic conditions crucial for park planning and internal and external decisions that may impact scenic, cultural, and natural resources. Collaboration with a variety of stakeholders will build understanding about the value of clean air and scenic views, and encourage actions to protect them.

This air quality assessment report presents air pollution effects, sources, monitoring data, and trends relevant to George Washington Memorial Parkway before reviewing some of the applicable laws, responsibilities, and progress toward clean air goals in the region.

Air Pollution Effects in GWMP

Most visitors expect clean air and clear views in parks. However, air pollution often affects George Washington Memorial Parkway (GWMP). Air pollution can harm human health; visibility of scenic views; and ecological resources, including water quality, soils, plants, and animals. Air pollutants of specific concern include ground-level ozone, fine particles, sulfate, nitrate, ammonia, heavy metals (e.g., mercury), and toxic organic compounds.

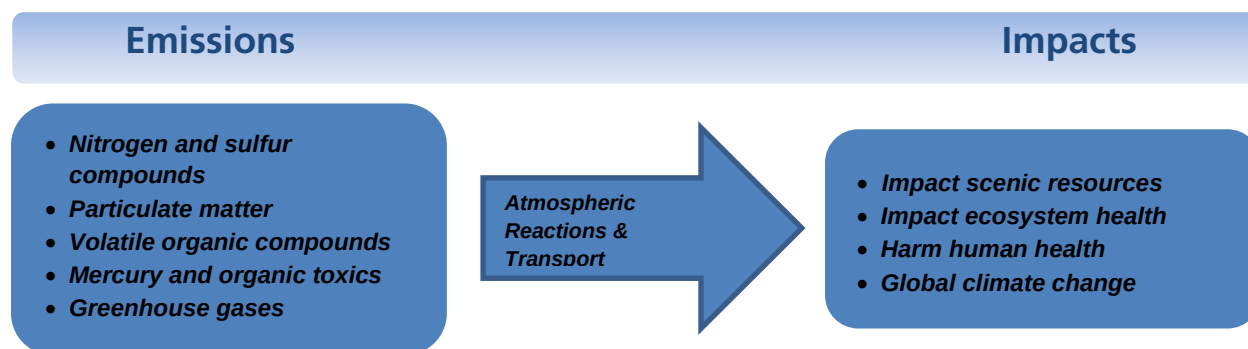


Figure 1. Air pollution causes a variety of resource impacts. Most pollution affecting NPS areas comes from outside the parks. Pollution from human-generated and natural sources is emitted in one place, transported through the air—and sometimes changed by chemical reactions—before impacting national park units.

Visitor and Staff Health

Clean air allows people to fully enjoy national parks. Air pollution can impact human health, limiting activities for visitors and staff, and jeopardizing the park experience when it reaches unhealthy levels.

Ground-level ozone forms in the atmosphere when nitrogen oxides, from burning fossil fuels or fires, react in the presence of sunlight with volatile organic compounds, which are emitted from motor vehicles or industrial processes and natural sources like vegetation. Ground-level ozone can cause inflammation and irritation of the respiratory system in humans. The counties that GWMP is located in do not currently meet the national health standard for ozone.

Particulate matter, including fine particles (2.5 micrometers in diameter and smaller) and coarse particles (such as dust or smoke emitted from human-caused and natural sources) can also cause inflammation and irritation of the respiratory system in humans. People can be more susceptible to health effects from air pollution when they are engaged in strenuous recreation, which may be a primary reason visitors come to “the playground system of the National Capital.” The counties that GWMP is located in do not currently meet the national health standard for fine particulate matter.

Visibility of Scenic Views

Clean, clear air is essential to enjoying spectacular park views. Many visitors come to parks specifically to experience the magnificent scenery we are charged with protecting, including views

that extend beyond park boundaries. Our ability to clearly see color and detail in distant views (visibility) can be impacted by air pollution.

Particulate matter (i.e., fine, and coarse particles) decreases visibility to some degree in every national park including GWMP. Sulfate, nitrates, ammonium, organic compounds, and soil contribute to fine particle mass. Fine and coarse particles can create a white or brown haze—by absorbing or scattering light—this affects not only how far we can see but also how well we are able to see the colors, forms, and textures of a scenic vista. Some haze may have natural causes such as fog or wildfire smoke, but haze affecting GWMP is predominantly human-generated. GWMP’s scenery—including some of the most recognizable vistas in the world—is a draw for millions of visitors, yet is regularly marred by air pollution. Haze takes away from the visitor experience.

Ecological Resources

Good air quality supports healthy park wildlife, vegetation, lakes, streams, and soils. The ecosystem and its individual components including water, soils, plants and animals, constitute an interdependent system where all living things are dependent upon the other living and non-living things for survival. An impact to one resource can have cascading effects throughout the system.

Ground level ozone can cause plant injury and reduced growth in some sensitive plant species. Ozone enters plants through leaf openings called stomata and oxidizes plant tissue. Many other factors can magnify the extent of ozone injury such as soil moisture, presence of other air pollutants, insects or diseases, and other environmental stresses. A risk assessment concluded that plants at GWMP are at high risk for ozone damage ([Kohut 2007](#); [Kohut 2004](#)). Ozone-sensitive plants in the park include *Prunus serotina* (black cherry) and *Rudbeckia laciniata* (cut-leaf coneflower). A full list of ozone-sensitive plant species is available from [NPSpecies](#).

Also, **sulfur and nitrogen compounds** in air pollution can deposit into ecosystems and cause acidification, excess fertilization (eutrophication), and changes in soil and water chemistry that can alter aquatic life. Acidification of soils, lakes, and streams can result in changes in community structure, biodiversity, reproduction, and decomposition. Ecosystems in GWMP have been rated as moderately sensitive to acidification effects ([Sullivan et al. 2011a](#); [Sullivan et al. 2011b](#)). Plants sensitive to the effects of acidification in the park include *Acer saccharum* (sugar maple) trees.

Although nitrogen is an essential plant nutrient, surplus levels of atmospheric nitrogen deposition can stress ecosystems. Excess nitrogen acts as fertilizer, favoring some types of plants and leaving others at a competitive disadvantage. The long-term effects of these changes may include shifts in plant and animal species composition, increase in insect and disease outbreaks, and disruption of ecosystem processes such as nutrient cycling and wildfire frequency (Blett & Eckert 2013; Bobbink et al. 2010). Although GWMP receives high levels of nitrogen deposition, in general, ecosystems in the park are not typical of nitrogen-sensitive systems and were rated as having low sensitivity to nutrient enrichment effects ([Sullivan et al. 2011c](#); [Sullivan et al. 2011d](#)). However, some vegetation communities in the park—wetland, grassland, and meadow plant communities—may be more sensitive to excess nitrogen deposition.

