

The effects of air pollution

By Gale/Cengage Learning, adapted by Newsela staff on 04.20.18

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Image 1. Heavy smog on January 30, 2018, in Shanghai, China. The Shanghai Air Pollution Index (API) reached 235, indicating heavy pollution. Smog comes from ozone that is close to the Earth's surface. Ozone occurs naturally in the Earth's lower atmosphere, but near ground level, ozone is formed when pollutants emitted by cars, power plants, and factories react chemically in the presence of sunlight. Photo: VCG/VCG via Getty Images.

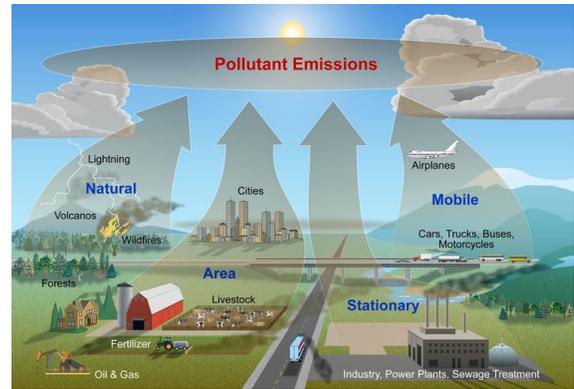
Air pollution refers to the substances in the Earth's atmosphere that are dangerous to human health or the environment. This pollution is usually considered anthropogenic, meaning "caused by humans." Although it can come from natural sources, most air pollution results from humans burning fossil fuels such as coal, oil and natural gas. Many serious problems are a result of air pollution, including ozone depletion, climate change, acid rain and respiratory illnesses.

The Earth's atmosphere is made up of several gases. The atmosphere contains 78 percent nitrogen, 21 percent oxygen, 0.4 percent water vapor, and – before the widespread use of fossil fuels – about 0.027 percent carbon dioxide. Carbon dioxide is released from burning fossil fuels, but also from cooking fires and slash-

and-burn agriculture. Human actions caused the amount of carbon dioxide in the atmosphere to rise to 0.04 percent (400 parts per million) in 2015. This increase causes climate change.

The Greenhouse Effect

Understanding climate change requires understanding the greenhouse effect. This natural process happens when radiation from the sun enters the Earth's atmosphere. Half of this radiation is absorbed by the Earth's surface and half is converted to infrared radiation or heat energy. Some radiation bounces back up into space, but some get trapped in the atmosphere by greenhouse gases (GHGs), and the more GHGs in the atmosphere, the more heat is trapped. The main GHGs are carbon dioxide, methane, nitrous oxide and ozone.



In addition to causing climate change, air pollution also leads to health problems. The World Health Organization (WHO) estimated that in 2012 air pollution caused 7 million deaths worldwide from respiratory diseases, and called it "the world's largest single environmental health risk." City residents in developing countries can suffer the most from air pollution. They often live near unregulated factories or cook with open fires indoors.

Ozone Depletion

Ozone is a molecule made up of three atoms of oxygen. The ozone layer is a thin coating of these molecules 6 miles above the Earth. This layer prevents some of the sun's harmful radiation from reaching the Earth, but air pollution has damaged these protective ozone molecules. As a result, dangerous ultraviolet radiation reaches the Earth's surface and causes serious health problems, including skin cancer and eye diseases.

Aerosol spray bottles, air conditioners, and refrigerators used to contain chlorofluorocarbons (CFCs) and halogens, all of which harmed the ozone layer. Drifting up into the atmosphere, they destroyed ozone molecules and created two large holes at the North and South Poles. However, most ozone-depleting substances are now banned.

Acid Rain

Acid rain is rain, snow, or fog that is acidic. Acid rain forms when sulfur dioxide and nitrogen dioxide, released from burning fossil fuels, mixes with water, oxygen and other chemicals to form sulfuric and nitric acids in the atmosphere. These then mix with water and fall to the ground.

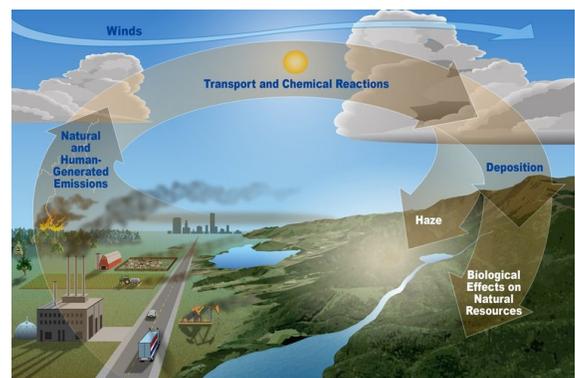
Acid rain harms both natural and built environments. It wears away buildings, cars and human structures. If lakes and rivers become too acidic, fish eggs might not hatch, and some fish may die. When acid rain falls on soil, it affects the balance of microorganisms, and soils that are too acidic make it hard for plants to absorb essential nutrients. Trees at high altitude are often harmed by acid rain, which damages their leaves and pine needles and stunts tree growth.

