

Celebrate
40 years of
cleaner
air!



Clean air, like many valuable resources, is something we may only appreciate after it is lost.

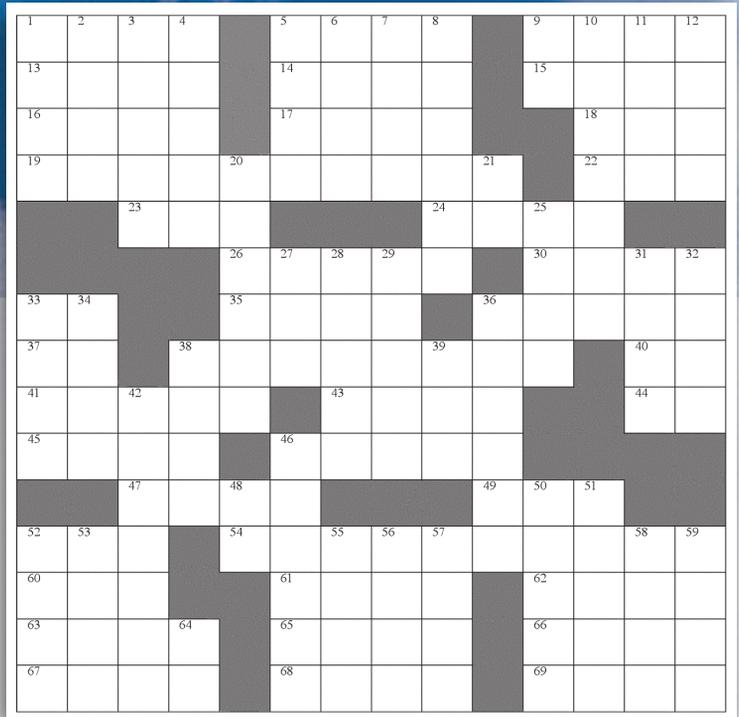
The 1940s were marked by a series of air pollution catastrophes that escalated as new technologies led to greater electricity consumption, increased production of materials like plastics, and a more automobile-based society. Throughout the 1960s, an environmental movement gained momentum. Contributing factors included:

- Damage to natural resources corresponding with new development and manufacturing
- More global awareness due to increased formal education and informal learning through television and pivotal books like *Silent Spring* by Rachel Carson
- The 1968 Apollo 8 photos that gave people views of the whole earth in space, looking both beautiful and vulnerable
- The energized activist culture that had developed around Civil Rights, the Cold War and the Vietnam War

The federal government responded to public outcry in 1970. President Nixon announced environmentalism as his new cause and Gaylord Nelson, a Wisconsin senator, helped found Earth Day. Later that same year, Congress passed strong environmental laws, including the Clean Air Act.



It All Adds Up to Cleaner Air



ACROSS

- Place for a compact fluorescent bulb
- Product of grapes
- Where to ride a bike or walk
- Historic time periods
- Possible tennis score
- Spanish artist Joan
- Host of PBS's *Scientific American Frontiers*/ MASH's Pierce
- French philosopher Descartes
- Bygone American motor car company
- Initials of "10 Ways to Measure Air Quality"
- Between bump and spike
- 180° from WNW
- Deep cut
- Magazine or newspaper article
- Coffee alternatives
- What you say for the doctor
- Small, medium or large, e.g.
- Country in northeast Africa, including Darfur
- Not yes
- What we hope this puzzle gives you
- Intl. vehicle ID for Romania
- Possible consequence of breathing toxics
- Electric sign gas
- Symbol for compound no longer found in gasoline
- Metal used in making steel
- Wrapped in cloth coated with wax
- Fedl. agency that studies climate and the atmosphere
- Clean air legislation passed in 1970, e.g.
- Scale for showing level of air pollution
- First letter of each of "10 Ways to Improve Air Quality"
- However
- Lion's "hair"
- Wrinkled relative of an orange
- African cat
- Spanish compass direction
- One possible component of particle air pollution
- American poet Pound
- Hair salon employee
- Fencing weapon

