IN THE AIR

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CORE Activity

"Constructing a Continuum of Commonly Held Beliefs About the Magnitude of Airborne Toxics"

9-12 EDUCATION MODULE

EPA

Missouri Botanical Garden

Correlation with Education Standards Summary

CORE Activity
"Constructing a Continuum of Commonly Held Beliefs About the Magnitude of Airborne Toxics"

For a narrative description of these standards, please refer to the Teacher's Guide.

National Standards

SOURCE: www.education-world.com/standards

NL-ENG.K-12. .3 .4 .7
NM-PROB.REP.PK-12.3
NS.9-12 .1 .6
NSS-C.9-12.5
NCSS Strands VIII IX, X
NT.K-12.2

Missouri Show-Me Standards

SOURCE: www.dese.mo.gov/standards

Performance Standards:
GOAL 1: 6, 8, 10
GOAL 2: 2, 3
GOAL 3: 1, 5, 6, 7
GOAL 4: 1, 6, 7

Knowledge Standards:
CA 1, 4, 5, 6
HPE 6
SC 8
SS 6, 7

Funding was provided by U.S. EPA, with generous support from Missouri Botanical Garden's EarthWays Center, and the 69 reviewers and partners.

"Constructing a Continuum of Commonly Held Beliefs About the Magnitude of Airborne Toxics"

Overview

This activity provides information necessary for understanding problems associated with airborne toxics and for constructing a continuum of commonly held beliefs about the seriousness of the problems. Throughout these exercises, students are called upon to research and analyze information and to come to conclusions based upon their findings.

Recommended Grade Level:

9-12

Preparation Time:

Time needed to copy student worksheets (four pages per student)

Presentation Time:

- Introduction: airborne toxics chart and America's Clean Air Act: one 45- minute to 50- minute class period
- Constructing a continuum of beliefs about the magnitude of air-borne toxics: one 45-minute to 50- minute class period

Goals

- To provide students with tools and information necessary for carrying out the Connecting Activities
- To introduce the concepts of continuum and dichotomy and demonstrate how these tools are useful for organizing information
- To demonstrate by means of a continuum how and why people hold different views about the seriousness of airborne toxics
- To encourage analysis of ideas and beliefs
- To promote decision making based on research and study

Objectives

When this activity is completed, students will be able to do the following:

- Distinguish airborne toxics from other kinds of air pollution.
- Briefly describe how the Clean Air Act has changed since its inception in 1955.
- State the purpose for which the U.S. Environmental Protection Agency was established.
- Define continuum and give examples relevant to beliefs about airborne toxics.
- Define dichotomy and state why it does not apply to beliefs about airborne toxics.

Materials

Copies of the student sheets:

- America's Clean Air Act
- Airborne Toxics Chart
- Dichotomy and Continuum
- A Continuum of Beliefs About the Magnitude of Airborne Toxics

Vocabulary List

Airborne toxic:
Any air pollutant . . . that may reasonably be anticipated to cause cancer; respiratory, cardiovascular, or developmental effects; reproductive dysfunctions, neurological disorders, heritable gene mutations; or other serious or irreversible chronic or acute health effects in humans.

Air pollutant:
Any substance in air that could, in high enough concentration, harm humans, other animals, vegetation, or buildings or other materials. Pollutants may include almost any natural or artificial composition of matter capable of being airborne. They may be in the form of solid particles, liquid droplets, gases, or in some combination.

Continuum: [con TIN u um]
A graphic model that describes two contradictory poles (ideas) with a range of possible steps between the two poles.

Dichotomy: [die COT uh me]
The division of an idea (or thing) into two parts between which no middle ground exists.

Hazardous Air Pollutants HAPs:
(a subset of airborne toxics) Air pollutants that may present a threat of adverse human health effects or adverse environmental effects, and for which legal standards have been defined in the Clean Air Act of 1990.

Magnitude: [MAG ni tude]
Significance, importance, or sheer size of anything

Smog:
A mixture of pollutants, principally ground-level ozone, produced by chemicals reacting in the air.

Procedures

America's Clean Air Act

1. Discuss with students why and how the Clean Air Act began in the United States, and how it became more comprehensive over time. See Background Information at the end of the module.
2. Hand out copies of America's Clean Air Act worksheet and the Airborne Toxics Chart. Have students take the quiz on the worksheet.
3. Using the Airborne Toxics Chart go over the definitions on the chart with the class, emphasizing that this module is only about airborne toxics and hazardous air pollutants as defined on the chart. Use the Teacher Answer Sheet to discuss the quiz questions with the students.

