



The Asian Brown Cloud

By: The Clean Air Campaign, Inc. and Earth Day Network

INTRODUCTION

In this lesson, students will learn about the 6 common air pollutants, as well as the poor air quality in Asia and the reasons for its cause.

LESSON OVERVIEW

Recommended Grade Level & Subject: Grades 6-8: Social studies

Length: One class period

Objectives:

After completing this lesson, students will be able to:

- Identify causes of air pollution in Asian cities.
- Show understanding of citizen's role in creating public policy.
- Learn about air pollution in Asia, aka "the Asian Brown Cloud."
- Discover how pollution impacts climate and weather.
- Create a protest poster for a rally seeking policy changes in current environmental control policies.

National Standards Addressed:

This lesson addresses the following standards.¹

- **Content Standard:** [NL-ENG.K-12.7 APPLYING KNOWLEDGE](#)
 - Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and non-print texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
- **Content Standard:** [NSS-G.K-12.5 ENVIRONMENT AND SOCIETY](#)

As a result of activities in grades K-12, all students should

 - Understand how human actions modify the physical environment.
 - Understand how physical systems affect human systems.
- **Content Standard:** [NSS-C.5-8.5 ROLES OF THE CITIZEN](#)
 - How can citizens take part in civic life?

¹ Education World (2008) *U.S. National Education Standards*. Retrieved February 5, 2009, from <http://www.education-world.com/standards/national/index.shtml>.

- **Content Standard:** [NSS-G.K-12.2 PLACES AND REGIONS](#)
As a result of their activities in grades K-12, all students should
 - Understand the physical and human characteristics of places.

Materials Needed:

- Magazines for cutting pictures
- Poster paper (or 10x13 construction paper)
- Markers, scissors, glue
- Reproducible #1 – **Cartoon Graphics**
- Reproducible #2 – **“Asian Brown Cloud”**
- Reproducible #3 – **“Children and Ozone Air Pollution”**
- Reproducible #4 – **Questions for Articles**
- Reproducible #5 – **Poster Rubric**
- Powerpoint – **“6 Major Pollutants”**

Assessment: Students will be assessed through the following activities:

- Participation in class discussion and group work
- Answering questions from articles
- Completion of poster (see Reproducible #5 – **Poster Rubric**)

LESSON BACKGROUND

Relevant Vocabulary: See Powerpoint

- **Ozone:** a gas that forms in the atmosphere due to the burning of fossil fuels (gas, diesel, coal, wood).
- **Carbon monoxide:** an odorless, colorless, poisonous gas that comes mainly from motor vehicles and other combustion exhaust.
- **Nitrogen Dioxide & Nitrogen Oxides:** Both are produced when fuel (gas, kerosene) is burned, especially in power plants and motor vehicles.
- **Sulfur Dioxide:** Created when fuel containing sulfur (such as coal & petroleum) is burned in power plants and diesel engines mainly.
- **Particulate matter:** Microscopic particles and tiny droplets of liquid. These particles come from the burning of fuels by industry and diesel vehicles and from earth-moving activities such as construction and mining.
- **Lead:** Has been identified as a poisonous substance for many years. There has been a major reduction and total elimination of lead in gasoline and a huge decrease in lead exposure to humans in outdoor air.
- **ppm:** (parts per million) - Describes the concentration of pollutants in the air.

Information:

Pollution is a threat to agriculture, public health, and native plants and animals. It can change the weather and cause people to die prematurely. It is made up of several types of ingredients mostly

created by humans and the way they interact with their environment. Many nations have taken steps to improve their environment through policies and laws. But there is still a long way to go to have clean air globally. The increase in industrialization in Asia for example has led to an increase in air pollution from factories, power plants and the rapidly growing population's reliance on fuel burning vehicles (cars & trucks).

Resources:

http://www.infoimagination.org/ps/warm/brown_cloud.html

<http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=44567>

LESSON STEPS

Warm-up: *Cartoons on Air Pollution*

- Begin this lesson by sharing **Reproducible #1 - Cartoon Graphics** with students. Have them think-pair-share about what subject they think the images attempt to introduce. Ask the following questions:
 - a) What are the cartoon images portraying? *Your students might discuss clean air, pollutants.*
 - b) Why might citizens care about this issue? *We need clean air, we are polluting our air.*
 - c) Who in the images is affected? *We are.*
 - d) Can you think of anything the people can do to change their environment? *Not use chemicals on plants, walk more, drive less.*
 - e) Ask the class to list some activities that they engage in that would not be possible without clean air. *Going outside at P.E. and recess, and playing outside at home.*