A critical load, defined as the level of deposition below which harmful effects to the ecosystem are not expected, is a useful tool in determining the extent of deposition impacts to park resources. It can also serve in communicating these impacts to managers, regulators, and the public. A critical load of 3–8 kilograms nitrogen per hectare per year (kg N/ha/yr) has been suggested to protect lichen and forest vegetation in the Eastern Temperate Forests Ecoregion, which includes GWMP (Pardo et al. 2011). The estimated maximum 2010–2012 average for total nitrogen deposition in the Eastern Temperate Forests ecoregion of GWMP was 13.3 kg/ha/yr (NADP 2014). Therefore, total deposition levels in the park are above ecosystem critical loads for some park vegetation communities, suggesting that lichen and forest vegetation are at risk for harmful effects.

Mercury and other toxic pollutants (e.g., pesticides, dioxins, polychlorinated biphenyls [PCBs]) can affect the reproductive health of both wildlife and humans when consumed. These toxics can build up in the food chain causing negative effects in fish, birds, and wildlife and cause reduced reproductive success, impaired growth and development, and decreased survival rates. Other toxic air contaminants of concern include pesticides (e.g., DDT), industrial by-products like PCBs, and emerging chemicals such as flame retardants for fabrics (PBDEs). PCBs, are a class of man-made compounds once manufactured for a variety of industrial applications, including coolants and lubricants in electrical equipment. New production of PCBs was banned in 1979 due to possible harmful human health effects and persistence in the environment. Mercury and other contaminants are known or suspected to cause cancer or other serious health effects in humans and wildlife.

While there are direct mercury inputs to surface waters from industrial processes, another contributor of mercury to inland water bodies is atmospheric deposition. Wet and dry deposition can lead to mercury loadings in water bodies, where mercury may be converted to a bioavailable toxic form of mercury, methylmercury, and bioaccumulate through the food chain. A mercury sensitivity analysis based on water chemistry and physical parameters rated the potential for methylmercury production at GWMP from moderate to severe, as compared to other NPS units (USGS 2015). There are no data on mercury in biota specifically in the parkway, but there are elevated levels of mercury (and other contaminants such as PCBs) in fish from adjacent reaches of the Potomac River through Maryland, Washington D.C., and Virginia. Fish consumption advisories have been issued by Maryland and Virginia for many riverine fish of varying sizes, because of elevated levels of PCBs (MDE 2013; VDH 2013). Sites previously contaminated with PCBs may emit and re-deposit the compound, and PCBs may be re-suspended with sediments in the water column. Tidal portions of the Potomac River are listed as impaired due to elevated levels of PCBs in fish tissue.

These threats to ecosystem resources have implications for the overall biodiversity, species preservation, and natural systems that GWMP contains in an otherwise urban environment.

Sources of Air Pollution

Most of the air pollution that impacts NPS areas comes from outside park boundaries. Vehicles using the GWMP are the most immediate sources of air pollution to the area, but GWMP is also downwind from large urban and industrial areas. Pollutants emitted from power plants, industries, and mobile sources can travel hundreds of miles in the atmosphere. Agricultural emissions also contribute to air pollution at the GWMP.

Mobile sources, such as cars, buses, planes, trucks, and trains, account for more than half of all the air pollution in the United States according to the Environmental Protection Agency (EPA) (<http://www.epa.gov/air/caa/peg/carstrucks.html>). Exhaust and dust from motor vehicles on and near GWMP contain nitrogen oxide, volatile organic compounds, and particulate matter emissions. For Virginia, Washington D.C., and Maryland, 69% of nitrogen oxide and 15% of particulate matter emissions come from mobile sources (NEI 2014).

Large point sources of air pollution like power plants, industrial paper mills, iron and steel mills, and petroleum refineries are major emitters of sulfur dioxide and nitrogen oxides. These pollutants react in the atmosphere to form sulfate and nitrate particles and acidic deposition. For Virginia, Washington D.C., and Maryland, electric generation and industrial processes account for 22% of nitrogen oxide and 87% of sulfur dioxide emissions (NEI 2014). Industry is also a significant source of airborne mercury and other toxics. A total of 77% of airborne mercury in Virginia, Maryland, and Washington D.C. stems from industry (NEI 2014).

Area sources of air pollution, such as agriculture, construction, and residential wood burning are sources of ammonia and particulate matter emissions. For Virginia, Washington D.C. and Maryland, 82% of ammonia emissions originate from agricultural fertilizer application and livestock waste. Construction and residential wood burning are responsible for 18% of particulate matter emissions (NEI 2014).

States and EPA have evaluated geographic source regions that contribute to regional haze, ozone, and fine particles. For the District of Columbia, coal- and oil-fired electric power plants in Ohio, Pennsylvania, Virginia, West Virginia, and Maryland are major contributions to regional haze, ozone, and fine particles.

Almost all the sources of pollutants such as sulfur dioxide, nitrogen dioxide, volatile organic compounds, and ozone, particulate matter also emit greenhouse gases (GHGs). GHGs contribute to global climate change. GWMP became a Climate Friendly Park in 2011, and completed a GHG emissions inventory and action plan (http://www.nps.gov/climatefriendlyparks/downloads/Action%20Plans%20and%20Inventories/GWMPCFPAActionPlan_Final.pdf). The total GHG emissions for the park, including park operations, concessioners, and visitors to the parkway, was 18,621 metric tons carbon dioxide (CO₂) equivalent (MTCO₂E). Visitors to the parkway emitted 15,944 MTCO₂E (86%). Visitor emissions are counted once they cross the boundary into the park until they leave the park. All of park operations emissions, including park employee commuting was 1,716 MTCO₂E (9%).

Air Quality Monitoring

The NPS Air Resources Division (ARD) coordinates an extensive air monitoring program that measures air pollution levels in national parks. This program collects data that allows NPS to:

- understand current air quality conditions,
- assess the effects of air pollutants on park resources,
- observe long-term trends of air pollutants,
- evaluate the causes and sources of air pollution,
- gauge the effectiveness of national and regional air pollution control policies, and
- provide a scientific basis for air resource management decisions.

When on-site monitors are not available, near-by representative monitors can sometimes be used to evaluate air quality trends. However, identification of a “representative site” depends on the pollutant, network, distance from the park, and local site characteristics.

Visibility Monitoring

The Interagency Monitoring of Protected Visual Environments (IMPROVE) is a national visibility monitoring program established in 1985. The goals of this program are to monitor current visibility conditions, track changes in visibility, and determine the causes of visibility impairment.

GWMP has one representative IMPROVE station (WASH 1) located in Washington, D.C. Data from the site can be used to assess visibility trends at GWMP (http://vista.cira.colostate.edu/improve/Data/IMPROVE/improve_data.htm).

