

# Protecting the Environment

## *A Half Century of Progress*

Los Angeles, California, 1960s



Cuyahoga River, Ohio, 1952



EPA Alumni Association

April 2020



# Contents

Introduction . . . . .	3
Key Conclusions . . . . .	3
1. Growing Environmental Concerns in the Last Century . . . . .	5
2. Progress in Seven Specific Environmental Programs . . . . .	8
Cleaning the Air We Breathe . . . . .	8
Protecting and Restoring Our Water Resources . . . . .	11
Delivering Safe Drinking Water . . . . .	13
Managing the Generation and Disposal of Waste Streams . . . . .	16
Containing and Restoring Hazardous Waste Sites (Superfund) . . . . .	18
Controlling the Use of Dangerous Pesticides . . . . .	20
Providing Information On and Protecting Against Risks From Toxic Chemicals . . . . .	22
3. Other EPA Programs and Activities . . . . .	25
Emergency Response to Hazardous Waste Releases . . . . .	25
International Programs . . . . .	26
Voluntary Programs . . . . .	26
4. Achieving Environmental Justice . . . . .	27
5. Implementing Federal Environmental Laws . . . . .	29
6. Compliance and Enforcement . . . . .	31
Looking Forward . . . . .	32

## Preface

Former managers and staff of the U.S. Environmental Protection Agency (EPA) have formed an [EPA Alumni Association](#) (EPA AA). The Association has developed these materials to inform high school and college students and other members of the public about the major environmental problems and issues encountered in the United States, and the actions taken and progress made in mitigating these problems over the last half-century. We also want to highlight continuing and emerging environmental challenges we face today. The supporting reports provide additional information on the [air](#), [water](#), [drinking water](#), [waste disposal](#), “[Superfund](#)” land cleanup, [pesticides](#), and [toxic substances](#) programs managed by EPA and operated in conjunction with state, local, and tribal programs. We hope that, besides summarizing the history of U.S. environmental programs, these reports might inspire some students and others to consider careers in the environmental field.

A number of retired EPA program managers and subject matter experts worked together to produce the first editions of these reports in 2016. Additional experts updated the seven supporting reports in 2020 in recognition of the 50th anniversary of Earth Day and the creation of the EPA. Roy Gamse and John Bachmann updated this summary based on the supporting reports. Phyllis Flaherty wrote the enforcement section and Pamela Hill developed a new section on environmental justice. This updated report has been reviewed by relevant members the EPA AA Board of Directors and other alumni. We welcome comments on this document, which you may provide at this [EPA Alumni Association link](#).

The Association has also produced a *Teacher’s Guide* to facilitate the use of these materials by educators interested in including the *Half Century of Progress* in high school and college curricula. The *Guide* contains data interpretation and other questions related to the report topics, with answers. It also includes activities that challenge students to learn more about environmental issues in their communities, web-based resources for additional activities, and three lesson plans related to the HCP materials. These plans were designed and tested by three AP Environmental Science Teachers. Teachers may request a copy [here](#).

*This document was produced by the EPA Alumni Association, with graphic design and production support provided by Regina Scheibner (courtesy of Tetra Tech).*





# Introduction

Over the past half century, our country has made enormous strides improving the environment. The laws that were passed to protect the environment and the public policy decisions that were made have yielded substantial progress. The air is demonstrably cleaner, our waterways are getting cleaner, our drinking water is safer, there are lower levels of exposure to toxic chemicals affecting people and wildlife than would have occurred, toxic waste sites are being cleaned up, and millions of acres of the most scenic and valuable parts of our country's landscape—parks, wilderness areas, and wildlife refuges—are being protected.

None of this has come easily. There have frequently been significant costs. The decision-making process has often been protracted—sometimes by lengthy litigation. Still the progress is undeniable.

This progress is a result of laws that Congress passed and federal, state, tribal, and local agencies implemented. It is a result of investments of government and private sector dollars and the hard work of many communities, companies, and citizens across the land. They have reduced their environmental footprint and improved the way they do business and live their lives. It is the result of technological and policy innovations and the entrepreneurial spirit built into the DNA of the American people. Most of all, it is the result of Americans' ongoing support for clean air and water, as we recognize that protection of public health and the environment benefits millions of our fellow citizens.

*(continued on next page)*



## Key Conclusions

- Strong growth of an industrializing country over nearly two centuries led to increasingly negative effects on our air, water, and land, with accompanying serious effects on people's health and the environment.
- Beginning in the 1960s, federal, state, and local governments took concerted actions, enacting and implementing legislation that created strong regulatory programs to clean up the environment, protect public health and welfare, and prevent further degradation.
- Those programs have dramatically improved the environment, resulting in significant commercial and recreational benefits. They have also greatly enhanced protection of public health.
- However, significant cleanup remains, and action is needed to address climate change, other continuing and emerging challenges, and to maintain the benefits achieved so far.





## Introduction *(continued from previous page)*

It is essential to understand this history and the lessons and insights learned if we as a country are to tackle today's formidable challenges, such as:

- coping with the ongoing effects of climate change and the massive changes needed to reduce greenhouse gases here and in the rest of the world,
- the effects of nonpoint source (runoff) pollution on our waterways,
- issues raised by changing technology, such as biotechnology and nanotechnology, and
- safeguarding the natural resources that are the foundation of our economic and recreational activities.

Many Americans today, including many legislators at the federal and state levels, were not yet born when the U.S. Environmental Agency (EPA) was created by President Nixon in 1970, or they were too young to appreciate how air and water quality were deteriorating until governments, private companies, and individual citizens stepped up to take action.

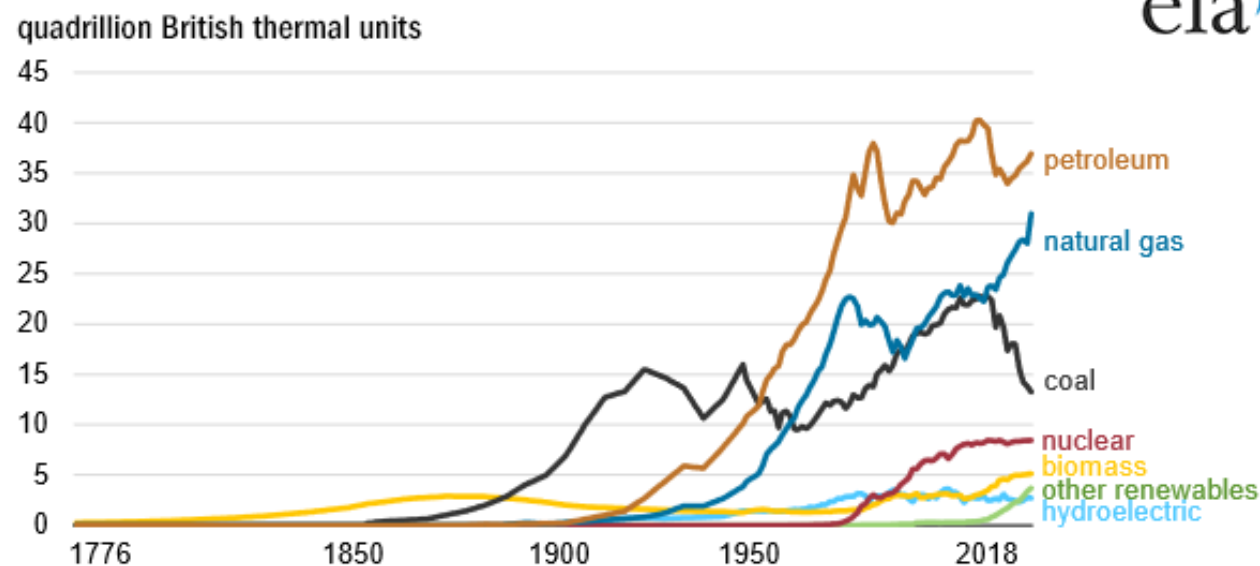
This report and seven supporting reports that provide more detail on the major environmental programs managed by EPA [available [here](#)] have been authored by many who worked long and hard to help achieve this progress. They document what has been accomplished and outline new challenges that need to be addressed to achieve a healthy, productive environment for all Americans, now and for generations to come.



# 1. Growing Environmental Concerns in the Last Century

The industrial revolution begun in the 1800s dramatically changed how society was organized and how energy and other resources were used in the U.S. and other nations. The result was rapid population growth, urbanization, and growth of extractive industries.

Energy consumption in the United States (1776-2018)



The industrial revolution prompted major changes in the amount and kind of energy used.

The mid-to-late 20<sup>th</sup> century brought a new understanding of the negative effects on human health, natural resources, and environmental quality. Here are a few of them:

- In 1948 the small industrial town of Donora, PA experienced an episode of dense industrial smoke and gases that sickened 40% of the population, resulting in 20 deaths. Other major episodes in New York City and London in the 1950s and 1960s showed that different kinds of air pollution in those areas could yield widespread effects on public health and far larger numbers of premature deaths.
- Until the 1962 publication of Rachel Carson's book, *Silent Spring*, pesticides were mainly viewed as a boon to the farmer. The initial pesticide legislation in 1910 focused on efficacy—whether the pesticides worked. Carson's book shifted attention to pesticides' effects on birds, nature, and humans.
- In the 1950s and '60s increased automobile emissions and industrial pollution in Los Angeles and other cities, combined with local topography and meteorology, resulted in "photochemical smog" that turned the sky brown, burned the eyes, and increased the rate of breathing disorders among vulnerable populations.