Activity One: *Six Pollutants*

1. Break students into groups of 3-4 and provide each group with 6 pieces of poster paper & magazines.
2. View the Powerpoint and/or print the Powerpoint in handout mode and assign each group to read the 6 pollutants and list the health effects of each pollutant from the Powerpoint vocabulary.
3. Have students make vocabulary flip chart posters with info from Powerpoint slides (word on front, health effect on back)

Activity Two: *Reading about Air Pollution*

1. After all groups have built compiled their health effects of pollution, students will read both articles: **Reproducible #2 – “Asian Brown Cloud”** and **Reproducible #3 - “Children and Ozone Air Pollution.”**

The articles used in the reproducibles can be found at these sites:

[Reproducible #2](http://www.infoimagination.org/ps/warm/brown_cloud.html) (http://www.infoimagination.org/ps/warm/brown_cloud.html)

[Reproducible #3](http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=44567) (<http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=44567>)

2. Students answer the questions on **Reproducible #4 – Questions on Articles.**

Activity Three: *Protest Poster with Slogan*

Have students create a poster with a slogan that reflects their understanding of air pollution and its impact on cities. The poster should state reasons for ensuring clean air in order to create changes in current public policy on environmental pollution.

Wrap Up: *Protest Rally*

Have students stage a mock protest in class with their posters.

Extension: *Share with Your School*

Bring the protest through the halls, lunchroom, etc.; invite available staff or students to witness the protest and comment.

CONCLUSION

Through this lesson, students should learn the 6 most common pollutants and their effects on human health. They will apply what they have learned through the creation of a protest poster and will have a better understanding of what they personally can do to help eliminate air pollution, as well as the type of public policies needed to reduce pollution.

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“And this little warning light flashes
when the outside air becomes too
polluted to breathe.”



Asian Brown Cloud Poses Global Threat

August 12, 2002

By CNN's Marianne Bray and wire reports

HONG KONG, China -- A dense blanket of pollution, dubbed the "Asian Brown Cloud," is hovering over South Asia, with scientists warning it could kill millions of people in the region, and pose a global threat. In the biggest-ever study of the phenomenon, 200 scientists warned that the cloud, estimated to be two miles (three kilometers) thick, is responsible for hundreds of thousands of deaths a year from respiratory disease. By slashing the sunlight that reaches the ground by 10 to 15 percent, the choking smog has also altered the region's climate, cooling the ground while heating the atmosphere, scientists said on Monday.



The potent haze lying over the entire Indian subcontinent -- from Sri Lanka to Afghanistan -- has led to some erratic weather, sparking flooding in Bangladesh, Nepal and northeastern India, but drought in Pakistan and northwestern India.

"There are also global implications, not least because a pollution parcel like this, which stretches three kilometers high, can travel half way round the globe in a week," U.N. Environment Program chief Klaus Toepfer told a news conference in London on Sunday. The U.N.'s preliminary report comes three weeks before the Earth Summit in Johannesburg, which opens on August 26, where all eyes will be on how not to overburden the planet.

Global threat

While haze hovers over other parts of the world, such as above America and Europe, what surprised scientists was just how far the cloud extended, and how much black carbon was in it, according to A P Mitra from India's National Physical Laboratory. Asia's brown haze is altering the weather, creating acid rain. A cocktail of aerosols, ash, soot and other particles, the haze's reach extends far beyond the study zone of the Indian subcontinent, and towards East and Southeast Asia.

While many scientists once thought that only lighter greenhouse gases, such as carbon dioxide, could travel across the Earth, they now say that aerosol clouds can too. "Biomass burning" from forest fires, vegetation clearing and fossil fuel was just as much to blame for the shrouding haze as dirty industries from Asia's great cities, the study found. A large part of the aerosol cloud comes from inefficient cookers, where fuels such as cowdung and kerosene are used to cook food in many parts of Asia, says Mitra.



Acid rain

Using data from ships, planes and satellites to study Asia's haze during the northern winter months of 1995 to 2000, scientists

were able to track its journey to pristine parts of the world, such as the Maldives, to see how it affected climate.

They discovered not only that the smog cut sunlight, heating the atmosphere, but also that it created acid rain, a serious threat to crops and trees, as well as contaminating oceans and hurting agriculture. "It was much larger than we thought," said Mitra. The report suggested the pollution could be cutting India's winter rice harvest by as much as 10 percent.

The report calculated that the cloud -- 80 percent of which was man-made -- could cut rainfall over northwest Pakistan, Afghanistan, western China and western central Asia by up to 40 percent.