Gaseous Pollutant Monitoring

The NPS ARD operates a network of air quality monitoring stations in rural areas that measure ground-level ozone and a variety of meteorological parameters. States and local air pollution agencies operate many additional stations in urban areas, including areas around GWMP.

There are four ozone monitors within 10 kilometers of park boundaries with enough data for trends and conditions analyses (http://www.epa.gov/airdata/ad_maps.html). The NPS Air Resources Divisions chose the Aurora Hills Visitor Center in Arlington, Virginia (Site ID 510130020) site for this analysis, as the site is closest to GWMP boundaries and is centrally located (Figure 1). The site is operated by the Virginia Department of Environmental Quality (DEQ).

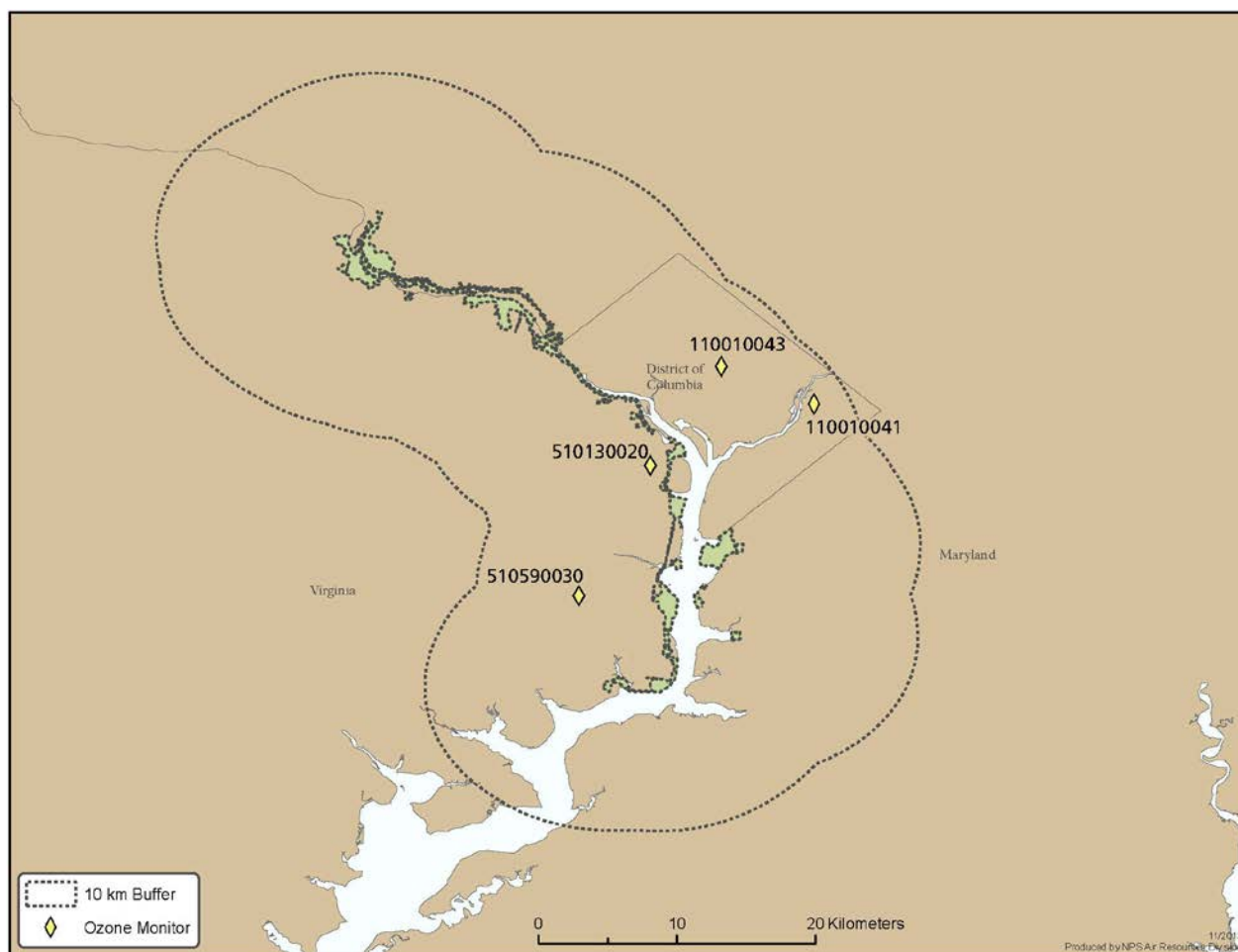


Figure 2. Ozone monitors within 10 kilometers of George Washington Memorial PKWY boundaries. Aurora Hills Visitor Center (510130020) monitor is closest to the parkway and is centrally located.

Atmospheric Deposition

The NPS and other federal, state, and local agencies monitor wet deposition of nitrate, ammonia, sulfate, mercury, and other compounds through the National Atmospheric Deposition Program (NADP) and the Mercury Deposition Network (MDN). There are no representative deposition samplers near GWMP. However, interpolated estimates are available and used to assess condition at GWMP.

Air Quality Conditions and Trends

Air quality status assessments are based on current conditions compared to NPS ARD benchmarks for specific measures of visibility, ozone, and atmospheric deposition. NPS ARD uses six specific measures to summarize current air quality conditions at GWMP:

Indicator of Air Quality	Specific Measure
Visibility	Visibility on mid-range days minus natural visibility condition on mid-range days
Ozone	Human health: 4th-highest daily maximum 8-hour concentration
	Vegetation health: 3-month maximum 12-hour W126
Atmospheric deposition	Sulfur wet deposition
	Nitrogen wet deposition

For each of the specific measures of air quality identified above, data from national air quality monitoring networks were reviewed and 5-year averages (2008–2012) were calculated for monitoring sites with at least 3 years of complete annual data. The Inverse Distance Weighted (IDW) interpolation method was then used to estimate 5-year average values for all locations in the contiguous U.S. The condition for GWMP is the value derived from this national analysis at the geographic center of the park. Interpolated data are useful for assessing current conditions because many parks do not have on-site air quality monitors. The estimated 5-year averages (conditions) for GWMP were compared to established benchmarks to assigned one of three status categories:

- Warrants Significant Concern,
- Warrants Moderate Concern, or
- Resource is in Good Condition.

At GWMP trends were computed from data collected over a 10-year period from the WASH 1 IMPROVE monitor located in Washington, D.C., for visibility; and the Virginia DEQ Aurora Hills Visitor Center in Arlington, Virginia (Site ID 510130020) for ozone. These locations have at least 6 years of annual data and an annual value for the final year of the 10 year period, i.e. 2012.