Climate Change

According to the U.S. Environmental Protection Agency (EPA), changes to Earth's climate are linked to more GHGs in the atmosphere. GHGs absorb radiation from the sun, keeping heat in the atmosphere instead of reflecting it back into space. When GHG particles fall on snow and ice, they melt faster, and fewer ice-covered surfaces mean less heat is reflected away from Earth. This process creates a feedback loop that increases average global temperatures while also melting more snow and ice. With temperatures rising, the planet's glaciers and polar ice caps are dissolving, increasing sea levels worldwide.

Indoor Air Pollution

Most people think of air pollution as an outdoor problem, but indoor air pollution can also be harmful. Air pollution inside buildings is caused by cigarette smoke, cooking fires and chemicals given off by materials like carpeting, electronics and plastics. Older buildings can be contaminated with poisonous lead paint and asbestos dust. Mold, dust mites and other allergens spread through air conditioners and heating vents.



Indoor air pollution tends to be especially bad in developing countries. In these places, many people cook indoors over an open fire, a practice that creates pollution called "particulate" pollution, because it's made up of tiny particles. According to the WHO, 3.8 million people worldwide die each year from diseases and health conditions caused by household air pollution.

Stopping Air Pollution

Air pollution causes heart disease, strokes, lung cancer, acute lower respiratory system infections, and more. During the 1970s, many countries made laws to limit air pollution.

In the United States, the Clean Air Act of 1963 was the first legislation designed to limit air pollution. It was expanded twice to address acid rain and ozone depletion. The laws established air-quality standards and guidelines for motor vehicle and smokestack emissions. The substances regulated by the Clean Air Act include ozone, particulates, carbon monoxide, nitrogen oxides, sulfur dioxide and lead. The EPA estimates that between 2010 and 2020, the Clean Air Act will prevent 230,000 early deaths. Their Acid Rain Program has also been successful. Between 1995 and 2011, sulfur dioxide emissions fell 64 percent, and nitrogen oxide emissions fell 67 percent.

Internationally, the most successful treaty dealing with air pollution was the United Nations' 1987 Montreal Protocol on Substances That Deplete the Ozone Layer. The first universally approved treaty in U.N. history, every nation on Earth signed it. Everyone phased out ozone-depleting pollutants worldwide, and it had a significant impact. The hole in the ozone layer at the South Pole is now much smaller than it was in the past.

Quiz

- 1 Read the selection from the section "Climate Change."

When GHG particles fall on snow and ice, they melt faster, and fewer ice-covered surfaces mean less heat is reflected away from Earth. This process creates a feedback loop that increases average global temperatures while also melting more snow and ice. With temperatures rising, the planet's glaciers and polar ice caps are dissolving, increasing sea levels worldwide.

What can be inferred from this selection?

- (A) Pollution from GHG particles only harms areas covered in snow and ice because they reflect the sun's heat.
- (B) The creation of man-made ice-covered surfaces is the best way to counteract global warming and rising sea levels.
- (C) The feedback loop of melting ice and snow means temperatures will continue to rise even without additional air pollution.
- (D) Stopping the flow of GHG particles into the environment would reverse the feedback loop and end sea-level rise.

2 Read the paragraph below from the section "Indoor Air Pollution."

Indoor air pollution tends to be especially bad in developing countries. In these places, many people cook indoors over an open fire, a practice that creates pollution called "particulate" pollution, because it's made up of tiny particles. According to the WHO, 3.8 million people worldwide die each year from diseases and health conditions caused by household air pollution.

What idea is BEST supported by this paragraph?

- (A) One of the most effective ways to prevent deaths from particulate pollution is to ban indoor cooking in developing countries.
- (B) Only people who are living in developing countries or cooking over an indoor fire need to be worried about indoor air pollution.
- (C) Providing people in developing countries with alternatives to cooking indoors over an open fire could save millions of lives.
- (D) Particulate pollution only affects people while they are indoors and does not have an impact on the environment.

3 Which topic is emphasized in the images included with the article, but NOT in the article itself?

- (A) the cycle of pollution rising into and falling from the atmosphere
- (B) the development of haze and smog as a result of air pollution
- (C) the burning of fossil fuels as a primary cause of air pollution
- (D) the exposure of human beings to the dangers of air pollution

4 Image 3 shows that pollution has biological effects on natural resources.

Based on the article, which of the following MOST DIRECTLY causes these effects?

- (A) chlorofluorocarbons
- (B) radiation
- (C) indoor pollution
- (D) acid rain