EPA United States Environmental Protection Agency

Air Pollution: Current and Future Challenges

> ***Despite dramatic progress cleaning the air since 1970, air pollution in the United States continues to harm people's health and the environment. Under the Clean Air Act, EPA continues to work with state, local and tribal governments, other federal agencies, and stakeholders to reduce air pollution and the damage that it causes.***

All Clean Air Act Topics

- Learn about more about air pollution, air pollution programs, and what you can do.

Outdoor air pollution challenges facing the United States today include:

- Meeting health-based standards for common air pollutants
- Limiting climate change
- Reducing risks from toxic air pollutants
- Protecting the stratospheric ozone layer against degradation

Indoor air pollution, which arises from a variety of causes, also can cause health problems. For more information on indoor air pollution, which is not regulated under the Clean Air Act, see EPA's indoor air web site.

Air Pollution Challenges: Common Pollutants

Great progress has been made in achieving national air quality standards, which EPA originally established in 1971 and updates periodically based on the latest science. One sign of this progress is that visible air pollution is less frequent and widespread than it was in the 1970s.

However, air pollution can be harmful even when it is not visible. Newer scientific studies have shown that some pollutants can harm public health and welfare even at very low levels. EPA in recent years revised standards for five of the six common pollutants subject to national air quality standards. EPA made the standards more protective because new, peer-reviewed scientific studies showed that existing standards were not adequate to protect public health and the environment.

Status of common pollutant problems in brief

Today, pollution levels in many areas of the United States exceed national air quality standards for at least one of the six common pollutants:

- Although levels of **particle pollution and ground-level ozone pollution** are substantially lower than in the past, levels are unhealthy in numerous areas of the country. Both pollutants are the result of emissions from diverse sources, and travel long distances and across state lines.

  An extensive body of scientific evidence shows that long- and short-term exposures to fine particle pollution, also known as fine particulate matter ($PM_{2.5}$), can cause premature death and harmful effects on the cardiovascular system, including increased hospital admissions and emergency department visits for heart attacks and strokes. Scientific evidence also links PM to harmful respiratory effects, including asthma attacks.

  Ozone can increase the frequency of asthma attacks, cause shortness of breath, aggravate lung diseases, and cause permanent damage to lungs through long-term exposure. Elevated ozone levels are linked to increases in hospitalizations, emergency room visits and premature death.

  Both pollutants cause environmental damage, and fine particles impair visibility.

  Fine particles can be emitted directly or formed from gaseous emissions including sulfur dioxide or nitrogen oxides. Ozone, a colorless gas, is created when emissions of nitrogen oxides and volatile organic compounds react.

- For unhealthy peak levels of **sulfur dioxide and nitrogen dioxide**, EPA is working with states and others on ways to determine where and how often unhealthy peaks occur. Both pollutants cause multiple adverse respiratory effects including increased asthma symptoms, and are associated with increased emergency department visits and hospital admissions for respiratory illness. Both pollutants cause environmental damage, and are

byproducts of fossil fuel combustion.

- Airborne **lead** pollution, a nationwide health concern before EPA phased out lead in motor vehicle gasoline under Clean Air Act authority, now meets national air quality standards except in areas near certain large lead-emitting industrial facilities. Lead is associated with neurological effects in children, such as behavioral problems, learning deficits and lowered IQ, and high blood pressure and heart disease in adults.

- The entire nation meets the **carbon monoxide** air quality standards, largely because of emissions standards for new motor vehicles under the Clean Air Act.

In Brief: How EPA is working with states and tribes to limit common air pollutants

- EPA's air research provides the critical science to develop and implement outdoor air regulations under the Clean Air Act and puts new tools and information in the hands of air quality managers and regulators to protect the air we breathe.

- To reflect new scientific studies, EPA revised the national air quality standards for fine particles (2006, 2012), ground-level ozone (2008, 2015), sulfur dioxide (2010), nitrogen dioxide (2010), and lead (2008). After the scientific review, EPA decided to retain the existing standards for carbon monoxide. EPA strengthened the air quality standards for ground-level ozone in October 2015 based on extensive scientific evidence about ozone's effects.