DOWN

- Part of milkweed that shows effects of ozone pollution
- Folk singer Guthrie
- Spanish mother
- Tests taken in Soph. or Jr. year
- Guarded
- French thought or notion
- One of Columbus's ships
- Something to save or use wisely
- Type of pollution that can cause haze, abbr.
- Area affected by same pollution sources
- Source of shade, biofuel, and carbon sequestration
- "Give a ____, don't pollute"
- Polite agreement
- Continent that includes Bra., Equa. and Ven.
- Shock
- Small grey crested bird, fam.
- Pollutant that forms on hot, sunny days
- Direct (to)
- Org. for those over 50
- One who acts superior
- One opposed
- Ozone eight-__ standard
- Ice cream, bananas, hot fudge, e.g.
- Philanthropic Irish musician from U2
- Enemy
- Device for measuring air pollution
- Freed from agitation or fear
- Item to turn down in summer to save energy, abbr.
- Unrefined oil
- Retouch a base after a flyball is caught
- Having the needed capacity or skills
- Informal test
- Not hard
- Before, pref.
- Poetic "at no time"
- German river
- Ceremony
- USA's continent

■ Crossword puzzle answers online at dhr.wi.gov/air/

Ten steps that led to cleaner air

1 1970
Clean Air Act
 This landmark act laid the groundwork for successful public health and air quality improvements.

2 1973
Phase-out of lead gasoline began
 These rules triggered a decrease in lead content in gasoline, which continued with the introduction of catalytic converters and later amendments to the Clean Air Act. By 1995, lead was banned from gasoline for all on-road vehicles.



TOM SABO

4 1978
U.S. bans chlorofluorocarbons (CFCs) in aerosol cans
 The Montreal Protocol of 1987 led to further phasing out of CFCs, as did the 1990 Clean Air Act Amendments. As of 1996, the United States no longer produces or imports CFCs because they destroy the Earth's protective ozone layer.



5 1986
Wisconsin's Acid Rain Law
 This law made Wisconsin a leader in acid rain regulation. It required electric utilities to reduce their sulfur dioxide emissions. The 1990 Clean Air Act Amendments limited emissions of sulfur dioxide and nitrogen oxides across the country because they both acidify precipitation.

6 1988
Wisconsin Air Toxics Rule
 This unprecedented state rule set limits on emissions of 438 hazardous air pollutants. The 1990 Clean Air Act Amendments led to toxic pollutant controls across the United States.

9 2004
Wisconsin mercury rule
 Wisconsin required large, coal-fired electric utility plants to reduce mercury emissions. A 2008 revision means emissions reductions will be even bigger and affect facilities of all sizes. Mercury is toxic for humans and wildlife and persists in the environment.

7 1990
Clean Air Act Amendments
 This legislation targeted urban smog by introducing new permits for businesses, an emissions cap and trade program, and initiatives to reduce single-occupant commutes. It also addressed leaded gasoline, CFCs, acid rain and toxics.



LANCE GREEN

8 1996
Major voluntary initiatives began to reduce air pollution
 The DNR formed a partnership called the Wisconsin Partners for Clean Air in Southeastern Wisconsin to encourage businesses and the public to limit polluting activities. Similar partnerships in other Wisconsin regions and throughout the country focus on voluntary efforts to reduce air pollution for public health and to avoid mandatory regulations.

10 2007
U.S. Supreme Court decides that greenhouse gases fall under the Clean Air Act
 Later, in 2009, the federal government took further action on climate change. One rule required large sources of greenhouse gases to begin annual reporting of their emissions.



FILE PHOTO

3 1975
Energy Policy and Conservation Act
 This law set fuel economy standards, which prompted unprecedented innovation and engineering for fuel efficient motor vehicles including catalytic converter development.