A Continuum of Beliefs About the Magnitude of Airborne Toxics

4. Comment that few people within the general public have the time or background to understand the technical aspects of airborne toxics or calculate their dangers. Instead, most people develop beliefs from bits and pieces they read or hear, or from situations they have personally experienced. Not surprisingly, then, beliefs about the magnitude of airborne toxics problems run the gamut from skepticism that the situation is as bad as it has been portrayed to fear that problems are so serious they may be unsolvable.
5. To introduce the concepts of dichotomy and continuum, hand out copies of the Dichotomy and Continuum worksheet. Discuss the worksheet with students and have them complete the exercises. Follow up with a discussion, stressing that most human beliefs and activities are more accurately illustrated by means of a continuum rather than a dichotomy.
6. Divide the class into small groups, or let students work in pairs. Hand out copies of the worksheet A Continuum of Commonly Held Beliefs About the Magnitude of Airborne Toxics. Go over the instructions with the class. For assistance, see the teacher's copy of the continuum page.
7. After a reasonable period of time, reconvene the class and discuss the results. After the discussion, sum up their ideas - you can also use the examples on the Teacher Copy of the worksheet.
   - BELIEF STATEMENT 1—The magnitude and urgency of airborne toxics problems have been greatly overstated.
   - BELIEF STATEMENT 2—Why worry about airborne toxics? What you don't know won't hurt you.
   - BELIEF STATEMENT 3—Airborne toxics are a nuisance, but they seriously affect only a few people.
   - BELIEF STATEMENT 4—Airborne toxics are a serious problem, but I'm not responsible.
   - BELIEF STATEMENT 5—Airborne toxics are a critical problem. However, the effects may be remediable.

Conclusion

Most of the important issues faced by human beings cannot be reduced to simple dichotomies, as if only two ways of perceiving an issue existed. When organized on a continuum, however, differing attitudes between opposing viewpoints may be explored and evaluated.

In-depth analysis about the differing attitudes is continued in the five Connecting Activities that follow. Sugesstions for teaching the Connecting Activities are found in the Teacher's Guide.

For Further Reading and Research

Bates, David V. and Caron, Robert B., Eds. *A Citizen's Guide to Air Pollution*. Kingston, Ontario: McGill-Queen's University Press, 1972. A bit dated, but the authors present basic information about air pollution and what citizens may do about it in non-technical terms.

For Further Reading and Research (Cont.)

Davis, Devra. *When Smoke Ran Like Water: Tales of Environmental Deception and the Battle Against Pollution*. New York: Basic Books, 2002. Author Davis is a renowned environmental epidemiologist who grew up in Donora, Pennsylvania, the scene of devastating smog in 1948. In this book, she presents evidence that airborne toxics are responsible for thousands of deaths in America each year. She documents how powerful vested interests in business and government resist making needed changes.

For a summary of views from both ends of the continuum see:
http://www.ncpa.org/bothside/krt/krt081999b.html

Masters

Student Sheets

- America's Clean Air Act
- Airborne Toxics Chart
- Dichotomy and Continuum
- A Continuum of Beliefs About the Magnitude of Airborne Toxics

America's Clean Air Act

STUDENT WORKSHEET

Air Pollution Control Act of 1955	Clean Air Act of 1963	Clean Air Act of 1970	Clean Air Act of 1990
"An Act to provide research and technical assistance relating to air pollution control."	"An Act to improve, strengthen, and accelerate programs for the prevention and abatement of air pollution."	"An Act to amend the Clean Air Act to provide for a more effective program to improve the quality of the Nation's air."	"An Act to amend the Clean Air Act to provide for attainment and maintenance of health protective national ambient air quality standards, and for other purposes." ***** This act listed 189 hazardous air pollutants
For more information about the above Clean Air Acts, see http://www.ametsoc.org/AMS/sloan/cleanair/index.html.			