- EPA has designated areas meeting and not meeting the air quality standards for the 2006 and 2012 PM standards and the 2008 ozone standard, and has completed an initial round of area designations for the 2010 sulfur dioxide standard. The agency also issues rules or guidance for state implementation of the various ambient air quality standards – for example, in March 2015, proposing requirements for implementation of current and future fine particle standards. EPA is working with states to improve data to support implementation of the 2010 sulfur dioxide and nitrogen dioxide standards.

- For areas not meeting the national air quality standards, states are required to adopt state implementation plan revisions containing measures needed to meet the standards as expeditiously as practicable and within time periods specified in the Clean Air Act (except that plans are not required for areas with "marginal" ozone levels).

- EPA is helping states to meet standards for common pollutants by issuing federal emissions standards for new motor vehicles and non-road engines, national emissions standards for categories of new industrial equipment (e.g., power plants, industrial boilers, cement manufacturing, secondary lead smelting), and technical and policy guidance for state implementation plans. EPA and state rules already on the books are projected to help 99 percent of counties with monitors meet the revised fine particle standards by 2020. The Mercury and Air Toxics Standards for new and existing power plants issued in December 2011 are achieving reductions in fine particles and sulfur dioxide as a byproduct of controls required to cut toxic

emissions.

- Vehicles and their fuels continue to be an important contributor to air pollution. EPA in 2014 issued standards commonly known as Tier 3, which consider the vehicle and its fuel as an integrated system, setting new vehicle emissions standards and a new gasoline sulfur standard beginning in 2017. The vehicle emissions standards will reduce both tailpipe and evaporative emissions from passenger cars, light-duty trucks, medium-duty passenger vehicles, and some heavy-duty vehicles. The gasoline sulfur standard will enable more stringent vehicle emissions standards and will make emissions control systems more effective. These rules further cut the sulfur content of gasoline. Cleaner fuel makes possible the use of new vehicle emission control technologies and cuts harmful emissions in existing vehicles. The standards will reduce atmospheric levels of ozone, fine particles, nitrogen dioxide, and toxic pollution.

Learn more about common pollutants, health effects, standards and implementation:

- *fine particles*
- *ground-level ozone*
- *sulfur dioxide*
- *nitrogen dioxide*
- *lead*
- *carbon monoxide*

Air Pollution Challenges: Climate Change

EPA determined in 2009 that emissions of carbon dioxide and other long-lived greenhouse gases that build up in the atmosphere endanger the health and welfare of current and future generations by causing climate change and ocean acidification. Long-lived greenhouse gases, which trap heat in the atmosphere, include carbon dioxide, methane, nitrous oxide, and fluorinated gases. These gases are produced by a numerous and diverse human activities.

In May 2010, the National Research Council, the operating arm of the National Academy of Sciences, published an assessment which concluded that "climate change is occurring, is caused largely by human activities, and poses significant risks for - and in many cases is already affecting - a broad range of human and natural systems." [1] The NRC stated that this conclusion is based on findings that are consistent with several other major assessments of the state of scientific knowledge on climate change.[2]

Climate change impacts on public health and welfare

The risks to public health and the environment from climate change are substantial and far-reaching. Scientists warn that carbon pollution and resulting climate change are expected to lead to more intense hurricanes and storms, heavier and more frequent flooding, increased drought, and more severe wildfires - events that can cause deaths, injuries, and billions of dollars of damage to property and the nation's infrastructure.

Carbon dioxide and other greenhouse gas pollution leads to more frequent and intense heat waves that increase mortality, especially among the poor and elderly.[3] Other climate change public health concerns raised in the scientific literature include anticipated increases in ground-level ozone pollution[4], the potential for enhanced spread of some waterborne and pest-related diseases[5], and evidence for increased production or dispersion of airborne allergens. [6]

Other effects of greenhouse gas pollution noted in the scientific literature include ocean acidification, sea level rise and increased storm surge, harm to agriculture and forests, species extinctions and ecosystem damage.[7] Climate change impacts in certain regions of the world (potentially leading, for example, to food scarcity, conflicts or mass migration) may exacerbate problems that raise humanitarian, trade and national security issues for the United States.[8]

The U.S. government's May 2014 National Climate Assessment concluded that climate change impacts are already manifesting themselves and imposing losses and costs.[9] The report documents increases in extreme weather and climate events in recent decades, with resulting damage and disruption to human well-being, infrastructure, ecosystems, and agriculture, and projects continued increases in impacts across a wide range of communities, sectors, and ecosystems.