Visibility

The Clean Air Act established national goals to preserve, protect, and enhance air quality in national parks and other special areas, and specifically return visibility to “natural conditions” in Class I areas. The NPS Air Resources Division (ARD) recommends a visibility benchmark condition for all NPS units, regardless of Class designation, consistent with the general Clean Air Act goal. Natural visibility conditions are those estimated to exist in a given area in the absence of human-caused

visibility impairment. Currently, average visibility is often impaired by haze and warrants a condition of “Significant Concern” at GWMP, a condition seen throughout most of the eastern U.S. This condition is based on [NPS Air Resource Division benchmarks](#) and the 2008–2012 estimated visibility on mid-range days of 11.3 deciviews (dv) above estimated natural conditions (7.8 dv). (*The deciview (dv) is a visibility metric used track visibility conditions. One deciview represents the minimal perceptible change in visibility to the human eye.*) At the Washington D.C. monitor, pollution has reduced average visual range from natural conditions of 100 miles to 20 miles. On the haziest days, visual range has been reduced from 75 miles to 10 miles. Severe haze episodes occasionally have reduced visibility to as little as 6 miles (IMPROVE 2013). Currently visibility on the average and haziest days in 2008–2012 are 40 and 20 miles, respectively, at the Washington D.C. monitor.

Visibility trends are evaluated for the 20% best visibility days, when concentrations of haze-causing pollutants are the lowest, and the 20% worst visibility days, when concentrations of haze-causing pollutants are the highest. The Clean Air Act visibility goal seeks to improve visibility on the 20% worst days, and maintain visibility on the 20% best days. Data show that from 2003–2012 visibility improved on both the 20% clearest days and 20% haziest days at the Washington D.C. monitor (Figure 3), primarily due to emissions reductions required under state and federal requirements to reduce ozone and fine particle pollution in the East.

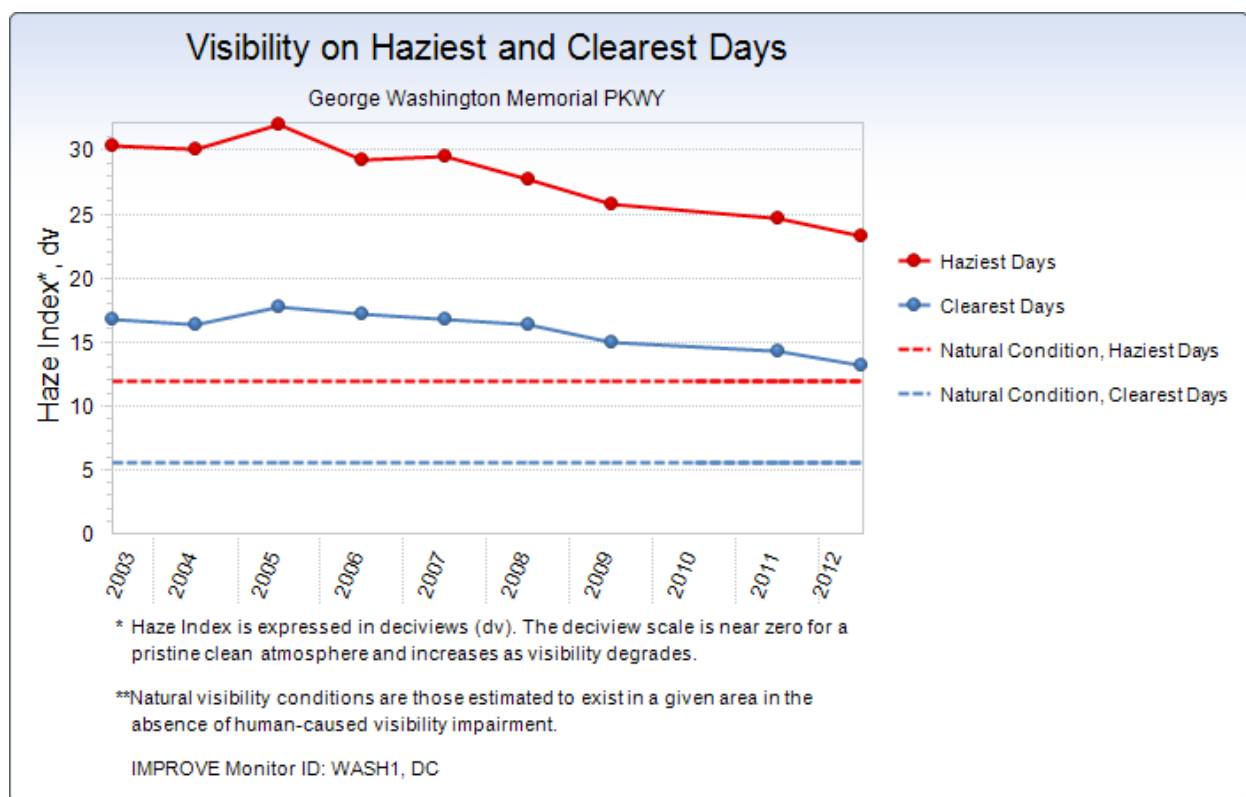


Figure 3. Visibility on haziest and clearest days, 2003–2012.

To improve visibility at GWMP, it is important to understand which pollutants have the greatest contributions to haze. Light extinction is used to calculate the contributions of individual pollutants

to haze. At the Washington D.C. monitor (Figure 4) and most monitors in the eastern U.S., sulfate, primarily from fossil fuel burning, is the largest contributor to haze on the 20% percent worst visibility days. Nitrate is a larger component of haze at the Washington D.C. monitor than at nearby rural monitors due to the contribution from mobile vehicle traffic in the urban area. Organic carbon, from a combination of natural vegetation emissions, biomass burning, and human caused emissions (for example, diesel and gasoline fuel combustion from mobile and industrial sources), is also an important contributor. Figure 4 illustrates that reductions in sulfate have been responsible for improved visibility at the Washington D.C. monitor over the past decade. Nitrate and organic carbon contributions to haze have not greatly changed over the decade.