- Water pollution caused Cleveland's Cuyahoga River to catch fire in 1969 (see [cover photo](#) ), a phenomenon also seen in the Houston Ship Channel and the Chicago, Buffalo, and other rivers. Lake Erie was declared “dead” in the early 1970s due to massive algal blooms and widespread fish kills.
- The 1969 blowout of an oil well offshore of Santa Barbara, California, released 80–100,000 barrels of crude oil, killing an estimated 3,500 seabirds as well as dolphins, seals, and sea lions.
- In the 1960s and '70s new reports regularly revealed problems from chemicals, such as people and cattle being poisoned by polybrominated biphenyls (PBBs) mistakenly mixed into cattle feed, chlorofluorocarbons (CFCs) depleting the ozone layer, asbestos causing lung cancer, and the suspected high incidence of cancers from chemicals improperly disposed of in places like Love Canal in New York and the “Valley of the Drums” in Kentucky.
- *Time* magazine raised concerns about chemical exposure with a cover story in September 1980, “[The Poisoning of America](#).”

Growing awareness of widespread environmental degradation led to a consensus that we needed to protect American health and environmental quality from the damages and risks of pollution. The nation started to take concerted actions to address

environmental issues in an organized way in 1970. Highlights of this transformative year include:

- **President Nixon signed the National Environmental Policy Act** on the first day of 1970, inaugurating what he called “the decade of the environment.”
- The **first Earth Day**, April 22, recognized a growing public concern for the environment, with rallies of up to 25,000 people in major cities and “teach-ins” at thousands of schools involving an estimated 20 million mostly young people.
- In July, **President Nixon sent Congress a plan** that combined most existing federal pollution programs into a single department, **creating the U.S. Environmental Protection Agency** in December (play the video below).





- Congress enacted and **President Nixon signed the landmark 1970 Clean Air Act**, which strengthened earlier legislation by requiring nationwide health-protecting air quality standards, state plans to meet those standards, and emissions standards for new industrial plants and automobiles.

This flurry of activity was followed by bipartisan Congressional passage of over a dozen major statutes over the next 10 years, setting ambitious goals and assigning responsibility for attaining them to federal, state, and local programs. These included:

- Clean Water Act (1972)
- Federal Environmental Pesticide Control Act (1972)
- Safe Drinking Water Act (1974)
- Resource Conservation and Recovery Act (1976)
- Toxic Substances Control Act (1976)
- Comprehensive Environmental Response, Compensation, and Liability Act, commonly known as Superfund (1980)

The requirements of these laws varied by program, but they generally involved EPA providing science-based criteria for environmental standards (such as health-protective air quality standards) as well as technology-based requirements to limit releases from new (and, in some programs, existing) facilities to protect human health and environmental quality. States (or tribes) were expected to design and then implement programs to meet these requirements in their jurisdictions. These laws generally required EPA to oversee state and tribal programs, intervene where they were unable or unwilling to meet their obligations under the law, and provide federal grants for municipal wastewater treatment. EPA was also given direct responsibility for licensing pesticides and overseeing safe introduction of new chemicals into our society.

Once among the most polluted rivers in the United States, the Cuyahoga River is now a Cleveland attraction. Photo courtesy of [wyliepoon](#), flickr.





## 2. Progress in Seven Specific Environmental Programs

A lesson of the past half-century is that environmental issues must be addressed in an integrated way. It does no good to capture toxic air or water emissions and deposit them on unprotected land, only to contaminate groundwater or cause public exposure. **That's fundamentally why an integrated EPA was established in 1970**, along with its counterparts in the states. Nonetheless, the statutes governing environmental protection are structured by program and use varying approaches. What follows is a capsule review of the progress made under each such program, with links to more detailed reports for each at the [EPA Alumni Association \(EPA AA\) website](#). These documents contain relevant materials and references that support key developments and results presented here.

### Cleaning the Air We Breathe

Air pollution was perhaps the most visible environmental problem a half century ago because of the heavy smog in Los Angeles, Pittsburgh, and other industrialized cities. Studies reported excess deaths during severe air pollution episodes in Donora, PA (20 in October 1948), London (4,000+ in 1952), and New York City (200 in November 1953, 170 in November 1966). Air pollution endangered the health of both young and elderly people and threatened the lives of those with lung or cardiovascular diseases.

As science and public awareness tied air pollution to industrial and auto emissions, a broad consensus led Congress to adopt

the 1970 Clean Air Act Amendments, greatly strengthening earlier legislation passed in the 1960s. The 1970 amendments directed EPA to set air quality standards based on scientific criteria and to establish national technology-based standards for motor vehicles and new industrial facilities. States were required to develop plans for meeting the air quality standards, including setting emissions standards for existing facilities. Those requirements were augmented and adjusted in the 1977 and 1990 Clean Air Act Amendments, the latter tightening motor vehicle emission standards, addressing acid rain impacts from power plants with an innovative market-based program, strengthening limits on toxic



**New York City, 1966.** Smog blankets New York City in late November 1966. Records indicate that the city recorded 170 excess deaths during this Thanksgiving episode. Photo: Neil Borzoi, *The New York Times*/Redux.

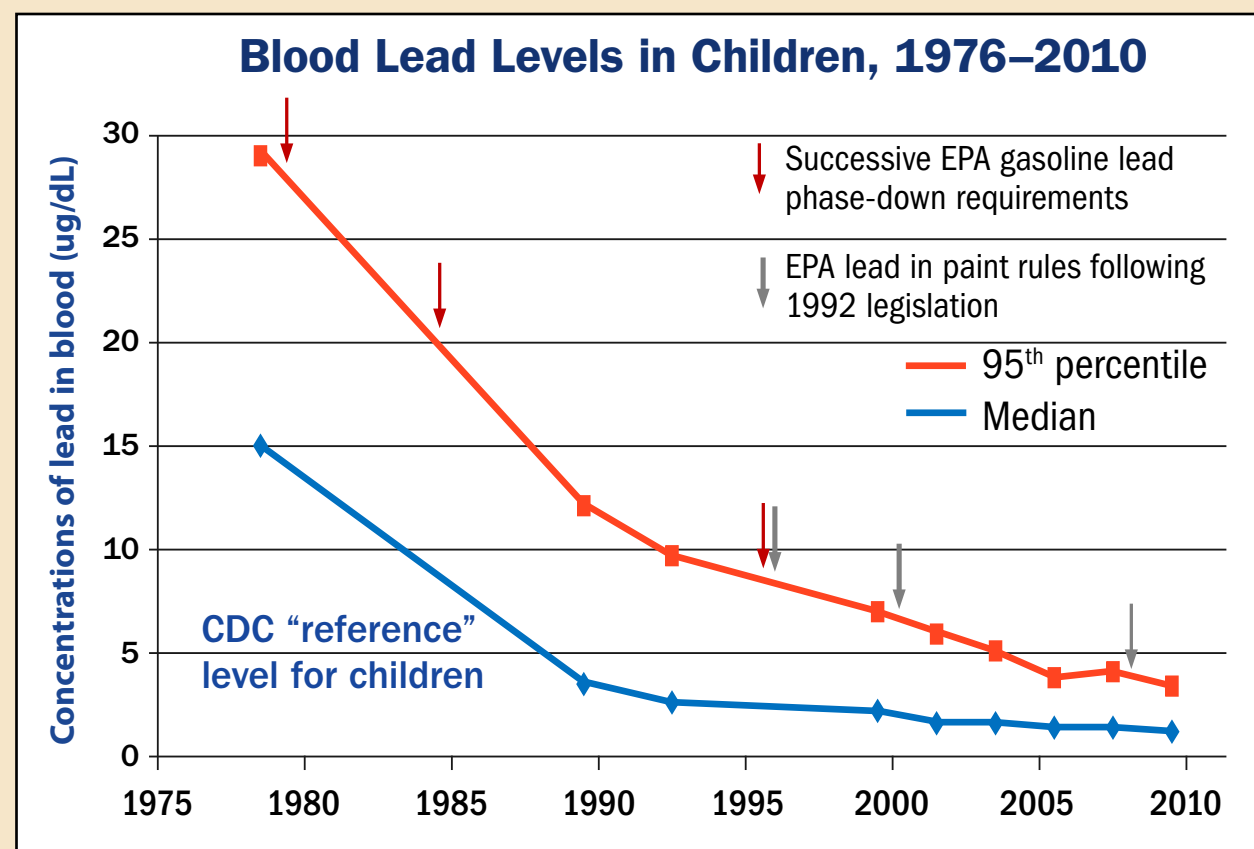
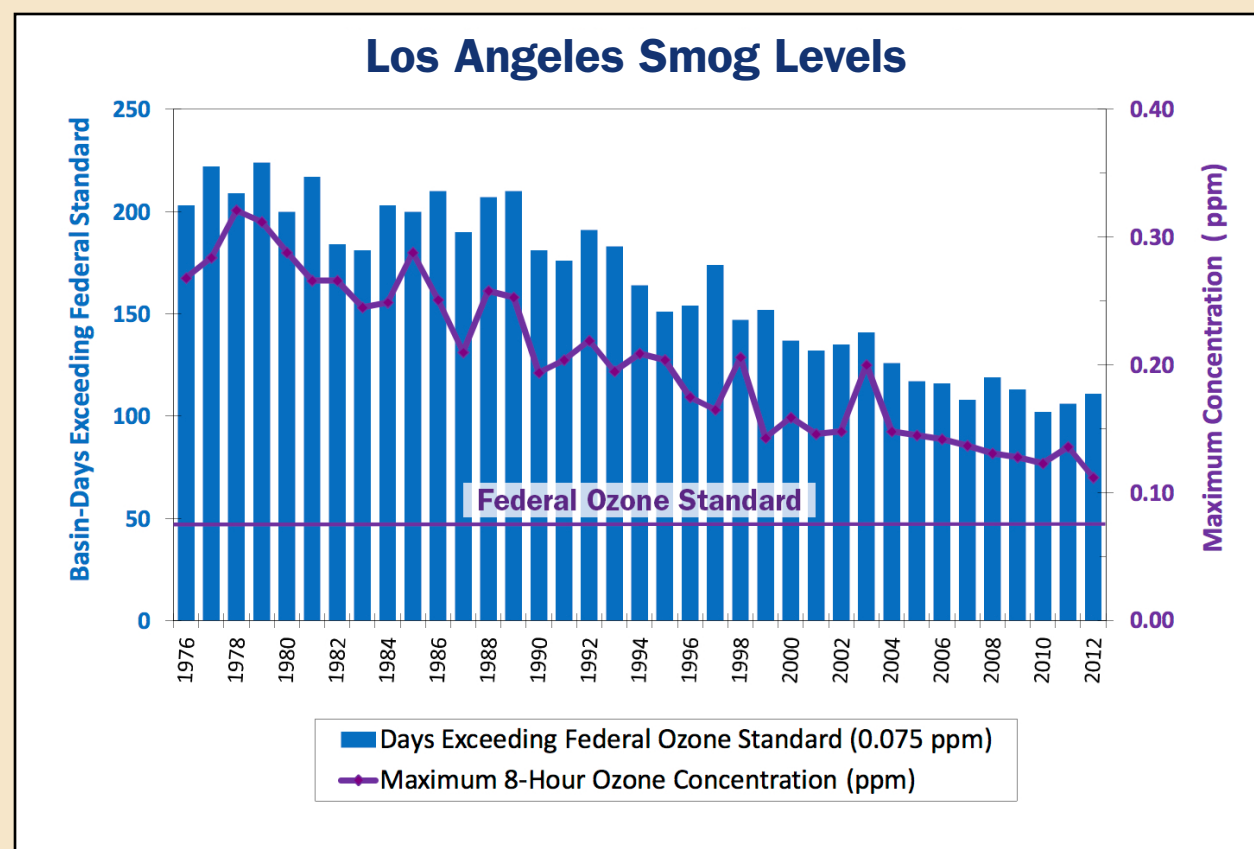