Those most vulnerable to climate related health effects - such as children, the elderly, the poor, and future generations - face disproportionate risks.[10] Recent studies also find that certain communities, including low-income communities and some communities of color (more specifically, populations defined jointly by ethnic/racial characteristics and geographic location), are disproportionately affected by certain climate-change-related impacts - including heat waves, degraded air quality, and extreme weather events - which are associated with increased deaths, illnesses, and economic challenges. Studies also find that climate change poses particular threats to the health, well-being, and ways of life of indigenous peoples in the U.S.

The National Research Council (NRC) and other scientific bodies have emphasized that it is important to take initial steps to reduce greenhouse gases without delay because, once emitted, greenhouse gases persist in the atmosphere for long time periods. As the NRC explained in a recent report, “The sooner that serious efforts to reduce greenhouse gas emissions proceed, the lower the risks posed by climate change, and the less pressure there will be to make larger, more rapid, and potentially more expensive reductions later.”[11]

In brief: What EPA is doing about climate change

Under the Clean Air Act, EPA is taking initial common sense steps to limit greenhouse gas pollution from large sources:

- EPA and the National Highway and Traffic Safety Administration between 2010 and 2012 issued the first national greenhouse gas emission standards and fuel economy standards for cars and light trucks for model years 2012-2025, and for medium- and heavy-duty trucks for 2014-2018. Proposed truck standards for 2018 and beyond were announced in June 2015. EPA is

also responsible for developing and implementing regulations to ensure that transportation fuel sold in the United States contains a minimum volume of renewable fuel. *<Learn more about clean vehicles>*

- EPA and states in 2011 began requiring preconstruction permits that limit greenhouse gas emissions from large new stationary sources - such as power plants, refineries, cement plants, and steel mills - when they are built or undergo major modification. *<Learn more about GHG permitting>*

- On August 3, 2015, President Obama and EPA announced the Clean Power Plan – a historic and important step in reducing carbon pollution from power plants that takes real action on climate change. Shaped by years of unprecedented outreach and public engagement, the final Clean Power Plan is fair, flexible and designed to strengthen the fast-growing trend toward cleaner and lower-polluting American energy. With strong but achievable standards for power plants, and customized goals for states to cut the carbon pollution that is driving climate change, the Clean Power Plan provides national consistency, accountability and a level playing field while reflecting each state's energy mix. It also shows the world that the United States is committed to leading global efforts to address climate change. *<Learn more about the Clean Power Plan, the Carbon Pollution Standards, the Federal Plan, and model rule for states>*

The Clean Power Plan will reduce carbon pollution from existing power plants, the nation's largest source, while maintaining energy reliability and affordability. The Clean Air Act creates a partnership between EPA, states, tribes and U.S. territories – with EPA setting a goal, and states and tribes choosing how they will meet it. This partnership is laid out in the Clean Power Plan.

Also on August 3, 2015, EPA issued final Carbon Pollution Standards for new, modified, and constructed power plants, and proposed a Federal Plan and model rules to assist states in implementing the Clean Power Plan.

On February 9, 2016, the Supreme Court stayed implementation of the Clean Power Plan pending judicial review. The Court's decision was not on the merits of the rule. EPA firmly believes the Clean Power Plan will be upheld when the merits are considered because the rule rests on strong scientific and legal foundations.

On October 16, 2017, EPA proposed to repeal the CPP and rescind the accompanying legal memorandum.