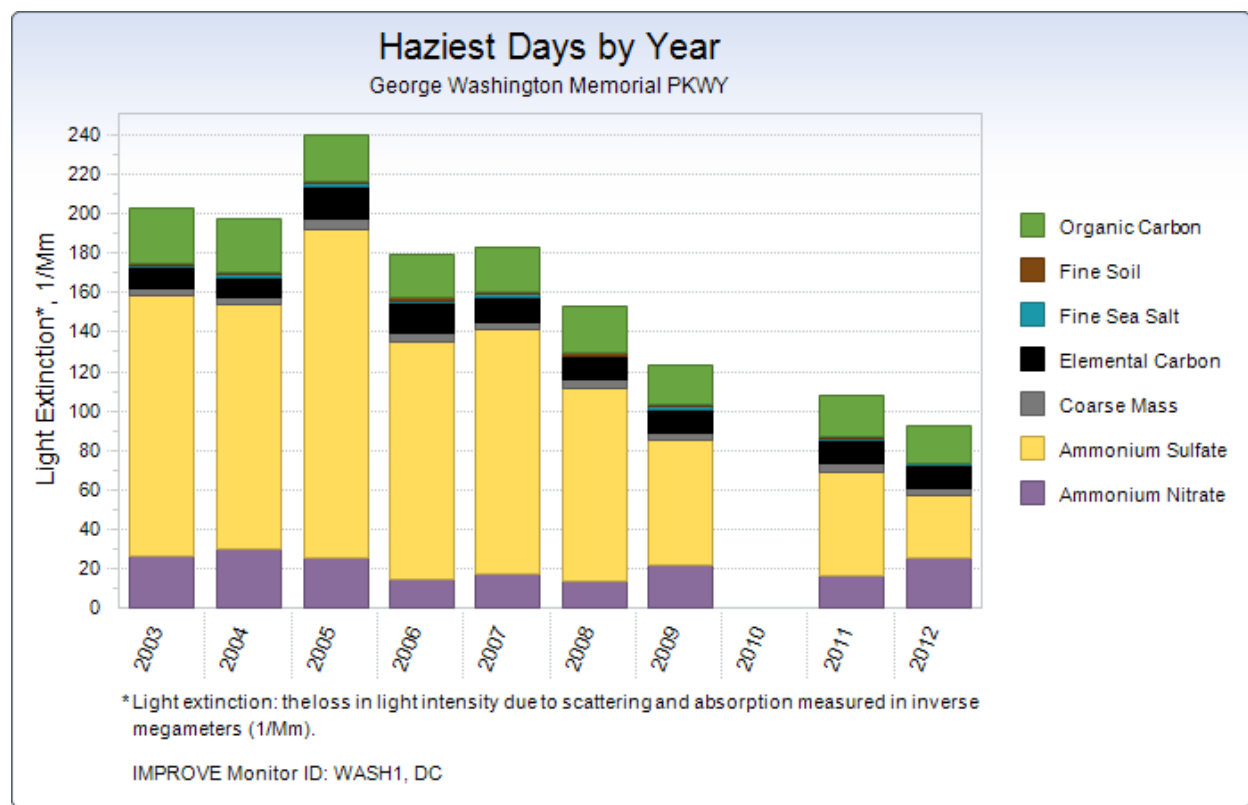


Figure 4. Contributions to haze on the haziest days, 2003–2012.

Long-term visibility monitoring also shows strong seasonal differences in visibility at the Washington D.C. monitor. As illustrated for 2012 (Figure 5), sulfate contributions are greatest in the summer months and lowest in the winter months. This is a function of both highest coal-fired power generation in summer months when air conditioning demand is highest and higher photochemical formation of sulfate in the atmosphere at warmer temperatures. In contrast, nitrate formation is greater at colder temperatures and nitrate concentrations are highest during the winter months and lowest during the summer months. Higher organic carbon in November and December might reflect contributions from prescribed fire and/or residential wood burning.

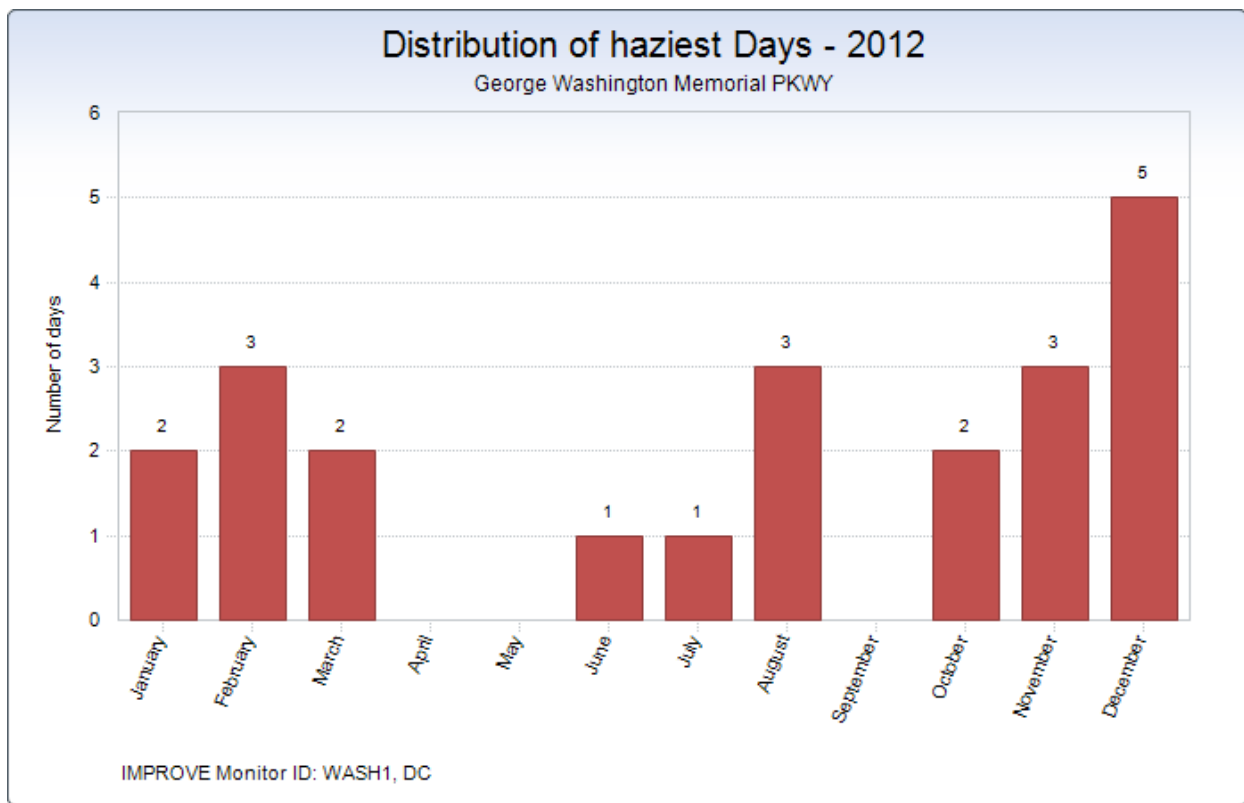


Figure 5. Seasonal variations in haze contributions on the haziest days, 2012.

Ozone

The EPA's ozone standards are the basis for benchmarks for rating ground-level ozone condition. These standards were revised in 2008 in order to be more protective of human health and welfare. The primary standard to protect human health and secondary standard to protect ecosystem health are identical. To attain the standard, the 3-year average of the annual 4th-highest daily maximum 8-hour average ozone concentrations measured at each monitor must not exceed 75 parts per billion (ppb). The NPS ARD recommends a benchmark for good ozone condition of 60 ppb or less, which is 80% of the human health-based NAAQS.