air pollutants, protecting the stratospheric (good) ozone layer, and requiring states to issue operating permits for pollution sources.

As a result, there have been dramatic reductions in levels of air pollution:

- Automotive emissions have been reduced well over 90% per mile driven, leading to significant reductions in national emissions and in smog levels despite 400% growth in miles driven since 1970.

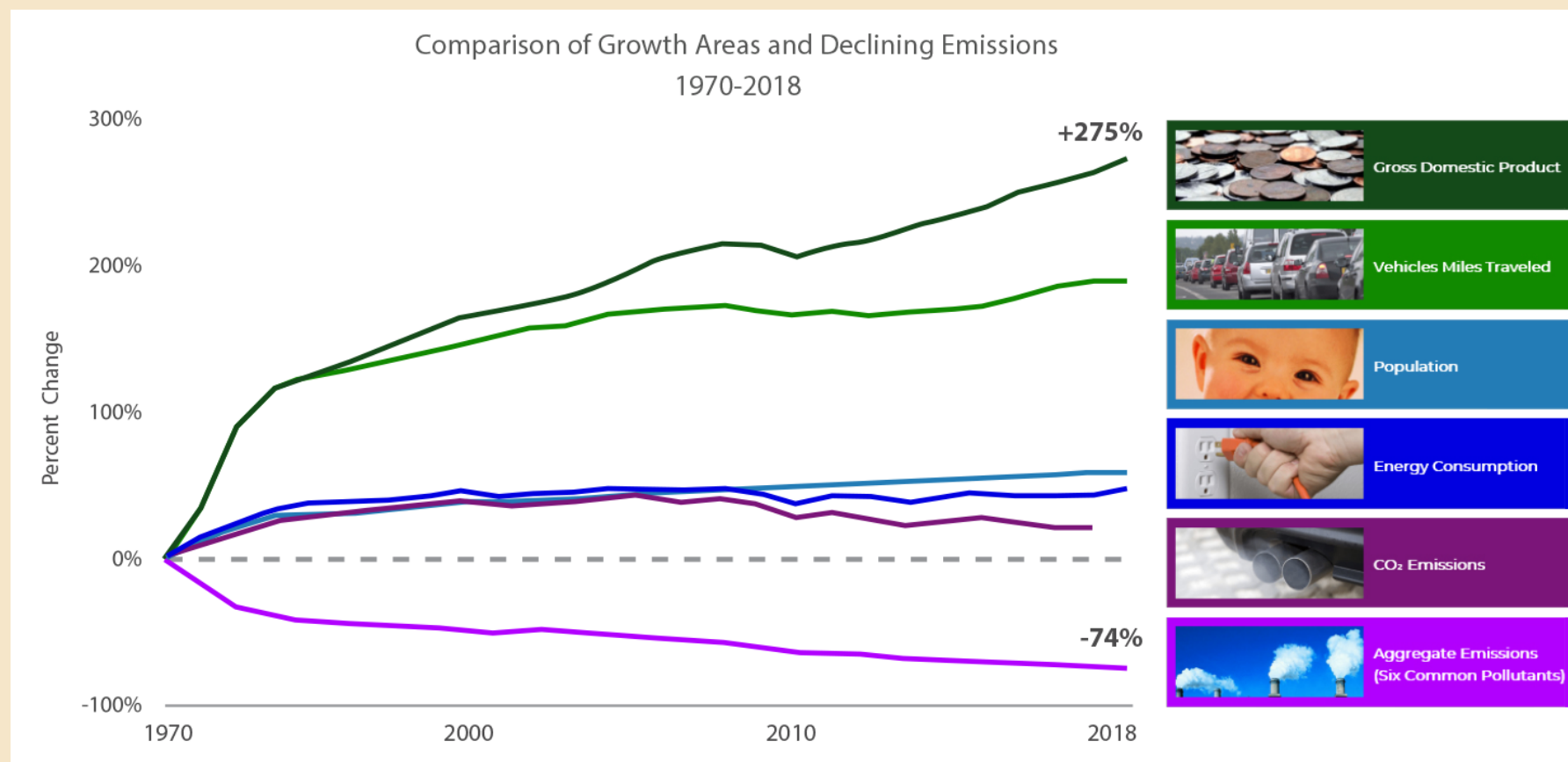
- Average lead concentrations in children's blood (which harms neurological development of children, affecting behavior and IQ) have fallen over 90%, in significant part from removing lead from gasoline.
- Aggregate emissions of six key air pollutants have fallen by 74% since 1970, though population has grown 58% and GDP by 275% in the same period.
- Analysis shows that clean air programs are preventing tens of thousands of early deaths each year.



**A Clean Air Success Story.** Controlling motor vehicle emissions. Catalytic converters were effectively required on new cars nationwide by the mid-1970s, and standards for vehicles and gasoline have been strengthened periodically. *Above:* Air monitoring showed dramatic reductions in Los Angeles smog resulted from these and other regulations. This chart depicts the 2008 EPA 8-hour ozone standard. EPA strengthened that standard to 0.70 ppm in 2015.

EPA's phase down (red arrows) of lead in gasoline was a major cause of reduced blood lead levels in the most exposed (red line) and average children (blue line) below Center for Disease Control (CDC) target values. Rules to reduce children's exposure to lead in paint helped to continue the decline in later years.

**Clean Air Act programs reduced national emissions of regulated air pollutants despite growth in societal activities.** This graph shows the percentage decrease in emissions of six air pollutants (74%) regulated under the 1970 Clean Air Act relative to their combined levels in 1970 (0% change), contrasted with the relative expansion of four societal/economic activities. Since 1970, emissions of regulated pollutants (dark green line) have steadily declined despite continued growth in population, energy consumption, traffic, and the economy. By contrast, carbon dioxide (CO<sub>2</sub>), which was not targeted by these programs until 2012, has mainly tracked trends in energy consumption and traffic. The recent downturn in CO<sub>2</sub> emissions that began with the 2009 recession has continued due to several factors, including a leveling of total vehicle miles, a reduction in coal combustion for electric power generation as some power plants switched to natural gas, and a significant increase in power generation from renewable sources, particularly wind and solar (see [energy consumption figure](#) on page 5).



Despite this progress, formidable air pollution challenges remain:

- Some U.S. cities still do not meet health-protective air quality standards.
- Recent analyses show that premature deaths may result from fine particles and ozone even after new standards for motor vehicles and power plants are implemented.
- Despite the widespread scientific consensus regarding the threat of continued emissions of greenhouse gases (GHG) through climate change, there has been insufficient action

to slow or reverse these effects. Recent U.S. regulations such as the 2012 GHG auto emissions limits and the August 2015 Clean Power Plan have been withdrawn or weakened. Broad global commitments to GHG reductions from almost 200 nations were formalized in the December 2015 United Nations Paris accords, reflecting a global recognition of the seriousness of the threat of climate change in the 21<sup>st</sup> century. Yet the U.S. plans to withdraw from the accords and progress from other nations has been limited.

For more detail, see the air program report [here](#).



