

Air Quality

GLOSSARY

Ambient

Surrounding, encircling.

Attainment area

A geographic area in which criteria pollutant concentrations do not exceed national ambient air quality standards.

Criteria pollutants

Six pollutants for which there are national ambient air quality standards to protect public health.

Ground-level ozone

A gas formed in the atmosphere near the earth's surface by a chemical reaction, on hot, humid days, between volatile (vaporizes readily) organic compounds and oxides of nitrogen; it is smog's primary component.

Hazardous air pollutant (HAP)

One of 188 substances known or suspected to cause, from even relatively low exposure, cancer, genetic mutation, birth defects, or other serious illness in people.

National ambient air quality standards (NAAQS)

The level above which the presence in the air of any of the six criteria pollutants is considered harmful to the public health.

BACKGROUND

Air quality is affected in many ways by the wide variety of pollutants that are emitted from numerous sources. Air pollution comes from such stationary sources as factories, power plants, smelters, and dry cleaners; from such mobile sources as automobiles, buses, planes, trucks, and trains; and from such naturally occurring sources as windblown dust and volcanic eruptions. These pollutants can impair the health of people and wildlife; reduce visibility; corrode cars, buildings, and historical monuments; produce unpleasant odors; and damage agriculture and forests.

Clean Air Act

Since 1970 the federal Clean Air Act (CAA) has provided the principal framework for national, state, and local efforts to protect air quality. The CAA underwent major revisions in 1977 and again in 1990. Central to the 1990 amendments are

- revisions to the *permit system* that allows entities to emit certain substances into the air,
- additional specifications to reduce *urban smog* and reduce pollutants in ambient (surrounding) air,
- a change from using primarily health-based standards to using *technology-based standards* to regulate air pollution,
- more restrictive *mobile-source emission standards*, requiring automobile manufacturers to further reduce tail pipe emissions and refineries to reformulate fuel,
- *acid rain* emission caps and air-particle restrictions to address long-range transport of sulfur and nitrogen pollutants, and
- more stringent *enforcement*.

To comply with the federal amendments, Michigan enacted enabling legislation amending the state Air Pollution and Motor Fuels Quality acts and created four new statutes that (1) provide the basis for the Michigan Department of Environmental Quality (MDEQ) pollution-emission permit program; (2) authorize fees mandated by the federal legislation; (3) create a program to help small businesses comply with requirements; and (4) increase the state's enforcement authority. In 1996 all state air pollution and control laws were codified into the already-existing Public Act 451 of 1994, the Natural Resources and Environment Protection Act (NREPA).

Stationary Sources: Permits and Fees

For stationary facilities that wish to emit pollutants, including toxics, the NREPA establishes three types of air-pollution permit:

- Permit to install (or construct, reconstruct, relocate, alter, or modify) any process or equipment that may emit a pollutant into the air
- Nonrenewable permit to operate
- Renewable permit to operate (renewal is required every five years)

The cost of the permit program is paid for largely through annual facility and emission fees that are established by the legislature (most recently in 2001) and based on the type of facility and the type and tons of pollutant(s) emitted. Facility fees range from \$250 to \$24,816, and emission fees are \$45.25 per ton of pollutant unless fewer than 10 tons are emitted, in which case no emission fee is assessed.

Criteria Pollutants

For certain air pollutants, the U.S. Environmental Protection Agency (EPA) sets ambient air concentration limits called national ambient air quality standards (NAAQS). The EPA has set standards for six common pollutants.

Particulate matter

Solid particles or fine liquid droplets in the air as a result of industrial processes; the chemical composition depends on the emission source.

Smog

A harmful concentration of ground-level ozone.

State implementation plan (SIP)

A plan required by the federal Clean Air Act that provides for the way in which a state will implement, maintain, and enforce the national ambient air quality standards.