Currently, ozone conditions at GWMP are not meeting the NPS ARD desired conditions and warrant significant concern. Estimated 4th-highest daily maximum 8-hour average ozone concentration for the parkway from 2008–2012 was 77.4 parts per billion (ppb). In addition, GWMP falls within a county designated by the EPA as "nonattainment," for, it doesn't attain the ozone standard of an 8-hour average concentration of 75 ppb. There were no statistically significant trends in ozone concentration at the park from 2003–2012 (Figure 6). The drop in ozone levels in 2009 reflects reduced emissions from electricity generation and industry, a potential result of the economic recession

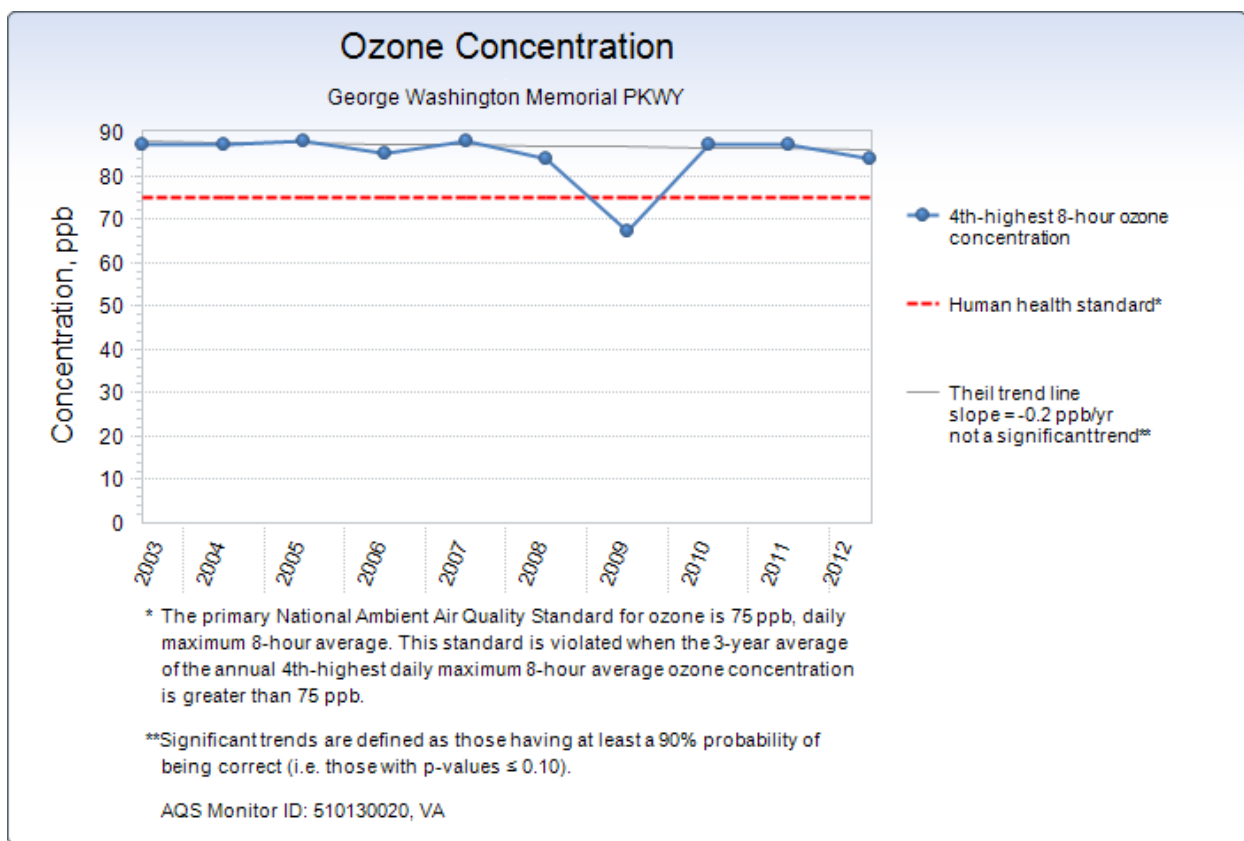


Figure 6. Trends in annual 4th-highest daily maximum 8-hour average ozone concentration (ppb/yr), 2003–2012. Monitor ID: Aurora Hills Visitor Center (510130020).

The NPS ARD also rates ozone condition using the W126 metric, which focuses on the biological response of vegetation to ozone. The W126 metric is a biologically relevant measure that focuses on plant response to ozone exposure and is a better predictor of vegetation response than the metric used for the human health standard. The W126 metric measures cumulative ozone exposure over the growing season in parts per million-hours (ppm-hrs). The NPS ARD recommends a W126 of less than 7 ppm-hrs as the desired condition to protect sensitive vegetation. The estimated W126 metric at the Aurora Hills monitor for 2008–2012 was 18.0 parts per million-hours (ppm-hrs), and is rated as a significant concern for vegetation risk. For 2003–2012, there was not a statistically significant trend in the W126 metric at the Aurora Hills monitor (Figure 7).

Sulfur and Nitrogen Wet Deposition

Although both wet and dry forms of deposition affect ecosystems, wet deposition alone is frequently used to characterize deposition, because dry deposition measurements are very limited. Deposition is measured in kilograms per hectare per year (kg/ha/yr) of wet nitrogen or sulfur deposition. Deposition monitoring data are not available near GWMP, so estimates generated by interpolating data from more distant sampling sites are used to evaluate condition.

NPS ARD recommends a nitrogen or sulfur wet deposition of less than 1 kg/ha/yr as the desired condition to protect sensitive ecosystems. Evidence is not currently available to indicate that wet

deposition amounts less than 1 kg/ha/yr cause ecosystem harm. Nitrogen and sulfur deposition are rated as a significant concern at the park because levels are estimated well above natural background levels (for 2008–2013: estimated wet nitrogen deposition was 4.1 kg/ha/yr and estimated wet sulfur deposition was 3.5 kg/ha/yr).