## Protecting and Restoring Our Water Resources

In the 1960s, U.S. rivers, lakes, streams, coastal waters, and wetlands were in deplorable condition. Extraordinary events such as Cleveland's Cuyahoga River catching fire (as did the Buffalo and Chicago Rivers and Houston Ship Channel) accentuated concerns that many rivers were unsafe for drinking or recreational purposes such as swimming or fishing.

The bipartisan 1972 Clean Water Act greatly strengthened laws passed in 1899, 1948, and 1965 by requiring EPA to 1) identify water quality criteria (specifying the level of pollutants allowable for habitat, recreation, and other uses) and 2) establish requirements for treatment of industrial and municipal wastewater. The Clean Water Act outlined a local/state/federal partnership, requiring states to set local water quality standards and implement permit systems for controlling industrial and municipal discharges. The Act also established grant and low interest loan programs, which together have resulted in over \$190 billion for construction of municipal sewage treatment systems. Other provisions addressed discharges to or disruption of wetlands, as well as control of stormwater.

There have been substantial reductions in water pollution discharges, and as a result:

- The jarring instances of burning rivers, visible floating discharges, noxious odors, daily sewage overflows, and widespread fish kills have been dramatically reduced.



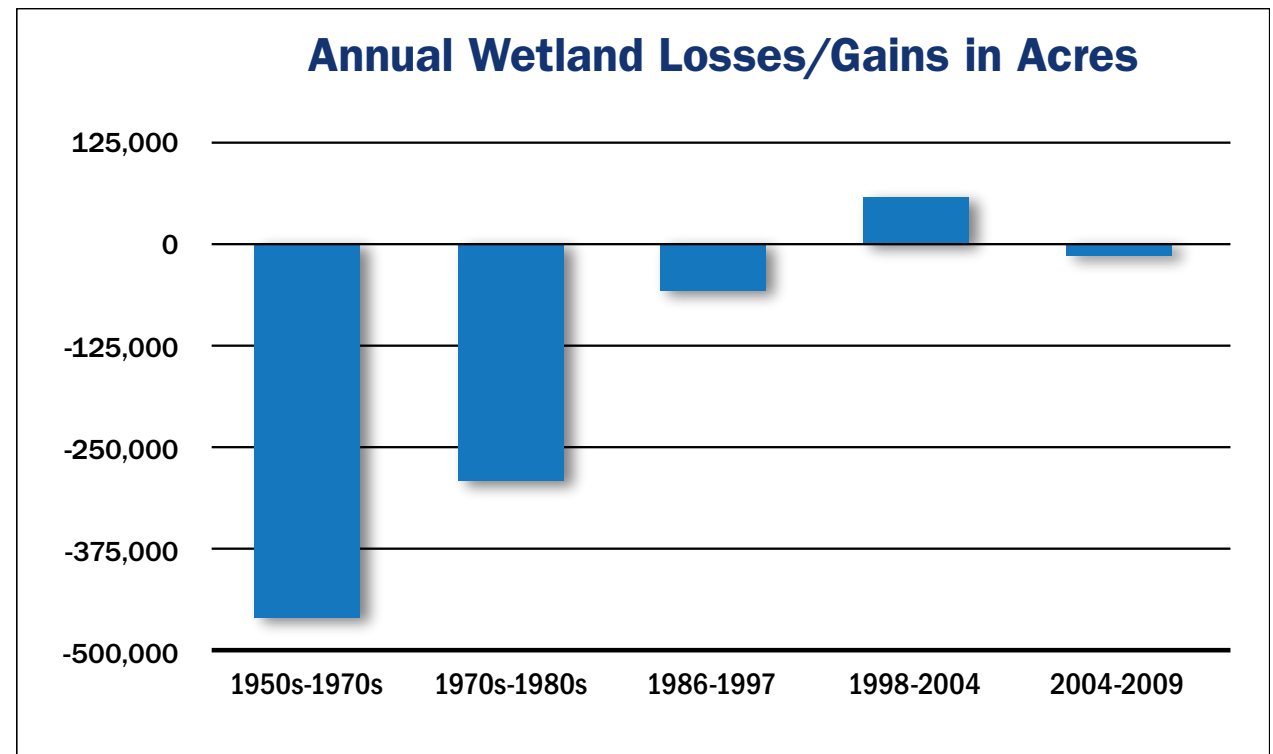
**Detroit River Recovery.** Top: Waste from the Rouge River flows into the Detroit River. (1966). Photo: Michigan Department of Natural Resources. Water pollution took a heavy toll on the ecosystem. Bottom: Today, large sturgeon and other fish have returned to the river thanks to clean water programs. Photo: U.S. Fish and Wildlife Service.



- States have written discharge permits supported by EPA guidelines for 57 industries, resulting in a huge reduction of pollutant discharges to U.S. waters.
- Between 1972 and 2008, the number of people served by sewer systems increased by more than 50%. Whereas 44% of them provided only basic (less stringent) treatment in 1972, by 2008, 98% included more stringent secondary treatment, removing 85% of solids and organic pollution. Many were built to provide much more stringent tertiary treatment.
- Stormwater overflows to local waterways are now managed by about 7,000 municipal, 90,000 industrial, and 121,000 stormwater discharge permits issued primarily by state agencies.
- The annual loss of wetlands has slowed by 96% from the rates of the 1970s and '80s due to the control of fill and other discharges to wetlands under the permit program operated by the U.S. Army Corps of Engineers and EPA, as well as programs undertaken to restore wetlands.

Significant water resource management challenges remain. For example:

- Polluted runoff from streets, farms, and other land has not been adequately reduced, with nutrients from these sources degrading lakes and estuaries, endangering the Chesapeake Bay ecosystem, and creating a large dead zone in the Gulf of Mexico.



- A variety of pollutants that are not well understood, including pharmaceuticals and plastic microbeads from cosmetics and toothpaste, are entering our waters. They are not completely removed by sewage treatment processes, potentially affecting fish and entire aquatic ecosystems.
- Maintaining and upgrading aging municipal wastewater infrastructure in the face of budget pressures is a major concern.
- The need to address the impacts of climate change and related effects of sea level rise, ocean warming, and ocean acidification is growing.

For more detail, see the water resources program report [here](#).



## Delivering Safe Drinking Water

The link between unsafe drinking water and disease (e.g., cholera, typhoid) was first recognized in the 1850s. By the beginning of the 20<sup>th</sup> century, techniques to reduce microbial content by filtration and disinfection with chlorine had virtually eliminated fatal epidemics of these classic waterborne diseases in industrialized countries. However, in the 1970s, detection of new potentially toxic and possibly cancer-causing chemicals in previously immeasurable concentrations, coupled with uneven state oversight of public water supplies, revived concerns about public health risks from drinking water.

The 1974 Safe Drinking Water Act (SDWA) required EPA to create scientifically based drinking water standards for all systems serving more than 25 people, thus covering systems serving over 300 million people. Under the provisions of this law:

- Enforceable interim standards were to be set, updating preexisting standards that had been largely advisory. Then more comprehensive revisions were to be based on a study of health risks from drinking water contaminants conducted by the National Research Council of the National Academy of Sciences.
- Program grants funds were to be distributed by EPA to build states' institutional capacity and enhance their ability to enforce the interim standards.
- EPA established science-based standards for 88 individual chemicals and all radionuclides, disinfection byproducts, and *E. coli* bacteria, as well as technology standards for surface water supplies and groundwater disinfection.
- EPA issued the Lead and Copper corrosion control rule in 1991, which was updated in 2000 and 2007. Water suppliers must regularly test for excessively corrosive drinking water at taps in highest risk distribution system locations. If corrective actions to reduce corrosivity are insufficient, then a schedule for removing lead service lines is required.



- In addition to setting standards, EPA issued a series of Health Advisories that help states and drinking water systems deal with emergencies such as spills and detection of unregulated contaminants of concern.

The Act was further strengthened by 1996 amendments, providing for federal contributions to a State Drinking Water Revolving Fund to help water supply systems achieve the health protection objectives of the SDWA. With federal investment of over \$17.3 billion, the fund has provided \$27.9 billion to water systems through 2014.

In 2014 a sudden increase in lead in drinking water in Flint, Michigan, was caused by a water switching its water to a more corrosive source, leading to major anxieties and significant conflicts in the community. In December 2019, EPA proposed revisions its drinking water rules to further reduce lead exposure.

As a result,

- Many states have developed sophisticated programs to oversee the quality of drinking water from public water systems.
- Drinking water systems today treat for a wider range of contaminants, some of which were unknown or unmeasurable a half-century ago.



**National Guard delivering bottled water to Flint Michigan residents March 2016.** *Photo: Army Master Sgt. Daniel Griego, Texas National Guard.* In 2014 a sudden increase of lead in drinking water in Flint, Michigan was caused by the water utility switching its water supply to a more corrosive source, without the addition of an appropriate corrosion inhibitor to the water. This serious and prolonged degradation in water quality as well as in the pipes that delivered the water to users led to major anxieties and significant conflicts in the community. The switch in water source violated EPA's 1991 regulations and standard industry practice, but authorities were slow to respond. Most residents switched to bottled water because of the unpleasant appearance and odor of their tap water, which helped limit increases in blood lead in children. The change was, however, believed to be linked to at least 12 deaths and more illness from Legionnaire's disease. Legionella bacteria levels were elevated in the water delivery system during this period. In December 2019, EPA proposed revisions to its drinking water rules to further reduce lead exposure.