While scientists say it is just early days and they need more scientific data, they do say the regional and global impact of the haze will intensify over the next 30 years, with an estimated five billion people living in Asia. Nobel laureate Paul Crutzen -- one of the first scientists to identify the causes of the hole in the ozone layer and also involved in the U.N. report -- said up to two million people in India alone were dying each year from atmospheric pollution. In the next phase of the project, scientists will collect data from the entire Asian region, over more seasons with more observation sites and refine their techniques.

But because the lifetime of pollutants are short and they can be rained out, scientists are hopeful that if Asians use more efficient ways of burning fuel, such as better stoves, and cleaner sources of energy, time has not run out.

Children and Ozone Air Pollution Fact Sheet

While exposure to ozone air pollution causes adverse health effects in most people, children are especially susceptible to these effects. Children spend significantly more time outdoors, especially in the summertime when ozone levels are the highest.

National statistics show that children spend an average of 50 percent more time outdoors than do adults.

A recent study conducted by the American Lung Association shows that as many as 27.1 million children age 13 and under, and over 1.9 million children with asthma are potentially exposed to unhealthy levels of ozone based on the new 0.08 ppm, eight-hour ozone level standard.

Minority children are disproportionately represented in areas with high ozone levels. Approximately 61.3% of black children, 69.2% of Hispanic children and 67.7% of Asian-American children live in areas that exceed the 0.08 ppm ozone standard, while only 50.8% of white children live in such areas.

Children spend more time engaged in vigorous activity (i.e., exercise). Such activity results in breathing in more air, and therefore more pollution being taken deep into the lungs. A California study found that children spend three times as much time engaged in sports and vigorous activities as adults do.

Children have a higher breathing rate than adults relative to their body weight and lung surface area. This creates a greater dose of pollution delivered to their lungs. Most biological air pollution damage is related to the dose of pollution inhaled in relation to the body weight and surface area of the target organ.

Even when children experience significant drops in lung function, they do not seem to suffer or report some of the acute symptoms, such as coughing, wheezing or shortness of breath, associated with ozone exposure in adults. Thus, children are not likely to receive or may not understand the biological warnings to reduce their ozone exposure by stopping their exercise or moving indoors.

Children have narrower airways than do adults. Thus, irritation or inflammation caused by air pollution that would produce only a slight response in an adult can result in a potentially significant obstruction of the airways in a young child.

During exercise, children, like adults, breathe with both their nose and mouth rather than just their noses. When the nose is bypassed during the breathing process, the filtering effects of the nose are lost, therefore allowing more air pollution to be inhaled.

Air pollution, including ozone, can result in more frequent respiratory infections in children due to impairment of the lung's ability to defend itself. Scientists are concerned that children who experience more frequent lower respiratory infections may be at greater risk of lower-than-normal lung function later in life.

When ozone levels are high, children should avoid calisthenics, soccer, running and other strenuous outdoor exercise. They should be encouraged to participate in less strenuous activities such as recreational swimming, swinging or indoor activities such as floor hockey and gymnastics instead.

Questions for Articles: “Asian brown cloud poses global threat” and “Children and ozone air pollution fact sheet”

Answer the following questions:

1. What are some pollutants mentioned in the article?
2. How has air pollution affected the weather?
3. What did scientists discover about the effects of smog on the climate?
4. List some of the costs of air pollution to a government? To a family?
5. List some of the ways to reduce air pollution.

Rubric:

Making A Poster: Asian Brown Cloud Poster

Teacher Name: _____

Student Name: _____

CATEGORY	4	3	2	1
Required Elements	The poster includes all required elements as well as additional information.	All required elements are included on the poster.	All but 1 of the required elements are included on the poster.	Several required elements were missing.
Knowledge Gained	Student can accurately answer all questions related to facts in the poster and processes used to create the poster.	Student can accurately answer most questions related to facts in the poster and processes used to create the poster.	Student can accurately answer about 75% of questions related to facts in the poster and processes used to create the poster.	Student appears to have insufficient knowledge about the facts or processes used in the poster.
Content - Accuracy	At least 7 accurate facts are displayed on the poster.	5-6 accurate facts are displayed on the poster.	3-4 accurate facts are displayed on the poster.	Less than 3 accurate facts are displayed on the poster.
Attractiveness	The poster is exceptionally attractive in terms of design, layout, and neatness.	The poster is attractive in terms of design, layout and neatness.	The poster is acceptably attractive though it may be a bit messy.	The poster is distractingly messy or very poorly designed. It is not attractive.