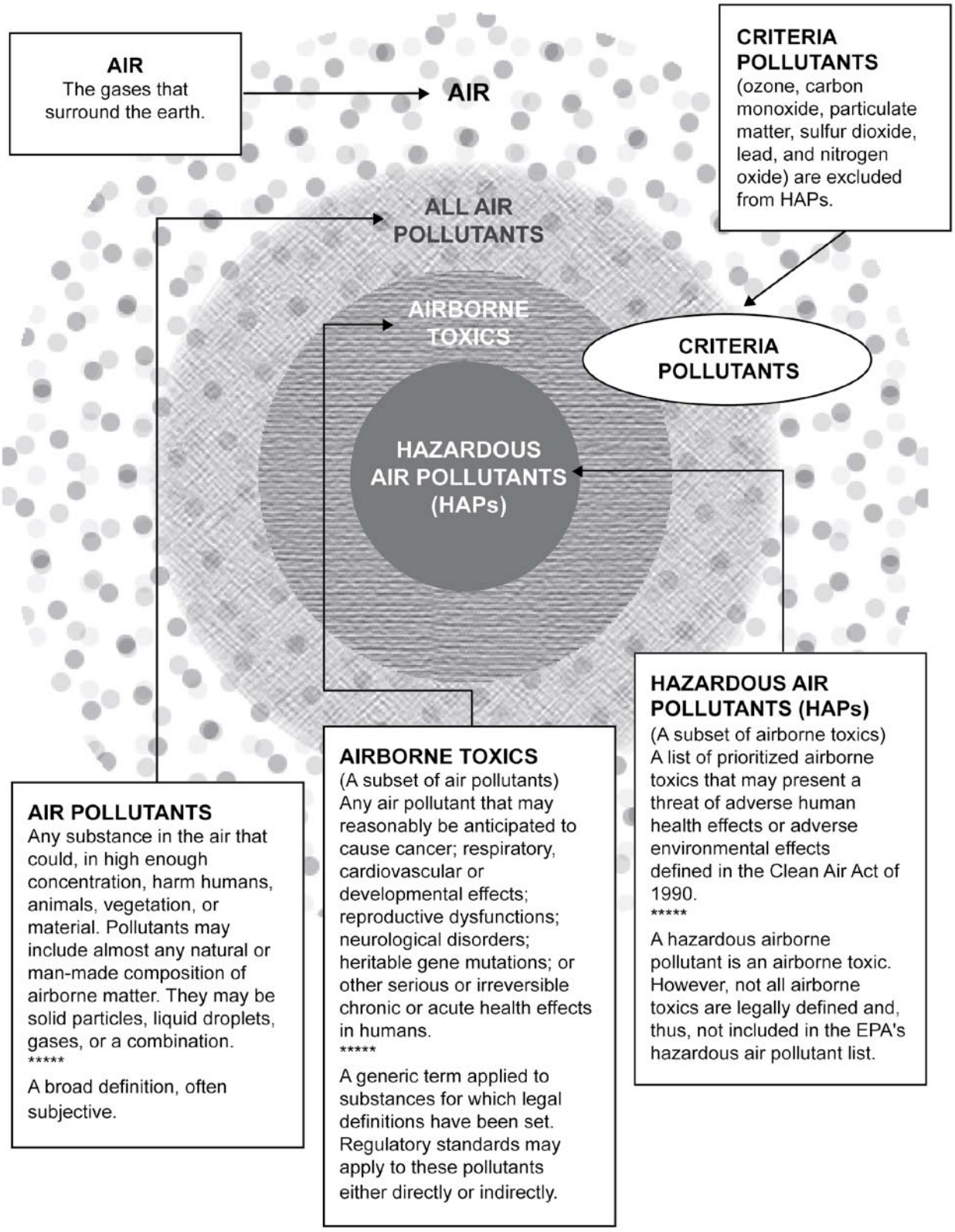
What Do You Know About the History of Clean Air Laws?

1. The United States was the first nation to pass regulations regarding air pollutants.
2. Some cities in the United States passed clean air regulations long before the federal government did.
3. Once clean air regulations are passed, they cannot be changed, modified, or reversed by other elected officials.
4. Factories and other industrial facilities are by far the greatest source of air pollutants in America.
5. The U.S. Environmental Protection Agency (USEPA) has authority to enforce clean air regulations.

	T	F
1		
2		
3		
4		
5		

YOUR SCORE →	5 CORRECT	4 CORRECT	3 CORRECT	2 CORRECT	1 CORRECT	0 CORRECT
	Blue Skies				**Where Did Everyone Go?**	

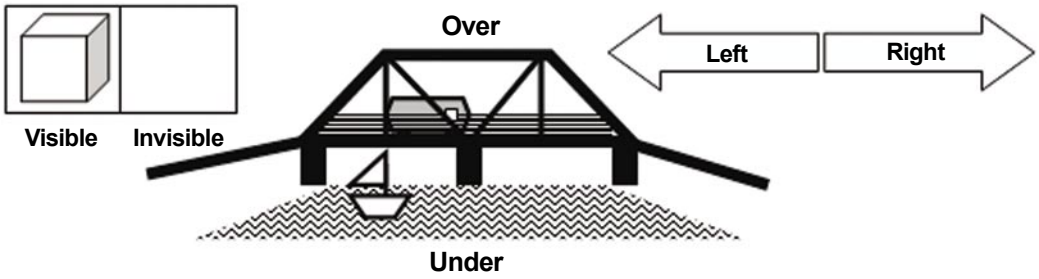
Airborne Toxics Chart



Dichotomy and Continuum

STUDENT WORKSHEET

The physical and social sciences make use of the concepts, dichotomy and continuum, for various purposes. As used in this module, dichotomy (die COT uh me) refers to a division of something into two distinct parts between which there is no middle ground.