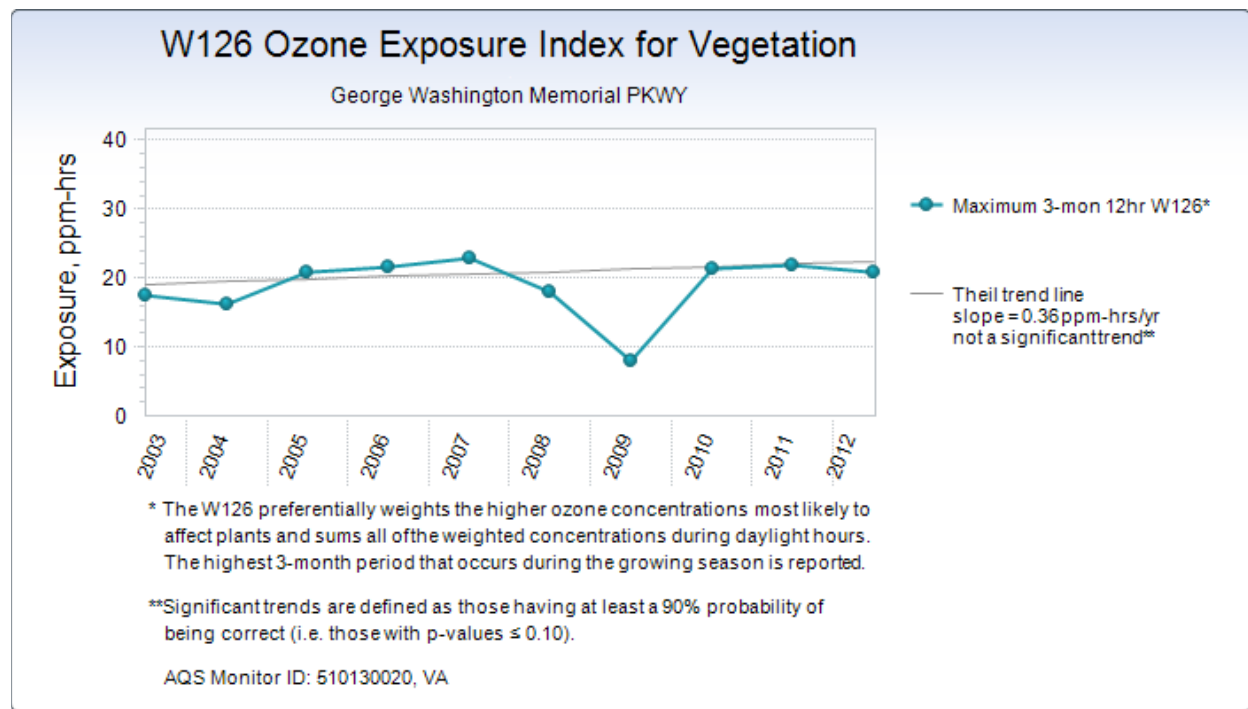


Figure 7. Trends in maximum 3-month 12-hour W126 2003–2012. Monitor ID: Aurora Hills Visitor Center (510130020).

GWMP does not have a representative wet deposition monitor to assess 10-year trends. Although interpolated estimates are sufficient for evaluating condition, ARD recommends they not be used in trends analyses.

Mercury Wet Deposition

The NPS ARD does not currently assess the condition for mercury deposition, as condition thresholds for mercury deposition have not been established. Environmental conditions play a significant role in the potential for mercury to be a contaminant of concern across the landscape. Therefore, the ARD recommended desired condition, once developed, will take into account the landscape type and various water chemistry parameters.

Air Quality Laws, Responsibilities and Progress

Clean Air in National Parks – Law, Policy and Guidance

In the Clean Air Act (CAA), Congress set a national goal "to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic or historic value" (42 U.S.C. §7470(2)). This goal applies to all units of the National Park system. Air quality is important for all parks, such as GWMP, that contain air quality-sensitive natural resources, where clarity of scenic views is an important value or where maintenance of air quality standards is important for protecting visitor and employee health.

Additional authority to consider and protect air quality related values (AQRVs) such as visibility and ecosystem health in parks is provided by Title 54 commonly known as the NPS Organic Act (54 USC 100101(a) *et seq.*), which requires that parks remain "unimpaired for the enjoyment of future generations" providing a mandate for environmental protection. This gives the NPS a responsibility to ensure that internal management actions do not conflict with the purposes for which parks were established by impairing natural resources.

The NPS Management Policies of 2006 clearly reiterate our responsibilities to protect air resources. The Service will actively promote and pursue measures to protect natural and cultural resources and visitor enjoyment, human health and scenic vistas from air pollution. We are directed to integrate air resource management into NPS operations and planning, work externally to prevent air pollution, keep our own operations clean, and promote public understanding of air resources through educational and interpretive programs.

The NPS ARD has developed guidance and recommendations to assist parks, other agencies, and partners with air quality analyses needed for park natural resource condition assessments, planning, and NEPA analyses:

Internal Air Quality Planning Guidance (<http://www.nature.nps.gov/air/planning/index.cfm>)

External (NEPA) Air Quality Planning Guidance
(<http://www.nature.nps.gov/air/planning/index.cfm>)

Federal Land Managers' Air Quality Related Values Work Group (FLAG) Guidance, Nitrogen & Sulfur Deposition Analysis Guidance (<http://www.nature.nps.gov/air/permits/flag/index.cfm>)

GWMP Responsibilities and Opportunities

Parks are required to obtain permits for certain air pollution sources such as electrical generators that burn fossil fuels like diesel, propane, or coal. Whether or not a permit is required depends upon the amount of emissions from the generator and the particular state or local requirements. "Conformity" refers to the requirement that park operations be consistent with state regulatory plans to attain or maintain air quality standards. This means GWMP must ensure that their park actions do not cause a violation of air quality standards or prevent improvement in an area that already violates one or more

standards. GWMP is in an area that violates both the ozone and the PM_{2.5} standards. GWMP staff can check with the NPS ARD for further assistance.

The NPS successfully influences the reduction of air pollution from sources that threaten park resources. The NPS ARD, and in some cases parks, engage in extensive cooperative conservation with air regulatory agencies, stakeholders, and other federal land managers to address air resource issues. For example, the Clean Air Act requires companies to obtain an air emissions permit prior to constructing new sources of air pollution or making modifications to an existing facility. When a new or modified source would affect park resources, NPS ARD works with the air quality regulators to analyze the potential impacts to park resources and identify appropriate control technologies. Park support is often important in the process and effectively engaging with stakeholders.

Park planning efforts such as foundation documents, general management plans, and resource stewardship strategies provide an opportunity to highlight the importance of clean air to maintaining park resources and values. NPS management policies state that “the Service will seek to perpetuate the best possible air quality in parks.” Addressing air resources in park planning provides a framework for managing air resources and communicates the importance of air resources to the public, industry, air regulatory agencies, and future NPS managers and staff.

The NPS has successfully influenced initiatives aimed at reducing air pollution from sources that threaten park resources. Success requires active NPS participation and cooperative conservation partnerships with air regulatory agencies, stakeholders, and other federal land managers to address air resource issues. Including protection of air and scenic resources in park planning documents supports these efforts.

Air resources can be addressed in GWMP planning in many ways. The conditions of air resources and known threats can be identified along with further data and research needs. Management goals for air resources, as well as strategies for meeting those goals and overall protection of the resources, should be included in plans.