- Public awareness of drinking water quality issues has been enhanced by requirements for periodic reporting to customers when standards are not met in their water systems.
- The annual number of waterborne disease outbreaks reported by the Centers for Disease Control has progressively declined since 1980.
- By 1995, 70% of the water systems serving fewer than 100 people were providing appropriate treatment (vs. about 33% in 1976, and vs. about 95% for systems serving over 10,000 people).
- By 1993, 79% of the U.S. population got its drinking water from public water systems that consistently met EPA health-based standards, and that percentage increased to about 91% after about 1999 despite the introduction of new health-based standards during that period.

Today about 7% of people using community water systems are estimated to have any remaining lead service lines.

The major remaining issues are:

- addressing disease risks from inhalation of aerosols with bacteria such as *Legionella* that regrow in plumbing during water distribution,
- facilitating the introduction of new technologies for reusing treated wastewater and desalinating water in water-short areas, and
- maintaining, upgrading, and replacing deteriorating infrastructure (e.g., 100-year old pipes). Cost estimates are from \$384 billion to \$1 trillion in the next 20 years.
- The need to address risk of [PFAS](#) in drinking water, persistent chemicals for which [EPA issued health advisories in 2016](#).

For more detail, see the safe drinking water program report [here](#).

## Managing the Generation and Disposal of Waste Streams

Before the U.S. began seriously regulating waste disposal, public health was put at risk by solid and liquid waste, often containing toxic materials, disposed of in rivers, burned in open pits, or dumped into unlined landfills or evaporation ponds. The result was fire hazards, odors, and contamination of land, surface water, and groundwater.

The 1976 Resource Conservation and Recovery Act (RCRA) amended the 1965 Solid Waste Disposal Act. RCRA set requirements for managing hazardous waste from generation to disposal and provided enforcement authorities. It banned open dumping, regulated municipal solid waste landfills, and promoted reduction of waste at the source, recycling and safe disposal of non-hazardous waste. States implement RCRA through permits for waste management and disposal of and enforcement of the requirements.

The 1984 Hazardous and Solid Waste Amendments (HSWA) required states to implement a Corrective Action Program for managing and cleaning up hazardous waste sites. It also required rules for land disposal to protect groundwater and for underground storage of petroleum products and hazardous substances.





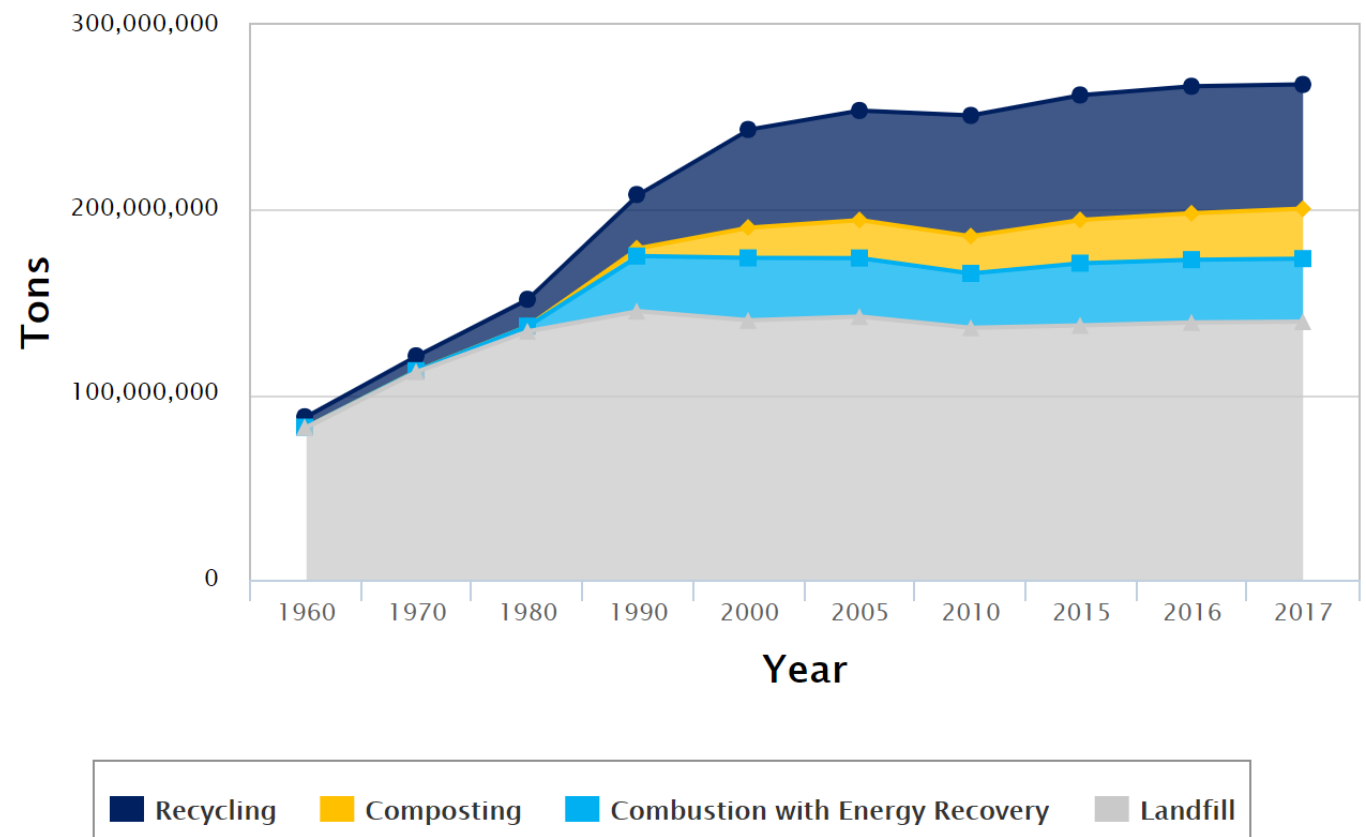
This legislation has created a comprehensive federal/state cradle-to-grave infrastructure for hazardous waste and a framework for states to govern disposal of municipal and non-hazardous waste. As a result:

- Municipal solid waste (MSW) delivered to landfills has declined since 1990 with 34% of MSW recycled and composted, and 13% combusted with energy recovery by 2017.
- Restrictions on industrial and commercial wastes and on land disposal encourage minimization of waste disposal through reuse, recycling, and reduction of waste generation, helping to protect the 80% of U.S. citizens who live within three miles of the 60,000 facilities generating 20–40 million tons of hazardous waste annually.
- Up to 18 million acres of contaminated lands have been cleaned up and restored to productive use.

The remaining challenges include:

- Completing corrective actions on thousands of facilities that have not yet been cleaned up under the Corrective Action Program,
- New hazardous wastes are being created by changes in technology. EPA needs to identify those wastes so they can be safely managed. The most prominent example is a

Municipal Solid Waste Management: 1960–2017



class of compounds called [PFAS](#). As a result of their use in both consumer and industrial products, the chemicals now are being found in groundwater aquifers across the U.S., especially near municipal landfills, airports and military air bases. PFAS chemicals are toxic at low concentrations, are persistent, and bio-concentrate up the food chain, making them a potential threat. Other emerging concerns are plastics and other products of nano-technology.

For more detail, see the managing waste streams program report [here](#).

## Containing and Restoring Hazardous Waste Sites (Superfund)

Before the 1970s, there were few controls on hazardous waste disposal. Wastes were disposed of onsite or frequently taken elsewhere by contractors to locations unknown by the waste generators. Unscrupulous transporters often used dump sites and disposal methods that led to significant harm to groundwater, surface water, and soil, leaving a legacy of sites exposing the public to health risks and damaging the environment.

In the late 1970s, revelations of some of the worst such sites—such as Love Canal in Niagara Falls, NY and “the Valley of the Drums” outside Louisville, KY—led to recognition of the need to clean up hazardous sites where the waste generators were often unknown or financially incapable of doing so.

In 1980 Congress passed the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), soon nicknamed “Superfund.” The new law ensured cleanup of hazardous waste sites at the expense of owners, waste generators, or transporters, where identifiable, or at public expense where they were not. Superfund funding started at \$1.6 billion, subsequently increased to \$8.5 billion.

Early emergency response efforts reduced public health threats at a number of sites. However, cleanup of the more complex sites was problematic, criticized by some because of huge costs, long timeframes, and concerns about program management



Cleanup of [Superfund site in Edgewater, N.J.](#)

Photos: EPA (above), NOAA (left).

capabilities and approaches. More recently, with clearer delineation of processes and responsibilities, remediation of hazardous waste sites has continued. Responsible parties carry out the cleanup under supervision of EPA and the states (for less contaminated sites). The federal government is responsible for cleaning up former or current federal facility sites, such as those under the Energy and Defense Departments.



Much progress has been made and as of 2018, clean-ups had eliminated unacceptable human exposures at 1,526 superfund sites. From 1980 through 2019 [EPA Reports](#):

- Of the 1,700 sites were included in the original Superfund list, 424 sites were cleaned up and removed from the list
- Of the remaining 1,335 national priority sites:
  - ▶ 1,212 sites had completed construction of cleanup facilities, but require ongoing operation to remain safe
  - ▶ 82 sites had partial area removed from the list
  - ▶ 51 new priority Superfund sites have been proposed

Despite this progress, important challenges remain for the Superfund program:

- With the easier sites remediated, the remaining sites tend to be difficult, massive sites, such as mine tailing and sediment cleanups, with costs in the hundreds of millions, even billions of dollars per site.
- With such large, difficult sites dominating the program, other smaller sites are not getting the attention that local residents demand.