- EPA is implementing its Strategy to Reduce Methane Emissions released in March 2014. In January 2015 EPA announced a new goal to cut methane emissions from the oil and gas sector by 40 – 45 percent from 2012 levels by 2025, and a set of actions by EPA and other agencies to put the U.S. on a path to achieve this ambitious goal. In August 2015, EPA proposed new common-sense measures to cut methane emissions, reduce smog-forming air pollution and provide certainty for industry through proposed rules for the oil and gas industry. The agency also proposed to further reduce emissions of methane-rich gas from municipal solid waste landfills. In March 2016 EPA launched the National Gas STAR Methane Challenge Program under which oil and gas companies can make, track and showcase ambitious commitments to reduce methane emissions.

- EPA in July 2015 finalized a rule to prohibit certain uses of hydrofluorocarbons -- a class of potent greenhouse gases used in air conditioning, refrigeration and other equipment -- in favor of safer alternatives. The U.S. also has proposed amendments to the Montreal Protocol to achieve reductions in HFCs internationally.

<Learn more about climate science, control efforts, and adaptation on EPA's climate change web site>

Air Pollution Challenges: Toxic Pollutants

While overall emissions of air toxics have declined significantly since 1990, substantial quantities of toxic pollutants continue to be released into the air. Elevated risks can occur in urban areas, near industrial facilities, and in areas with high transportation emissions.

Numerous toxic pollutants from diverse sources

Hazardous air pollutants, also called air toxics, include 187 pollutants listed in the Clean Air Act. EPA can add pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or to cause adverse environmental effects.

Examples of air toxics include benzene, which is found in gasoline; perchloroethylene, which is emitted from some dry cleaning facilities; and methylene chloride, which is used as a solvent and paint stripper by a number of industries. Other examples of air toxics include dioxin, asbestos, and metals such as cadmium, mercury, chromium, and lead compounds.

Most air toxics originate from manmade sources, including mobile sources such as motor vehicles, industrial facilities and small "area" sources. Numerous categories of stationary sources emit air toxics, including power plants, chemical manufacturing, aerospace manufacturing and steel mills. Some air toxics are released in large amounts from natural sources such as forest fires.

Health risks from air toxics

EPA's most recent national assessment of inhalation risks from air toxics[12] estimated that the whole nation experiences lifetime cancer risks above ten in a million, and that almost 14 million people in more than 60 urban locations have lifetime cancer risks greater than 100 in a million. Since that 2005 assessment, EPA standards have required significant further reductions in toxic emissions.

Elevated risks are often found in the largest urban areas where there are multiple emission sources, communities near industrial facilities, and/or areas near large roadways or transportation facilities. Benzene and formaldehyde are two of the biggest cancer risk drivers, and acrolein tends to dominate non-cancer risks.

In brief: How EPA is working with states and communities to reduce toxic air pollution

EPA standards based on technology performance have been successful in achieving large reductions in national emissions of air toxics. As directed by Congress, EPA has completed emissions standards for all 174 major source categories, and 68 categories of small area sources representing 90 percent of emissions of 30 priority pollutants for urban areas. In addition, EPA has reduced the benzene content in gasoline, and has established stringent emission standards for on-road and nonroad diesel and gasoline engine emissions that significantly reduce emissions of mobile source air toxics. As required by the Act, EPA has completed residual risk assessments and technology reviews covering numerous regulated source categories to assess whether more protective air toxics standards are warranted. EPA has updated standards as appropriate. Additional residual risk assessments and technology reviews are currently underway.

EPA also encourages and supports area-wide air toxics strategies of state, tribal and local agencies through national, regional and community-based initiatives. Among these initiatives are the National Clean Diesel Campaign, which through partnerships and grants reduces diesel emissions for existing engines that EPA does not regulate; Clean School Bus USA, a national partnership to minimize pollution from school buses; the SmartWay Transport Partnership to promote efficient goods movement; wood smoke reduction initiatives; a collision repair campaign involving autobody shops; community-scale air toxics ambient monitoring grants; and other programs including Community Action for a Renewed Environment (CARE). The CARE program helps communities develop broad-based local partnerships (that include business and local government) and conduct community-driven problem solving as they build capacity to understand and take effective actions on addressing environmental problems.