Regional Air Pollution Control Requirements and Progress

To reduce acid deposition, the 1990 Clean Air Act Amendments required reductions in sulfur dioxide and nitrogen oxide emissions from electric power plants beginning in 1995. In 1998, EPA required further controls of nitrogen oxides from power plants and large industrial sources in the eastern states to reduce ozone. Beginning in 2004 EPA has required highway vehicles, trucks, diesel engines, heavy duty equipment, and marine vessels to burn cleaner fuels and operate cleaner engines to reduce ozone and fine particles.

EPA sets National Ambient Air Quality Standards (NAAQS) for carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide. EPA is required to review the national standards every five years and to revise the standards as necessary to protect human health and welfare. EPA revised the national standard for ozone in 1997 and again in 2008. EPA proposed but did not finalize a further revision to the ozone standard in 2011. EPA is currently reviewing the latest scientific evidence and proposed (not yet finalized) a revised ozone standard in late 2014. EPA

revised the national standards for fine particles in 1997, 2006, and again in 2012. EPA reviewed and revised the carbon monoxide, lead, nitrogen dioxide, and sulfur dioxide standards between 2008 and 2011.

When any area of the country violates EPA's NAAQS, they are designated as 'nonattainment' areas. Each state or district, then has to develop a plan to implement the actions needed to reduce the pollution enough so that the NAAQS are attained (i.e., complied with, not violated).

GWMP is located in the metropolitan Washington D.C. nonattainment area for 8-hour ozone (2008 standard) and fine particulate matter (1997 standard). However, monitoring data show that the GWMP counties are currently meeting the national standard for fine particles. Washington D.C. submitted a re-designation request for meeting the 2006 fine particulate matter standard; but the EPA has not yet approved the district's request. To see the State Implementation Plan (SIP) for the Washington DC metropolitan area, click here: <http://www.mwcog.org/environment/air/SIP/default.asp>.

In 2004, EPA implemented the Clean Air Interstate Rule (CAIR) to require additional emission reductions from power plants in the eastern U.S. to reduce interstate transport of pollutants. In 2008, the Court for the District of Columbia partially overturned CAIR and instructed EPA to revise its definition of interstate contributions to ozone and fine particles in downwind states. In July 2011, EPA finalized the Cross State Air Pollution Rule (CSAPR) to replace CAIR. In August 2012, the Court overturned CSAPR and allowed EPA to continue to implement CAIR until legal review is completed and EPA could implement a revised rule for interstate transport. In 2013, the Supreme Court heard arguments from EPA and challengers concerning CSAPR and interstate transport, and upheld CSAPR in 2014.

Despite the legal uncertainty, significant reductions in sulfur dioxide and nitrogen oxide emissions from power plants have been accomplished, as illustrated for sulfur dioxide in Figure 8. In response to these reductions, acid deposition, ozone, fine particles and regional haze have decreased in the District of Columbia and surrounding counties.

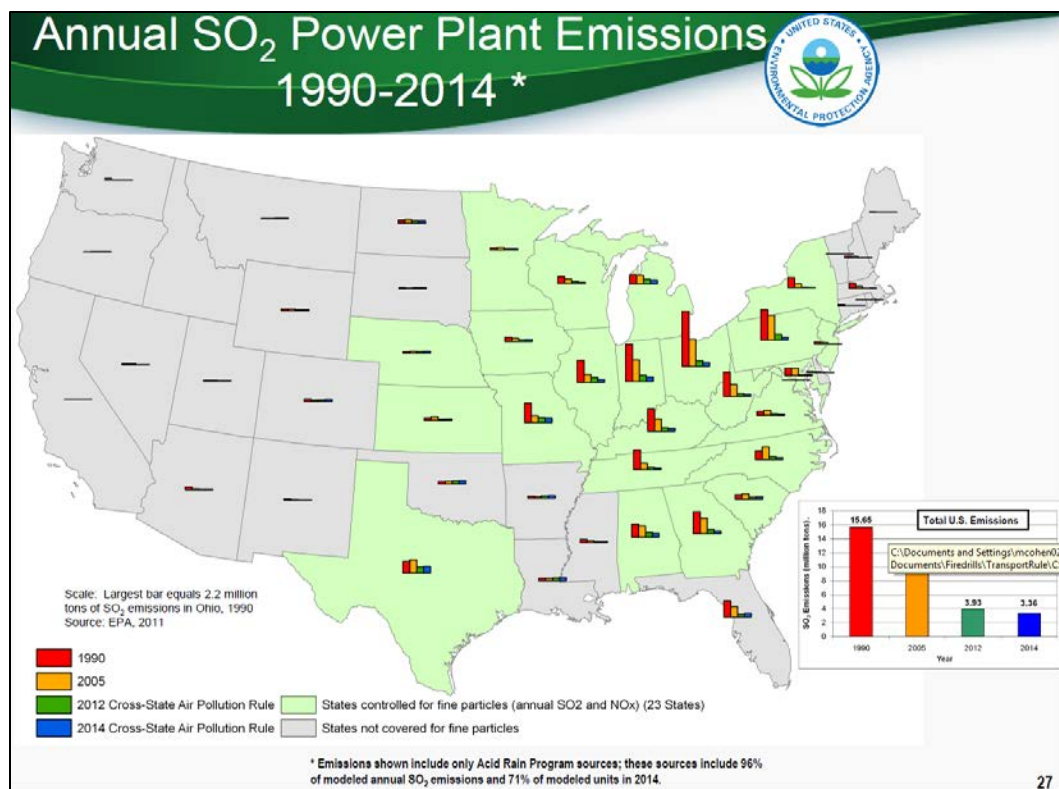


Figure 8. Annual sulfur dioxide emissions from electric power plants, by state, in 1990, 2005, and required by 2012 and 2014 under the Clean Air Interstate Rule. States covered by the Rule are highlighted in green.

The Regional Haze Rule (1999) requires states to protect visibility in Class I national parks and wilderness areas. The District of Columbia's regional haze plan, submitted to EPA in 2011, took credit for emissions reductions in eastern states for ozone and fine particles and did not define any controls specific for regional haze. Virginia and Maryland required controls for a few paper mills as part of their regional haze plans. States and the District of Columbia are required to submit revised regional haze plans in 2018.

Despite the progress that has been made in air pollution control, the Washington area has poor air quality at times, and is still not meeting the ozone standard. The Metropolitan Washington Council of Governments (COG) (<http://www.mwcog.org/environment/air/>) provides daily reports and forecasts of regional air quality for the Washington region, notifying the public (<http://www.cleanairpartners.net/airalert.cfm>) when unhealthy air quality is expected. Through COG, the Metropolitan Washington Air Quality Committee (http://www.mwcog.org/environment/committee/committee/default.asp?COMMITTEE_ID=14) coordinates planning to reduce pollutant emissions, including developing strategies to improve air quality and ensure compliance with national air quality standards.

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