DNR FILE

TOM SABO

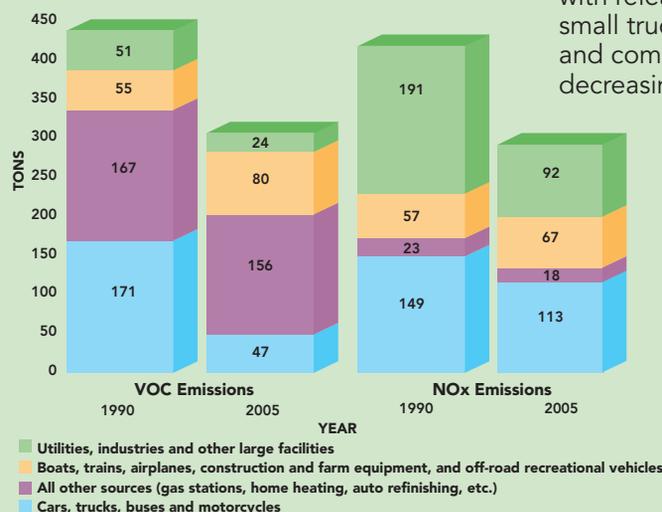
Ten air quality accomplishments

- From 1970 to 1990, the Environmental Protection Agency estimated the Clean Air Act prevented 205,000 premature deaths and millions of cases of illnesses including heart disease, chronic bronchitis, asthma attacks and more.
- Blood lead levels in children plummeted 78 percent from 1976 to 1994, thanks in large part to the phase-out of leaded gasoline.
- Carbon monoxide (CO) pollution reductions from automobiles are credited with saving 11,700 lives through 1998 due to Clean Air Act regulations. As seen in the graph below, levels of volatile organic compounds (VOCs) and nitrogen oxides (NOx) also declined drastically from 1970-2010, due to air pollution controls on cars, even though vehicle miles traveled have dramatically increased.

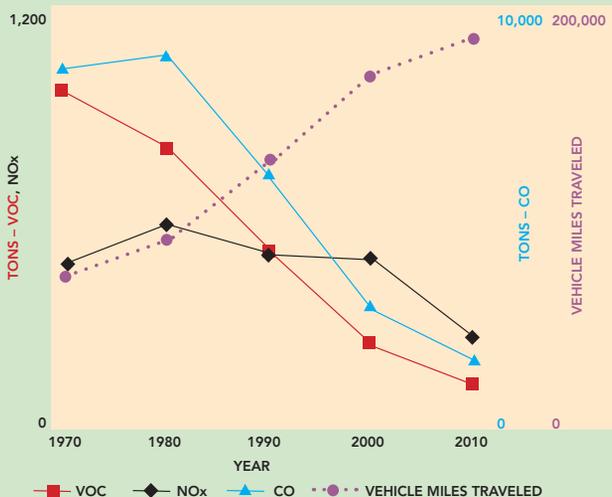
- Drops in sulfur dioxide (SO₂) and NOx emissions kept rain from becoming too acidic. By 2006, Wisconsin's electric utilities' SO₂ emissions were 67 percent lower than 1980 levels according to DNR data. Overall NOx emissions in Wisconsin fell by 31 percent between 1990 and 2005, with the biggest decline from large commercial and industrial facilities and on-road vehicles.

- Nationally, total toxic air pollutant emissions decreased by 40 percent between 1990 and 2005, due to regulations on cars and small trucks, businesses with chemical-intensive processes and incinerators.
- VOC emissions have decreased by 43 percent across the United States since 1970. VOC emissions in Wisconsin have decreased by 31 percent from 1990 to 2005, with releases from cars and small trucks, industrial plants, and commercial businesses decreasing the most. Gasoline, lighter fluids, dry cleaning solvents, cleaning solutions, fingernail polish and paints all contain VOCs. These VOCs contribute to ground-level (bad) ozone formation.

