

Why is air pollution a concern and what are the principal air pollutants that affect public health and the environment?

You could go days without food and hours without water, but you would last only a few minutes without air. On average, each of us breathes over 3,000 gallons of air each day. You must have air to live. However, did you know that breathing polluted air could make you sick?

Breathing polluted air can make your eyes and nose burn. It can irritate your throat and make breathing difficult. Air pollution especially affects the young, elderly, and people affected by heart or respiratory diseases. In fact, pollutants like tiny airborne particulates and ground-level ozone can trigger respiratory problems. Asthma sufferers can be severely affected by air pollution. Today, nearly 30 million adults and children in the United States have been diagnosed with asthma. Healthy individuals of all ages who participate in outdoor activities and sports, such as running, biking, hiking, etc., are also at a higher risk of suffering from the negative health effects of breathing polluted air.

Some toxic chemicals released in the air such as benzene or vinyl chloride are highly toxic and can cause cancer, birth defects, long term injury to the lungs, as well as brain and nerve damage. In some cases, breathing these chemicals can even cause death. Other pollutants make their way up into the upper atmosphere, causing a thinning of the protective ozone layer. This has led to changes in the environment and dramatic increases in skin cancers and cataracts (eye damage).

Air pollution can damage trees, crops, other plants, lakes, and animals. In addition to damaging the natural environment, air pollution also damages buildings, monuments, and statues. It not only reduces how far you can see in national parks and cities, it even interferes with aviation.

Most air toxics (air pollution) originate from human-made sources, including mobile sources (e.g. cars, trucks, buses) and stationary sources (e.g. factories, refineries, oil/gas wells, fossil fueled power plants, cleaning solvents). Some air toxics are also released from natural sources such as volcanic eruptions and forest fires.

1. Ozone (O₃)
2. Nitrogen oxides (NO_x: NO, NO₂)
3. Sulfur dioxide (SO₂)
4. Carbon monoxide (CO)
5. Particulate pollution (PM)
6. Lead (Pb)
7. Carbon dioxide (CO₂)

Source: EPA.gov

<http://www.epa.gov/airquality/urbanair/>

How is air pollution and air quality monitored and regulated?

The 1990 Clean Air Act is the most recent version of the law first passed in 1970 to clean up air pollution, which also the same year Congress created the Environmental Protection Agency (EPA). The National Ambient Air Quality Standards set the accepted levels of the six principal pollutants listed above that are regulated by the EPA.

Source: EPA.gov

<http://www.epa.gov/air/caa/>

<http://www.epa.gov/air/criteria.html>

Why monitor the air quality of the Denver Metro Area and the Front Range? Isn't Colorado's air cleaner and healthier than other parts of the US?

The Colorado Air Quality Control Commission 2012 Annual Report clearly stated that Northern Colorado's biggest air polluters are the oil & gas industry, fossil fuel power plants, and internal combustion engine vehicles (e.g. cars, trucks, etc.). Various air quality concerns exist in Colorado, including regional haze, greenhouse gas emissions, and particulate matter and nitrogen oxide air pollution but ground-level ozone pollution is the biggest air quality problem facing Northern Colorado.

Source:

<http://archive.coloradoan.com/article/20130226/NEWS01/302260034/What-we-breathing-Northern-Colorado-s-air>

http://airnow.gov/index.cfm?action=airnow.local_state&stateid=6&mapcenter=0&tabs=0

<http://www.epa.gov/ozone/index.html>

<http://www.epa.gov/airquality/ozonepollution/>

What was the purpose of the joint NCAR FRAPPÉ (Front Range Air Pollution and Photochemistry Experiment) and NASA DISCOVER-AQ (Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality) campaign conducted during July and August 2014?

Researchers from the National Center for Atmospheric Research (NCAR) and its University collaborators collected data about air quality for the FRAPPÉ project. The centerpiece of the campaign involved flights of the National Science Foundation C-130 aircraft, which were instrumented to measure air pollutant levels in the area. Despite efforts to limit emissions, this area is still experiencing air quality problems and is exceeding the Environmental Protection Agency's National Ambient Air Quality Standard for ozone on a regular basis in summer. The FRAPPÉ field project was designed to investigate and quantify all factors contributing to air quality in the Colorado Front Range with a special focus on summertime ozone pollution. These factors include:

- Man-made emissions from human activities such as transportation, energy generation, industry, oil and gas activities, and agriculture
- Natural emissions from vegetation and emissions from possible wildfires (not all of which are natural)
- Long-range transport of pollution into the Front Range area from other western states or cross-continental transport from Asia
- Downward transport of stratospheric air as a potential source for ground-level ozone
- Particulate pollution and its sources
- Effects of Front Range air pollution on surrounding areas, such as in Rocky Mountain National Park

Alongside FRAPPÉ, the National Aeronautics and Space Administration (NASA) DISCOVER-AQ campaign conducted its fourth and final mission in Colorado and employed aircrafts in a series of flights to monitor Front Range air pollution levels. On board the planes were a range of scientific instruments that measured gaseous and particulate air pollution in tandem with ground and other air monitoring methods. Accurate air pollution data can help us develop solutions to our region's persistent air pollution problems. Through NASA's DISCOVER-AQ project, scientists aimed to:

- Improve our ability to monitor pollution from satellites
- Allow us to make better air quality forecasts
- More accurately determine the sources of pollutants in the air
- Better understand how sources of air pollution combine and control air quality in the region

Which air pollutants did the joint FRAPPÉ & DISCOVER-AQ campaign monitor?

FRAPPÉ and DISCOVER-AQ researchers monitored the following natural and anthropogenic (human-caused) atmospheric gas emissions and pollutant levels:

- Ozone (O₃)
- Nitrogen oxides (NO_x), especially nitrogen dioxide (NO₂)
- Carbon monoxide (CO)
- Methane (CH₄) and other hydrocarbons
- Volatile organic compounds (VOCs e.g. formaldehyde CH₂O)
- Carbon dioxide (CO₂)
- Ammonia (NH₃)
- Particulate matter (PM), including possible wildfire smoke
- Plus other air pollutants

Source: NCAR, NASA

<https://www.eol.ucar.edu/eo>

<http://discover-aq.larc.nasa.gov/multimedia-newsCO2014.html>

<http://cires.colorado.edu/news/press/2014/airquality.html>