Valley of the Drums, near Louisville, KY 1981. Photo: EPA.

- Ironically, contamination of past or current federal facilities presents particular problems because of the number of such sites, EPA's difficulty in requiring action from other agencies, and the complexity of dealing with Energy Department radioactive waste sites.

For more detail, see the "Superfund" program report [here](#).

## Controlling the Use of Dangerous Pesticides

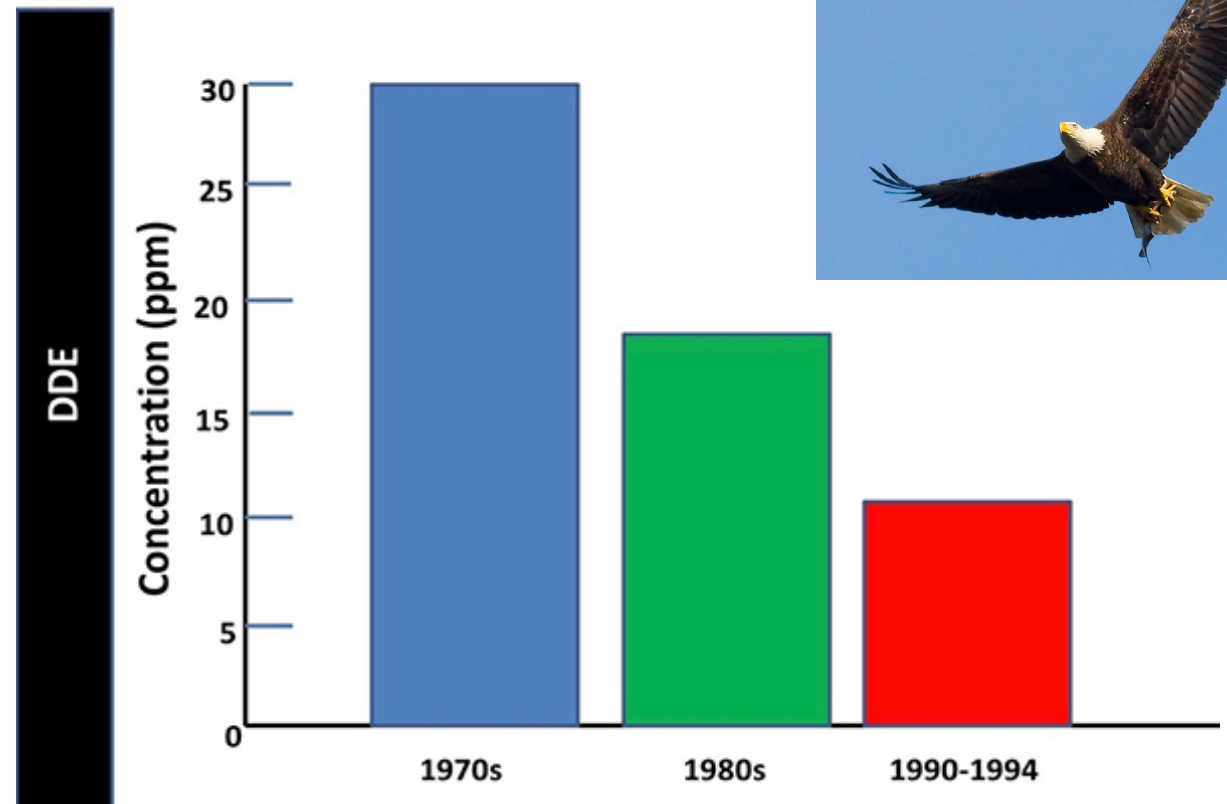
Publication of Rachel Carson's book, *Silent Spring*, led to a shift in legislative focus from boosting agricultural production to reducing negative effects on birds, people, and nature.

Driven by that concern, the 1972 amendments to the Federal Insecticide Fungicide and Rodenticide Act [FIFRA] required EPA to assess the potential risk of pesticides to humans, wildlife, and the environment. That legislation allowed EPA to refuse to allow pesticides in the market based on adverse health or environmental effects. However, many pesticides allowed in the market under the pre-1972 rules were essentially grandfathered. EPA was required to reconsider whether existing pesticides would be allowed to stay on the market, which required test data using more modern requirements.

New scientific concern about the effect of pesticides on children led to the 1996 Food Quality Protection Act which required EPA to review allowable limits of pesticide residues in food products, with extra safety factors for children and consideration of additional routes of human exposure, such as through drinking water.

The total reorientation of pesticide regulation from focusing on efficacy to protecting health and the environment has had major impacts:

- In 1972, EPA banned virtually all uses of the pesticide DDT and began the process of removing similar chemicals (the organochlorines) from the market. Endangered bald eagles,



**Pesticide Residues in Bald Eagle Eggs on Lake Erie 1970–1994.** Banning DDT in 1972 reduced associated pesticide residues (DDE) that had weakened bird eggs, leading to recovery of bald eagle, brown pelican, and peregrine falcon populations in the US.

Photo: U.S. Fish and Wildlife Service.

brown pelicans, and peregrine falcons have recovered from the brink of extinction, and organochlorines are now off the market in the U.S.

- The process of EPA reviewing whether to allow pesticides to remain on the market led to removal of some risky pesticides and discontinuation of thousands of other products by their manufacturers.



- The review of nearly 10,000 limits for pesticide residues on food under the 1996 Food Quality law led to removal of many of the more toxic products from the market.

New issues are appearing that may alter the future of pesticide regulation:

- Pesticides are suspected of contributing to the dramatic decline in the number of butterflies, honeybees, frogs, and other species. Declining numbers of pollinators is particularly of concern in food production.
- Concerns about the effects of certain pesticides on endocrine systems that produce hormones affecting physical or intellectual growth, as well as reproduction, are causing EPA to review pesticides and other chemicals in drinking water for endocrine effects, requiring development of new test methods.
- Genetic modification of plants to repel insects or resist herbicides results in these plants being classified as pesticides that must be approved by EPA, drawing EPA into the controversies surrounding genetically modified organisms (GMOs).
- Growing use of nanotechnology (extremely tiny particles) in pesticides requires new testing and analytic methods since nano-sized particles often have different characteristics than their larger counterparts.



Wild honey bee (*Apis mellifera*). Photo: Bob Peterson, flickr.

For more detail, see the pesticides program report [here](#).



## Providing Information On and Protecting Against Risks From Toxic Chemicals

News reports in the 1960s and '70s highlighted concerns about chemicals causing health or environmental problems, such as asbestos-causing lung cancer, chlorofluorocarbons depleting the Earth's ozone layer, PBBs poisoning cattle, and toxic PCBs showing up in unexpected places. A political consensus evolved that the risks from thousands of unknown chemicals being released into the environment needed to be evaluated and addressed.

The first step in response to this concern came in 1976 with the enactment of the Toxic Substances Control Act (TSCA), which gave EPA broad authority to (a) collect information about chemical hazard, exposure and use; (b) screen all “new” chemicals for health and environmental effects before they entered commerce; (c) regulate existing chemicals as needed to eliminate unreasonable risks; and (d) phase out PCBs. Congress amended TSCA several times over the following years directing EPA to address additional specific chemicals of concern, including asbestos, lead, formaldehyde and mercury. In 2016, Congress enacted a broad set of reforms to TSCA, which eliminated statutory obstacles to effective action by EPA, established clearer procedures for action on existing chemicals, tightened the standard of protection under the law, and increased transparency for the chemical information that EPA collects.



Photo Above: National Oceanic and Atmospheric Administration.

In 1986, in response to two tragic chemical plant accidents, Congress enacted another important chemical regulation law, the Emergency Planning and Community Right to Know Act. Among other things, this law required EPA to establish a Toxic Release Inventory (TRI) that would assemble information about releases of toxic chemicals from facilities in major industrial sectors and then report that information to the public in readily accessible form. With this program, EPA established the principle that citizens had a “public right to know” about chemicals in their communities that could be affecting their health and environment.



Over time, EPA has applied this principle beyond TRI to a wider array of environmental information, and developed a range of online resources that provide data and tools (e.g., maps, risk assessment indicators) to help the public understand chemical risks in their neighborhoods.

Under the framework of these laws, EPA has taken a wide range of actions to protect public health and the environment for all Americans:

- Through the TSCA new chemical review program, EPA has prevented potentially dangerous chemicals from entering the country. Specifically, the manufacturers of over 2,000 new chemicals declined to pursue U.S. commercialization of their chemicals in the face of EPA's risk concerns and expressed intent to regulate. Additionally, EPA has imposed protective measures or testing obligations on more than 3,000 additional chemicals that were allowed into commerce.
- EPA has established protective standards and built essential infrastructure to prevent children from receiving toxic doses of lead and formaldehyde in their homes or asbestos fibers in their schools.
- Under TSCA, EPA has collected tens of thousands of testing reports and studies on chemical hazard and exposure that would not otherwise be available, as well as extensive information on how chemicals are produced, distributed



Learn about and access the Toxic Substances Control Act (TSCA) Chemical Substance Inventory at <http://www.epa.gov/tsca-inventory>

and used in society. The Agency has shared much of this information with the public in online resources, consistent with its legal obligation to protect trade secrets and certain proprietary information. As a result, the country no longer faces the plight that regulators and the public faced in the 1960s and '70s, when very little was known about the risks of chemicals in our society.