Summer Daily VOC and NOx Emissions in Southeastern Wisconsin

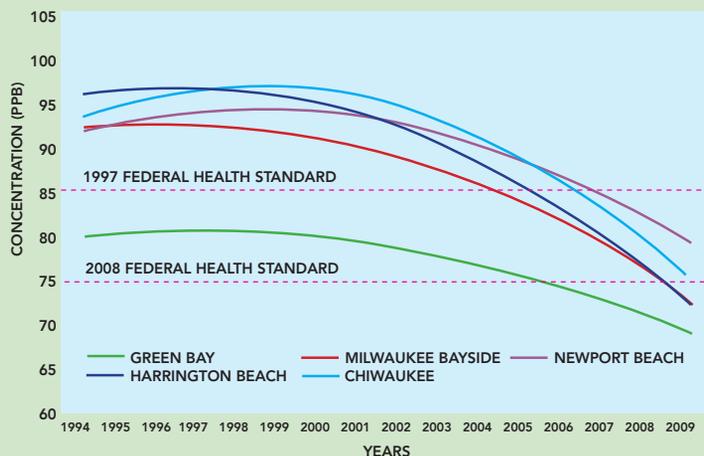


Wisconsin Highway Vehicle Emissions/Vehicle Miles Traveled



- Ozone pollution has declined in response to control measures. This graph shows that ozone levels reported at monitors in eastern Wisconsin have dropped between 1994 and 2009.

Wisconsin Lakeshore and Green Bay Ozone Trends



Ten ways to improve air quality

8 Particle pollution decreased by 88 percent across the United States between 1970 and 2000. Particle pollution is separated into sizes. Coarse particles (PM10), which decreased the most, are usually the result of mechanical processes like crushing or grinding. Fine particles (PM2.5) are directly emitted or created through chemical reactions.

9 Added up over 20 years (1970-1990), EPA estimated the benefits of the Clean Air Act to human health, human welfare and the environment to be \$22 trillion. This outweighs the actual cost of \$523 billion spent over the same time to achieve air pollution reductions.

10 Real-time air quality information appears on The Weather Channel and Airnow. Forecasts are published in *USA Today*. In Wisconsin, announcements from the National Weather Service are broadcast by radio and TV. DNR has an online tool (dnr.wi.gov/air/air/health/status.asp) and an Air Quality Hotline (1-866-DAILY-AIR) that operates seven days a week, 24 hours a day. Children, the elderly and people with respiratory and heart conditions can stay healthier by reducing strenuous outdoor activities during advisories.



DNR FILE

1 **Cut back on driving by carpooling, biking, or taking the bus, especially on Air Quality Watch Days** (days when air quality may become unhealthy).

2 **Learn to be an ecodriver.** Combine trips and avoid jack rabbit starts and stops.

3 **Energy conservation at home reduces greenhouse gases.** Set the thermostat lower (in winter) or higher (in summer) while your family is sleeping or away.

4 **Always turn off** your computer when you leave home or work.

5 **Nurture native plants instead of a big lawn.** Native landscaping provides food and habitat for wildlife, helps water infiltrate and cuts down on the need for fertilizing and mowing.

6 **Enjoy locally grown produce.** Reducing food miles (how far food travels to reach your plate), supports nearby farmers, brings you fresh meals and

limits transportation-related emissions.

7 **Recycle mercury-containing items** to keep this hazardous material out of the air, land and water. Contact your health department for information on free recycling programs for fluorescent lights, switches, old lawn chemicals and more.



DNR FILE

8 **Ask store managers to stock Earth friendly items.** Energy Star appliances, green cleaning products and goods with minimal packaging are excellent choices. Don't forget your reusable shopping bags.

9 **Instead of buying new, try to repair damaged items or buy gently-used products.** When you no longer need an item, donate it or sell it through a consignment shop or on the Internet.

10 **Reach out** to your friends, family and neighbors to teach them practices that promote cleaner air!



DNR FILE

Ten ways to measure air quality

1 Fish higher up the food chain, such as walleyes, and the people who eat them, are at risk of ingesting and accumulating dangerous levels of toxins like mercury. Mercury enters the air by various means including fossil fuel combustion, falls to Earth, and then makes its way into streams and lakes.



PETER BLOCK

4 The Air Quality Index (AQI) is a color-coded system for telling the public about air quality conditions. When the AQI is red or orange, people should avoid strenuous outdoor activities and change their activities to pollute less.



5 Yearly, businesses across the state submit information collected from their facilities to DNR's Air Emissions Inventory. DNR tracks the data to ensure that the air is safe to breathe.



MARITHA MARKOLM

6 You can find unique organisms – known as lichens (fungi and algae living together) on rocks and tree trunks. Lichens are air quality indicators. Each type of lichen varies in its sensitivity to air pollution, particularly sulfur dioxide.