- *Carbon monoxide (CO)* is a colorless, odorless gas formed when carbon in fuel from motor vehicles and other combustion processes is not burned completely; CO can harm one's health by reducing oxygen delivery to the body's organs (e.g., heart and brain) and tissues.
- *Nitrogen dioxide (NO₂)* is a reddish-brown gas with a pungent and unpleasant odor that can irritate one's lungs and lower one's resistance to respiratory infection. It transforms in the air to form gaseous nitric acid, which, when deposited, contributes to lake acidification, corrodes metals, degrades rubber, damages trees and crops, and fades fabrics. NO₂, along with other oxides of nitrogen (NO_x), plays a major role in atmospheric reactions that produce ground-level ozone, a major component of smog.
- *Ozone* is created by a chemical reaction between NO_x (the primary sources are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuel) and volatile organic compounds (VOCs) in the presence of heat and sunlight. Motor-vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents are among the major sources of NO_x and VOCs that help to form ozone. Even at very low levels, this pollutant triggers a variety of health problems—e.g., long-term exposure may cause permanent lung injury—and damages plants and ecosystems.
- *Lead* is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions historically have been motor vehicles and industrial facilities. Because lead primarily affects the brain and nervous system, children under age six are at the greatest risk because they then are undergoing rapid neurological and physical development.
- *Particulate matter* is the term for particles found in the air—including dust, dirt, soot, smoke, and droplets—that arise from such activities as combustion, incineration, construction, mining, metal processing, motor-vehicle exhaust, road dust, forest fires, and volcanic activity. Particulate matter causes a wide variety of health and environmental problems, including aggravated asthma, chronic bronchitis, and impaired visibility.
- *Sulfur dioxide* is released to the air primarily from coal-burning electric power plants and contributes to respiratory illness (particularly in children and the elderly), aggravates existing heart and lung diseases, and adds to the formation of acid rain.

These pollutants are referred to as *criteria* pollutants because health-based criteria are used as the basis for setting permissible ambient air levels.

Periodically, ambient air concentrations of the six criteria pollutants are measured at several locations within a region to determine its NAAQS attainment/nonattainment status. In Michigan, the MDEQ operates monitors that collect pollutant data. Air-quality levels must not exceed standards over various averaging times. Short averaging times

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(e.g., one hour) are used to measure acute, or short-term, health effects. Longer averaging times (e.g., one year) are used to gauge chronic effects.

Although the entire state of Michigan is in attainment for all six criteria pollutants, this may change when the EPA's revised standards for ozone and particulate matter (smog and soot) are implemented. The revisions, issued in 1997, were tied up in court until early 2002 due to legal challenges by industry groups and three states (including Michigan), but the EPA's authority to set NAAQS was upheld. The new standards, which the EPA expects to take effect in summer 2002, will reduce the allowed amount of ozone and small (2.5 micrometers) particulate matter (PM).

Existing MDEQ monitoring information suggests that the new ozone standard may not be met in ten counties: Allegan, Benzie, Berrien, Cass, Genesee, Mason, Muskegon, Macomb, St. Clair, and Wayne. The new particulate-matter emission limits are expected to affect only Wayne County.

In the last few years, a major effort has been made by the EPA to address ozone pollution (smog) in the northeast United States by reducing nitrogen oxide emissions from "upwind" states. In 1998 the EPA published a rule, referred to as the "NO_x SIP Call," requiring 22 midwest states and the District of Columbia to reduce their nitrogen oxide emissions by 85 percent, a significant amount. In 1999 the EPA also granted petitions filed under section 126 of the Clean Air Act by four northeast states seeking to reduce ozone pollution through NO_x reductions in emissions from other states. The State of Michigan, with seven other states, challenged the section 126 rule and the NO_x SIP Call, but the U.S. Court of Appeals issued decisions largely upholding both. The MDEQ currently is drafting its NO_x SIP, which must be adopted by the state and approved by the EPA by mid-2002.

Hazardous Air Pollutants

There currently are 188 substances that qualify as a hazardous air pollutant (HAP); that is, they are known or suspected to cause (1) cancer or such other serious health problems as reproductive effects or birth defects or (2) adverse environmental effects. Among the substances are benzene, dioxin, vinyl chloride, mercury, and polychlorinated biphenyls (PCBs).

Prior to the 1990 federal amendments to the Clean Air Act, HAPs were regulated, as criteria pollutants currently are, according to the risk each poses to human health. But because of the legal, political, and scientific complexity of this approach, the EPA had issued only eight standards

in 20 years. The 1990 amendments shifted HAPs from health-based to technology-based regulation, moving the focus from the individual *pollutants* to the *pollution sources*. The EPA now develops regulations called *maximum achievable control technology* (MACT) standards, which require a source to meet specific emissions limits that are based on levels already being achieved by similar sources in the country. The health-risk-based approach has not been abandoned but remains as a residual option.

As of August 2000, the EPA had issued MACT standards for 90 categories of industrial air-pollution sources, such as chemical plants, oil refineries, steel mills, and dry cleaners. These standards are expected to reduce air toxics emissions by about 1.5 million tons annually. In addition, the EPA has announced that by 2003 it will regulate mercury and other air toxics emitted from oil- and coal-fired power plants, the nation's largest sources of human-caused mercury emissions. Mercury is linked with several serious health problems, including both neurological and developmental problems; humans and wildlife are exposed to mercury primarily through consuming contaminated fish.