- EPA has directly served the American people through the TRI program by providing, on an ongoing basis, detailed and accessible information about hundreds of chemicals that may be released from industrial or commercial facilities in communities.

The key unfinished business involving toxic substances includes:

- ▶ While EPA made a good start in implementing the many new mandates in the 2016 TSCA amendments, the Agency has much work to do to follow through on the regulatory actions it has initiated to establish needed requirements. It will be particularly important to achieve results in its existing chemical program and in its efforts to make the chemical information it has collected as transparent as possible.

- ▶ The TSCA new chemical program has faced, and will continue to face, ongoing challenges as it seeks to understand advances in material science technology and then evaluate the implications of those advances for health and environmental protection. EPA has addressed this kind of challenge in the past, with new biotechnology substances in the 1990s and with new nanotechnology substances in the 2000s. At the same time, the pace of technological change is ongoing and accelerating. EPA will need to stay abreast of these technological changes to make sure that the materials of the future remain safe for health and the environment.

For more detail, see the toxic substances program report [here](#).





### 3. Other EPA Programs and Activities

EPA has many other programs and activities that support the Agency's mission. Examples include an emergency response team, international activities, managing voluntary programs, and supporting research on environmental issues done by scientists at EPA laboratories, universities, and other research groups.

#### Emergency Response to Hazardous Waste Releases

EPA's most visible operational responsibility is the emergency response to releases of hazardous chemicals, such as from oil and chemical spills, and abandoned leaking oil drums.

**EPA operates an Emergency Response Center 7 days a week, 24 hours a day.** It deploys emergency responders and on-scene coordinators in response to catastrophic events to assess the situation and work with partners in other federal and state agencies to reduce human and environmental risk. Notable examples of situations where the Emergency Response Center has played a key role include responses to:

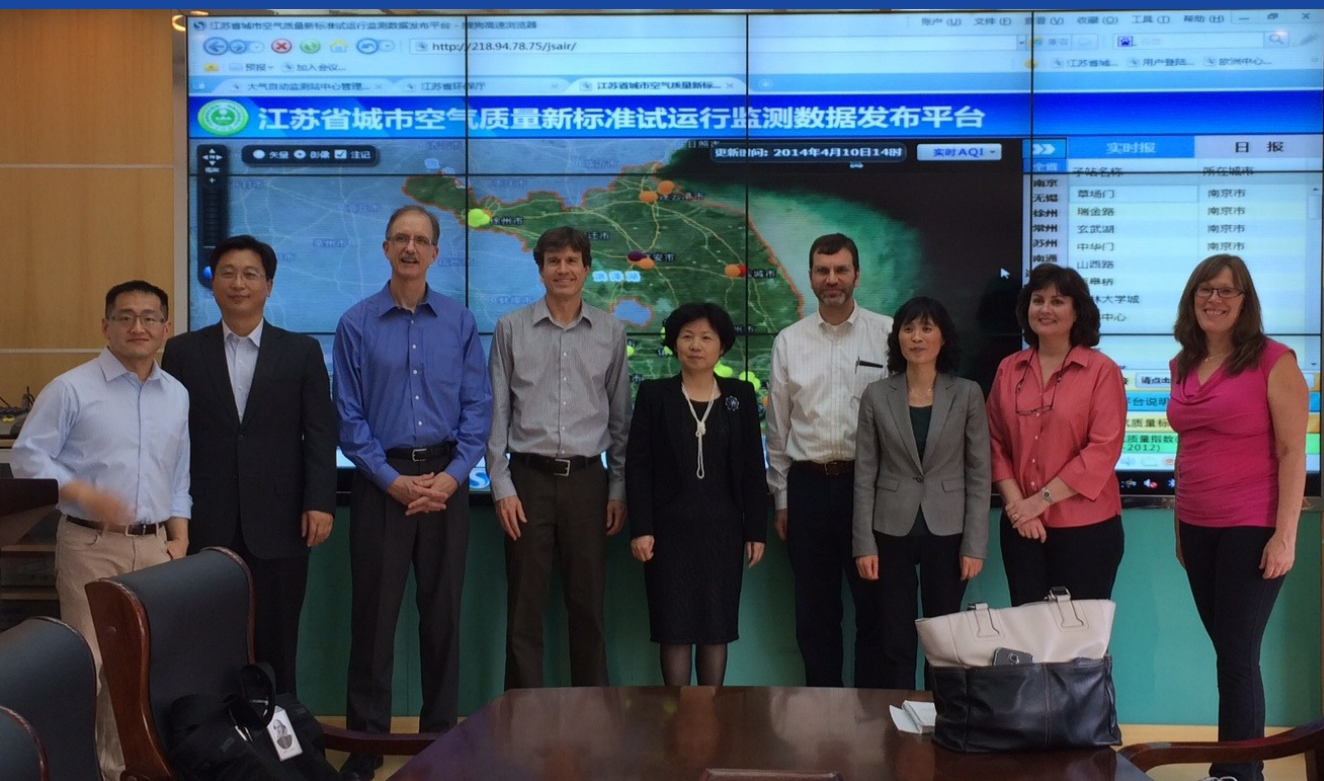
- Hurricanes Katrina (New Orleans) and Sandy (NJ), and
- the BP oil spill in the Gulf of Mexico.



Top: EPA Cincinnati Research Laboratory

Bottom: [EPA Emergency Responders](#) Photos: EPA.





**EPA Staff in China.** Air office staff met with provincial environmental officials in Nanjing to help develop a model air quality improvement plan. Photo: Dale Evarts, EPA.

## International Programs

Besides its regulatory and environmental leadership roles in the U.S., EPA also works with over 60 countries via multilateral and bilateral partnerships to address environmental issues of regional or global scope and to help some nations with their environmental challenges.

An important example of global negotiations involving EPA and the Department of State is the [1987 Montreal Protocol](#), in which nations agreed to reduce and then phase out production of chlorofluorocarbons (CFCs) and halons that deplete the protective stratospheric ozone layer. This agreement was strengthened in subsequent London (1990) and Copenhagen (1992) meetings. The

concentration of stratospheric ozone has been stabilized, and the ozone layer is expected to recover over time.

EPA has worked with the State Department in developing and administering international agreements. EPA has long-standing bilateral relationships with China, covering air, water, solid waste, climate change, and more.

## Voluntary Programs

EPA also encourages environmental improvement through voluntary actions, including cooperative pollution reduction programs as well as providing information to help individuals and companies make informed decisions. EPA has more than 40 voluntary programs that encourage actions to improve the environment without imposing any legal or regulatory requirements, such as [Nonpoint Source](#) (polluted runoff) Demonstration Projects, [WasteWise](#), and the [Global Methane Initiative](#). Public awareness programs include [Energy Star](#), the [Toxics Release Inventory](#) (described above), and [AIRNOW](#). EPA provides educational resources to educators through the [Environmental Education Grants Program](#) and free materials developed by various program offices.



## 4. Achieving Environmental Justice

Environmental protection requires strong laws that are enforced vigorously. It is important that this protection is delivered fairly to all populations and that the burdens of pollution are distributed fairly among us all. Environmental justice is the term used to express these goals, and efforts to achieve it should be central to the mission of EPA. These efforts have been hampered, however, by limitations in available legal mechanisms and by delay or failure to recognize environmental injustices.

EPA defines environmental justice as “the fair treatment and meaningful involvement of all people regardless of race, national origin, or income with respect to the development and enforcement of environmental laws and regulations.”

Environmental justice populations include people of color, indigenous populations, and low-income populations experiencing disproportionate adverse environmental and public health impacts. These populations also are often contending with multiple cumulative environmental and social stressors such as poor nutrition and inadequate housing.

Environmental injustice can occur when polluting industrial facilities are disproportionately located in low-income communities and communities of color, when the impacts of pollution on these communities are understated, or when, intentionally



Teens shoot hoops at a public park in Port Arthur, TX. African Americans are 75% more likely to live in fence-line communities, e.g., areas near gas and oil facilities—than the average American, [NAACP-CATE](#). Photo: Karen Kasmauski/ILCP

or inadvertently, these communities are denied meaningful participation in environmental decisions affecting them. Examples are (1) the clustering of petrochemical factories in what is called cancer alley in Louisiana, a largely low-income area with a significant nonwhite population; (2) the plight of environmental justice populations in New Orleans after Hurricane Katrina; and

(3) the initial inattention of federal and state regulators to the drinking water crisis in low-income Flint, Michigan. Sometimes, language differences create barriers to engagement by these populations created, for example, when the affected population speaks Spanish and the decision-makers speak and write in English.

Recognizing the need to promote environmental justice, in 1994 President Clinton issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Nearly all subsequent presidents have reaffirmed it, and it has never been rescinded. Because no federal environmental statute mentions “environmental justice” and there is no federal statute on environmental justice, the Executive Order remains the authoritative statement on the subject by the US government although it is not an enforceable law. Title VI of the

1964 Civil Rights Act is also used as authority in some instances. Several states, for example California and Massachusetts, have environmental justice programs.

The level of effort the EPA has given to achieving environmental justice has varied over time. The Obama administration made important advances including a roadmap, called Plan EJ 2014 (updated by Plan EJ 2020 which was released in 2016).

Over the last several decades the environmental justice movement, which originated in the U.S., has grown globally and the concept appears in many international environmental agreements. An example is “climate justice,” which refers to how climate change can disproportionately affect low-income populations and people of color, especially in developing countries.