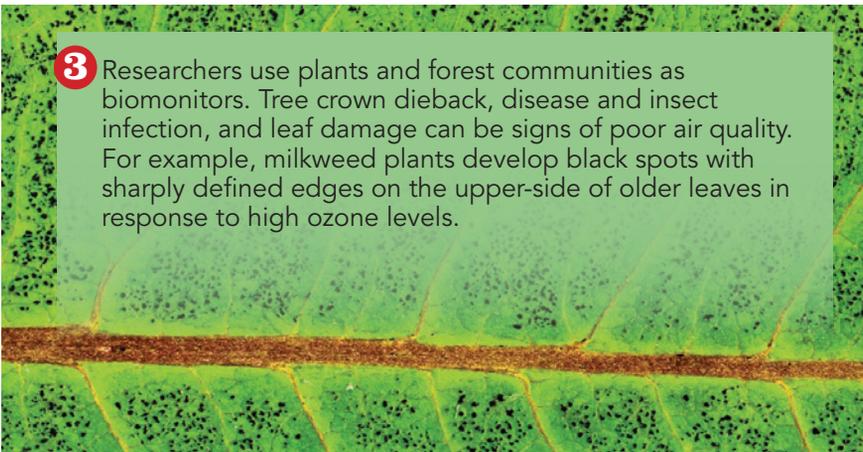
7 Even though many types of air pollution are invisible, some manifest as haze, including fine particles of sulfates, nitrates, organic carbon, elemental carbon (similar to soot) and dust-like materials. View real-time haze conditions, taken by haze cameras in Milwaukee and elsewhere around the Midwest, at mwhazecam.net.

2 Ozone around Lake Michigan was measured by monitors attached to a DNR airplane and the Badger Ferry.



DNR FILE

3 Researchers use plants and forest communities as biomonitors. Tree crown dieback, disease and insect infection, and leaf damage can be signs of poor air quality. For example, milkweed plants develop black spots with sharply defined edges on the upper-side of older leaves in response to high ozone levels.



ED JERSEN



Create your own pinwheel!

8 A National Core monitoring site, housed at the Horicon Marsh State Wildlife Area in Dodge County, measures air pollutants as part of a nation-wide network. The highly sensitive instruments detect low levels of pollutants and will help us understand regional air pollution trends.

9 Research about carbon dioxide, a greenhouse gas, is underway in Wisconsin. A tower in Park Falls is part of a national network measuring carbon storage and release by different plant communities. An experiment near Rhinelander is studying how carbon dioxide and ozone might impact northern forests.

10 Smoke schools around the country help environmental staff estimate air pollution emissions by reading smoke plumes.



What you need:

- Scissors
- Thumbtack or pushpin
- Pencil or straw

To create the pinwheel:

- Cut out the pinwheel on the solid lines only.
- Cut the dotted lines from the four corners towards the center circle, being careful to stop before cutting into the center.
- Use a thumbtack or pushpin to poke a hole through the center and the four tiny dark circles in the corners.
- Then, push the pin through the center circle from the patterned side of the paper to the back.
- One at a time, push the ends of the pin through the holes on the pinwheel corners, bending in the corners.
- Place the pencil or straw on the back side of your pinwheel. Push the pin through the straw or pencil eraser leaving a little space between the pinwheel and straw/eraser so the pinwheel can spin.
- Now you are ready to try out your pinwheel. All you need is a little bit of wind!



KRISTINA TEETER



MIDWEST HAZE/CAM

Publication Number: AM-397-2010

Written by Autumn E. Sabo

Crossword by Mary Hamel

Graphs by Chris Bovee, Donalea Dinsmore and Grant Hetherington

Edited by Anne Bogar, Mary Hamel, Autumn E. Sabo and Natasha Kassulke

Publication design by Thomas J. Senatori

Cover pinwheel photo by Susan M. Senatori

This publication is available in alternate formats. Call the DNR Accessibility Coordinator at 608-267-7490 or email andrew.janicki@wisconsin.gov for more information.

Links to data used to produce this publication may be found online at dnr.wi.gov/air/

