Lesson 3: Why is Ground-Level Ozone Monitored?

Oklahoma Department of Environmental Quality

Grade 5-12 | PASS Skills: Process Standard 4, 5/ Standard 3:1, 4.2

Objectives: Students will be able to identify the health effects associated with ozone and the groups of people who are most at risk from ozone pollution. Students will also be able to conceptualize reasons why air quality can differ from state to state and county to county.

Materials: Computers with internet access, AirCompare Student Worksheet (.pdf)

Pre-requisite Knowledge: An understanding of the ozone formation process will help students answer the **Brainstorm** question on the AirCompare Student Worksheet.

Activity: Based on actual state by state and county by county comparisons, students will develop an understanding of how the air quality can differ in certain areas using the AirCompare tool created by AIRNow.gov. Students can begin to brainstorm reasons why the air quality may differ from one area to another using the information collected in the data tables and their new knowledge of ozone formation.

Implementation Tips: Emphasize how critical it is to monitor ground---level ozone emissions because of the health---related conditions that can result from exposure. Monitoring information is especially important for those who suffer from asthma, other bronchial/pulmonary conditions, as well as elderly adults and young children. Students can gain more detailed information by viewing the following .pdf document that is specifically about "Ozone and Your Health", Page 2 (http://www.epa.gov/airnow/ozone-c.pdf).

Notes to Teacher: Teachers are encouraged to sign up to receive air quality health advisories to notify their students on the days when the air quality is poor, especially for those students who fall in the category of sensitive groups. Air quality awareness will help students know when they should stay indoors for recess or limit strenuous activities (http://www.deq.state.ok.us/aqdnew/AdvisorySignUp.htm).

Additional Resources: http://www.cdc.gov/asthma/asthmadata.htm
http://www.epa.gov/airnow/ozone---c.pdf
http://www.epa.gov/airnow//health---prof/EPA_poster-final(revised2).pdf

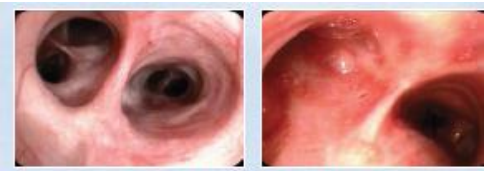
Why is air pollution monitoring important?

Poor air quality can affect everyone's health. It can have direct effects on the lungs, and it can worsen existing conditions, such as lung disease, emphysema, and asthma. Some groups of people are more sensitive to air pollution than others are. These sensitive groups include young children with developing lungs, elderly adults with weakened immune systems, people who frequently exercise or work outdoors, and individuals who suffer from cardiac, pulmonary or bronchial conditions.

In Oklahoma, the main types of air pollution are ground-level ozone and particulate matter; however, ozone is usually of greater concern due to its elevated concentrations in the warmer months. Because ozone can affect your health, it is important to avoid exposure to high concentrations.

According to the Oklahoma Public Health Data for 2012, 21.6% of high school students suffer from asthma (source: http://healthyamericans.org/states/?stateid=OK). Also, the Asthma and Allergy Foundation of America recently released the *Top Asthma Capitals for 2012*. Oklahoma City was ranked number 8 on the list based on air pollution levels, number of ozone days, poverty rates, and public smoking laws (source: http://www.asthmacapitals.com).

Based on those statistics, there is a significant portion of the Oklahoman population that could benefit from daily air quality information, specifically health alerts and advisories. To subscribe to air quality health advisories, please visit the Air Quality Division's website to receive the most up-to-date notifications (http://www.mailermailer.com/x?oid=20551e).



Ozone can inflame the lung's lining. These photos show a healthy lung airway (left) and an inflamed lung airway (right). Photos courtesy of PENTAX Medical Company.

Ozone: How it affects Your Health

On days that are forecasted or reported to be unhealthy, the following health issues can arise:

- Irritation of respiratory systems- symptoms usually include coughing, sore throat, or tightening of chest.
- Reduced lung function- symptoms usually include difficulty breathing and hyperventilation.
- Inflammation of lungs- after a few days of exposure, the previously mentioned symptoms continue to occur; however, cell damage begins to surface and the airways to the lungs become constricted.
- Susceptible to infection- when the lungs are inflamed and cell damage has occurred; infection is more likely to set in.
- Aggravation of asthma- for those who have existing respiratory conditions, high ozone levels can trigger asthma attacks which often require the need for medication or medical attention. Sensitivity to allergens can also arise.
- Permanent lung damage- repeated episodes of ozone pollution can result in long-term lung damage for developing children and an increased weakening of immune systems for elderly adults.

To avoid such symptoms and their potential long-term effects, it is necessary to limit exposure to unhealthy levels of ozone. Reduce time outdoors when ozone levels are high, or reserve certain outdoor activities for the morning and evening hours when ozone levels are typically lower. If you must be outside, limit levels of exertion and heed air quality health advisories.

Guided Solutions to Student Worksheet:

1 – 2. **Answers will vary. For example:**

Number of Unhealthy Days-- State Comparison: 2011

State	*Name of County*	*Number of Unhealthy Days*
Minnesota	Lake	7
Oklahoma	Tulsa	28
Texas	Harris	31

1. Out of the three states that were selected, one of which was Oklahoma, which state had county with the highest number of unhealthy days? **ANSWER: Texas.**

Number of Unhealthy Days Oklahoma County Comparison: 2011

Counties	*Number of unhealthy days*
Carter	22
Caddo	14
Creek	7

2. Out of the three counties that were selected, which county had the highest number of unhealthy days? **ANSWER: Carter County.**

3. **Brainstorm:** What are some factors that might cause air pollution (i.e., number of unhealthy days), to vary from state to state or from county to county?

ANSWER: Potential Factors that can cause air pollution levels to vary from area to area include population density (larger populations will have more sources of VOCs and NOx which are the necessary components in ozone formation—lesson 2) available sunlight (areas with more sunlight and ample sources of VOCs and NOx will easily facilitate ozone formation), and wind (wind can transport pollutants from one area to another or can decrease concentration levels if mixing occurs).

*Activity Extension: In addition to using AIRNow's AirCompare tool, students can also compare the air quality of different states by accessing the AIRNow Visibility Webcams (http://www.airnow.gov/index.cfm?action=airnow.webcams). Students will select three states from the index list and complete the following data table (information in the table has been provided as an example):

State	Camera Location	Current Air Quality	Pollutant being Monitored	Description of Air Quality
Massachusetts	Boston	Good	Ozone/Fine Particles	Clean air conditions are present with mostly cloudy skies
Washington	Mount Rainier National Park	Good	Ozone	Very clear skies and great visibility, indicating clean air conditions
Denver	Downtown Denver	Good	Particulate 2.5	Skies are clear with some hazy conditions