## 5. Implementing Federal Environmental Laws

Developing regulations to implement the environmental legislation that EPA oversees entails following a rigorous regulatory development and review process, structured with many checks and balances:

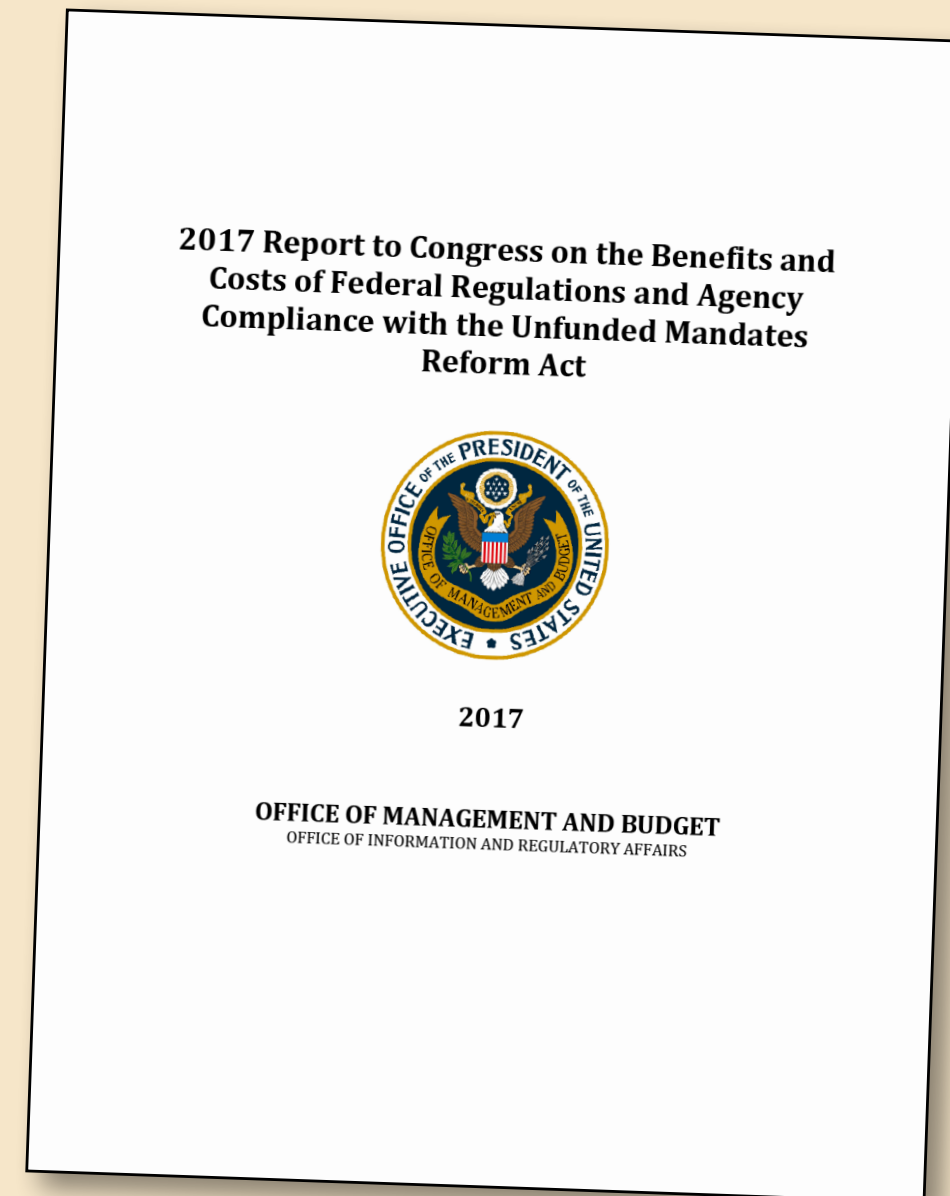
- Congress passes and the President signs laws requiring EPA to promulgate regulations that specify requirements for state and local governments, businesses, and individuals, including due process for all interested parties. In most cases, the laws provide criteria for regulations, but delegate the specifics to EPA, which has the technical expertise to determine the details.
- Development of specific regulations is governed by the Administrative Procedure Act, which requires that proposed regulations be published and subject to comment by all interested parties. The agency must respond to all major comments before finalizing regulations.
- Since 1974, a series of Presidential Executive Orders and internal management practices have, in combination, prescribed a detailed Executive Branch review process that mandated the analysis of the costs, benefits, and other impacts, of proposed “major” regulations as well as alternatives to them.

- Consequently, EPA’s proposed regulations go through a rigorous review process involving other government entities representing the interests of those regulated. The science upon which regulations are based also goes through a peer review process with independent science advisors to ensure appropriate use of scientific data.



Congress plays a major role in overseeing EPA activities, including regulations.

- EPA (like other regulatory agencies) must conduct cost-benefit analyses of major regulations, which are reviewed by the Federal Office of Management and Budget (OMB) and other agencies. The benefits stemming from all EPA major regulations introduced from October 2006 through September 2016 were estimated to fall in the range of \$196BB to \$706BB (in 2015 dollars), compared to societal costs of \$54BB to \$65BB, according to OMB's 2017 Annual Report to Congress on the Benefits and Cost of Federal Regulations.
- Affected parties can challenge regulations in court if they believe that EPA lacked legal authority for specific rules or that it did not follow the criteria or due process requirements set by Congress. Legal challenges are frequent, and some have been elevated to the Supreme Court.
- Many EPA programs are primarily implemented by state, or associated local or tribal government programs, with states adopting rules that require sources to meet particular pollution release or technology requirements. The following section discusses federal and state roles in compliance and enforcement of EPA and state/local regulations.





## 6. Compliance and Enforcement

Having environmental laws that protect public health and the environment does not guarantee everyone will comply. These laws generally require those who are regulated (e.g., industries) to obtain permits that include site-specific limits on pollution releases, to monitor their performance, and—in some cases—to report on permit violations and adverse effects. The laws give EPA the authority to collect environmental samples, conduct inspections, and enforce against violators. Federal environmental laws contain a range of actions to address violations, including notices of violation, monetary penalties, and even prison time for criminal violations.

Verifying compliance and taking enforcement actions are necessary to ensure compliance with laws and regulations and reduction of threats to public health and the environment. Effective enforcement programs create a level playing field so those who comply are not at an economic disadvantage versus those who do not. These monitoring and enforcement programs serve as a deterrent to violations.

Most (but not all) environmental laws have provisions for EPA to delegate programs to states and Indian tribes that adopt adequate laws and have the authority, resources, and procedures to enforce them. EPA generally retains its authority to inspect and enforce, as a backup to these partners. The Federal role is to ensure the effectiveness of enforcement and compliance programs and

policies on a national basis. This includes exercising oversight to ensure a level playing field across the nation. Since the 1970s, EPA has worked closely with states/tribes to delegate authority to those who wished to carry out environmental programs themselves. EPA has provided considerable federal grant money, technical assistance, and oversight to states and tribes so they could do so.

Today, most environmental programs are delegated. States/tribes carry out the majority of environmental inspections and take enforcement actions under their state laws.

EPA works closely with its state/tribal partners to implement environmental laws. Historically, EPA conducted 20,000 inspections a year but this number has declined recently. In 2018 EPA conducted about 10,000 inspections. EPA's annual enforcement results for 2018 are [here](#). Searchable data can be found on EPA's [Enforcement and Compliance History Online](#) (ECHO) website for the approximately 800,000 EPA-regulated facilities nationwide.



[EPA inspector using an infrared camera to detect invisible organic chemical emissions.](#) Photo: EPA

# Looking Forward

**The progress made in reducing and cleaning up pollutants affecting our air, land, water, and food supplies over the past half-century has turned the tide**, reducing environmental risks to public health and mostly slowing negative impacts on wildlife and recreational opportunities. These efforts have yielded innovations that saved resources, not only compared with the projected costs of cleanup, but also cutting overall costs in some industries due to process changes.

But in a number of areas, **the accomplishments thus far leave much to be done**, such as in the cleanup of hazardous waste sites; polluted runoff from streets, farms, and other lands; and reduction of exposures to certain pollutants that continue at levels dangerous to public health and welfare. Moreover, much of the developing world is experiencing environmental risks comparable to or greater than those seen in the U.S. in the 1960s.

As health and environmental research advances, we become more aware of **serious issues that were not as well understood when the original environmental legislation was adopted**. These emerging challenges include climate change, bacteria-laden aerosols in drinking water, the introduction of thousands of new and repurposed chemicals and treatment and nanotechnology. Like peeling an onion, we find that making progress in overcoming threats known earlier has revealed other, more complex challenges, some of which

have no clear path yet to resolution. In particular, the as yet unmet challenges presented by global climate change are likely to remain as a dominant environmental issue for the foreseeable future.

It is clear that **despite tremendous progress thus far, environmental risks continue in different forms**, requiring research, process changes, and new approaches to containing and reducing threats to public health and to our natural environment. It is therefore critical for our future that we engage a new generation of Americans to pursue careers that take on these environmental challenges, and that continue to identify risks and implement innovative solutions.

With well over three million jobs devoted to environmental improvement (per the Bureau of Labor Statistics [BLS] in 2013), almost 500,000 job openings available in 2015—and forecasts by the BLS that careers in environmental sustainability will grow by nearly 20% annually—there is plenty of opportunity for those who are inspired to take action to protect the environment and public health and welfare.

The same clear-headed determination that led to tremendous progress in environmental cleanup over the last half century will be needed to protect people and the environment that sustains them from the threats that remain.