<Learn more about air toxics, stationary sources of emissions, and control efforts>
<Learn more about mobile source air toxics and control efforts>

Air Pollution Challenges: Protecting the Stratospheric Ozone Layer

The ozone (O_3) layer in the stratosphere protects life on earth by filtering out harmful ultraviolet radiation (UV) from the sun. When chlorofluorocarbons (CFCs) and other ozone-degrading chemicals are emitted, they mix with the atmosphere and eventually rise to the stratosphere. There, the chlorine and the bromine they contain initiate chemical reactions that destroy ozone. This destruction has occurred at a more rapid rate than ozone can be created through natural processes, depleting the ozone layer.

The toll on public health and the environment

Higher levels of ultraviolet radiation reaching Earth's surface lead to health and environmental effects such as a greater incidence of skin cancer, cataracts, and impaired immune systems. Higher levels of ultraviolet radiation also reduce crop yields, diminish the productivity of the oceans, and possibly contribute to the decline of amphibious populations that is occurring around the world.

In brief: What's being done to protect the ozone layer

Countries around the world are phasing out the production of chemicals that destroy ozone in the Earth's upper atmosphere under an international treaty known as the Montreal Protocol. Using a flexible and innovative regulatory approach, the United States already has phased out production of those substances having the greatest potential to deplete the ozone layer under Clean Air Act provisions enacted to implement the Montreal Protocol. These chemicals include CFCs, halons, methyl chloroform and carbon tetrachloride. The United States and other countries are currently phasing out production of hydrochlorofluorocarbons (HCFCs), chemicals being used globally in refrigeration and air-conditioning equipment and in making foams. Phasing out CFCs and HCFCs is also beneficial in protecting the earth's climate, as these substances are also very damaging greenhouse gases.

Also under the Clean Air Act, EPA implements regulatory programs to:

- Ensure that refrigerants and halon fire extinguishing agents are recycled properly.
- Ensure that alternatives to ozone-depleting substances (ODS) are evaluated for their impacts on human health and the environment.
- Ban the release of ozone-depleting refrigerants during the service, maintenance, and disposal of air conditioners and other refrigeration equipment.
- Require that manufacturers label products either containing or made with the most harmful ODS.

These vital measures are helping to protect human health and the global environment.

The work of protecting the ozone layer is not finished. EPA plans to complete the phase-out of ozone-depleting substances that continue to be produced, and continue efforts to minimize releases of chemicals in use. Since ozone-depleting substances persist in the air for long periods of time, the past use of these substances continues to affect the ozone layer today. In our work to expedite the recovery of the ozone layer, EPA plans to augment CAA implementation by:

- Continuing to provide forecasts of the expected risk of overexposure to UV radiation from the sun through the UV Index, and to educate the public on how to protect themselves from over exposure to UV radiation.
- Continuing to foster domestic and international partnerships to protect the ozone layer.
- Encouraging the development of products, technologies, and initiatives that reap co-benefits in climate change and energy efficiency.

<Learn more About EPA's Ozone Layer Protection Programs>

References

Some of the following links exit the site EXIT

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2 National Research Council (2010), *Advancing the Science of Climate Change*, National Academy Press, Washington, D.C., p. 286.

3 USGCRP (2009). *Global Climate Change Impacts in the United States*. Karl, T.R., J.M. Melillo, and T.C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA.

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6 Ibid.

7 An explanation of observed and projected climate change and its associated impacts on health, society, and the environment is included in the EPA's Endangerment Finding and associated technical support document (TSD). See EPA, "Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act," 74 FR 66496, Dec. 15, 2009. Both the Federal Register Notice and the Technical Support Document (TSD) for Endangerment and Cause or Contribute Findings are found in the public docket, Docket No. EPA-OAR-2009-0171.

8 EPA, *Endangerment Finding*, 74 FR 66535.

9. U.S. Global Change Research Program, Climate Change Impacts in the United States: The Third National Climate Assessment, May 2014.

10 EPA, *Endangerment Finding,* 74 FR 66498.

11 National Research Council (2011) *America's Climate Choices: Report in Brief*, Committee on America's Climate Choices, Board on Atmospheric Sciences and Climate, Division on Earth and Life Studies, The National Academies Press, Washington, D.C., p. 2.

12 EPA, *2005 National-Scale Air Toxics Assessment* (2011).

LAST UPDATED ON SEPTEMBER 17, 2019