Although the federal government is responsible for regulating 188 specific hazardous air pollutants, it may delegate this responsibility to the states, and Michigan has received such "delegated authority." Michigan rules 230–32 are the "air toxic rules" and set out the state's role in this regard. Michigan law does not list specific air contaminants as toxic; instead, it defines as toxic—and thus subject to state regulation—"any air contaminant for which there is no national ambient air quality standard and is or may become harmful to public health or the environment when present in the outdoor atmosphere in sufficient quantity and duration." Michigan's air-toxic regulation rests on two basic requirements.

- Each new emission source must manage its toxics by using the best available control technology (referred to as T-BACT).
- A toxic emission cannot result in a maximum ambient concentration that exceeds the health-based screening level defined for each substance.

Mobile-Source Emissions

The federal Clean Air Act requires the EPA to prescribe standards for any class of vehicle causing or contributing to air pollution that may reasonably be anticipated to endanger public health or welfare. Recently, the EPA proposed new standards for NO_x, hydrocarbon (HC), and CO emissions from several types of currently unregulated nonroad engines and vehicles. Only newly manufactured products will be affected, among them forklifts, some diesel marine engines, off-highway motorcycles, all-terrain-

vehicles (ATVs), snowmobiles, electric generators, airport baggage-transport vehicles, and various other construction, farm, and industrial equipment.

The EPA also established a national program regulating, as a group, heavy-duty vehicles and their fuel. New emission standards will begin to take effect in model year 2007 and are based on the use of high-efficiency, catalytic exhaust emission-control devices or comparably effective advanced technologies.

Because these catalytic devices are damaged by sulfur, the EPA also is reducing, by 97 percent, the level of sulfur permitted in highway diesel fuel; the effective date is mid-2006. The program gives substantial flexibility to refiners, especially small operations, and engine/vehicle manufacturers, to help them implement the new requirements in the most cost-efficient manner.

DISCUSSION

Regional Ozone Transport

The EPA's latest effort to reduce nitrogen oxide emissions is opposed by the State of Michigan, business groups such as the Michigan Chamber of Commerce, and the electric utility industry. Opponents believe that (1) the proposed reductions are unnecessary in "downwind" states, and (2) the growth projections on which the emissions limits are based will not accommodate Michigan's energy needs. In support of the latter position, the Michigan House of Representatives adopted a resolution urging the EPA to re-evaluate and adjust Michigan's cap on NO_x emissions, using more realistic energy-growth rates.

The NO_x rules supporters, including the Michigan Environmental Council and the American Lung Association, believe that a decrease in smog is necessary to diminish asthma, bronchitis, and other respiratory ailment incidences. These organizations point to the health effects caused by ground-level ozone pollution, including aggravated asthma, reduced lung capacity, and increased susceptibility to respiratory illnesses such as pneumonia and bronchitis. In addition, a recent study links smog to low birth weight, premature birth, stillbirth, and infant death.

Ozone and Fine Particulate Matter

In Michigan, the new federal ozone and particulate matter air standards are being met with considerable criticism by the regulated community, the governor, and state administrators. The manufacturing and industry sectors claim that (1) air-quality laws already are too complicated and expensive, and (2) Michigan's air quality is greatly affected by pollutants coming from the Chicago area, which is in serious nonattainment for ozone and other criteria pol-

lutants. The governor further claims that the additional regulatory burden will outweigh any further benefit to human health.

The new standards' supporters, such as the American Lung Association and the Michigan Environmental Council, believe it is crucial that the EPA revise the ozone-standard implementation process quickly in order to minimize any further delay in protecting the public from ozone pollution. These organizations point to EPA research that indicates that the new particulate standard, along with other clean-air programs, will reduce premature deaths by about 15,000 a year and serious respiratory problems in children by about 250,000 cases a year.

See also Great Lakes Concerns; Water Quality.

FOR ADDITIONAL INFORMATION

Air Quality Division
Michigan Department of Environmental Quality
Constitution Hall, 3d Floor
525 West Allegan Street
P.O. Box 30260
Lansing, MI 48909
(517) 373-7023
(517) 335-6993 FAX
www.michigan.gov/deq

Capital Region Office
American Lung Association of Michigan
403 Seymour Avenue
Lansing, MI 48933
(800) 678-LUNG
(517) 484-4541
(517) 484-2118 FAX
www.alam.org

Director of Environmental and Regulatory Affairs
Michigan Chamber of Commerce
600 South Walnut Street
Lansing, MI 48933
(517) 371-2100
(517) 371-7224 FAX
www.michamber.com

Michigan Environmental Council
119 Pere Marquette Street
Lansing, MI 48912
(517) 487-9539
(517) 487-9541 FAX
www.mecprotects.org