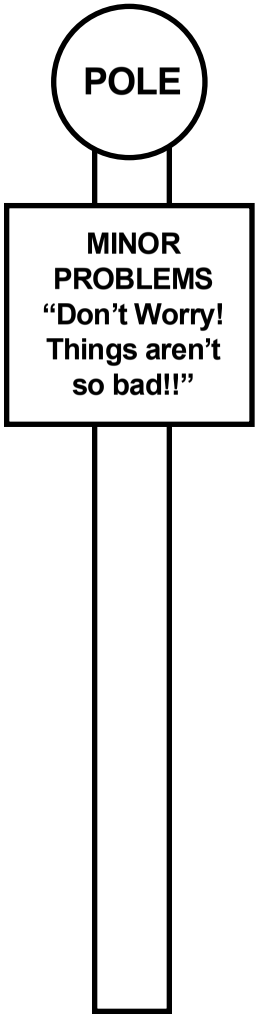
Give your own example of a dichotomy and explain what makes it so.

Continuum (con TIN u um): A continuum, as used in this module, is a graphic model that describes a range of possibilities between opposite ideas or things in a gradual or logical progression. A simple example may be demonstrated with terms **Rural and Urban** referring to human settlement patterns. On the continuum below, write the characteristics in the Rural box that typify the most rural place you can imagine. Do the same in the Urban box. Then fill in a range of possible types of human settlement from one extreme, or pole, to the other.

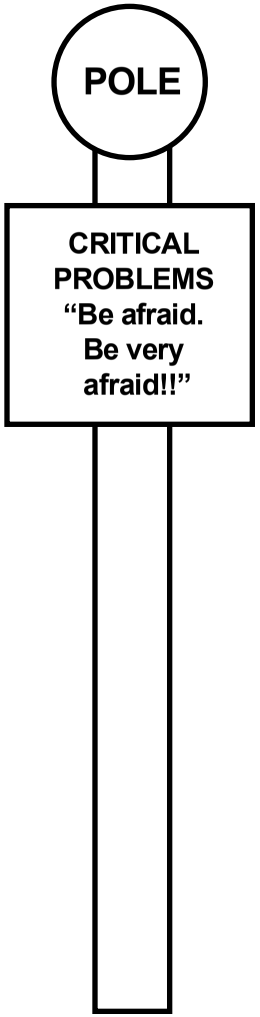
RURAL						URBAN

A Continuum of Beliefs About the Magnitude of Airborne Toxics

A dichotomy, represented by the poles in the diagram below, expresses opposing views about the magnitude of airborne toxics. Most people's perceptions, however, lie between the two poles. On the continuum below, work with your group or partner to fill in degrees of belief about the magnitude of airborne toxics problems from one pole to the other. Give an example of each type. (This is not a test with no definitive answers, so let your mind roam freely.)



SCALE OF BELIEFS FROM DENIAL THAT PROBLEMS ARE SERIOUS . . . . . .TO ANXIETY THAT PROBLEMS ARE CRITICAL				
Belief	**Belief**	**Belief**	**Belief**	**Belief**
Example	**Example**	**Example**	**Example**	**Example**



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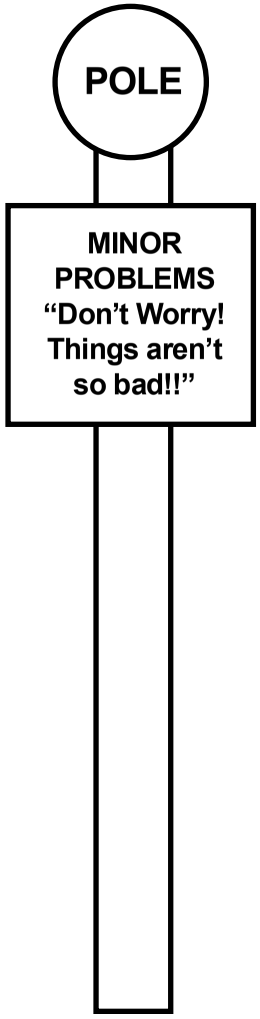
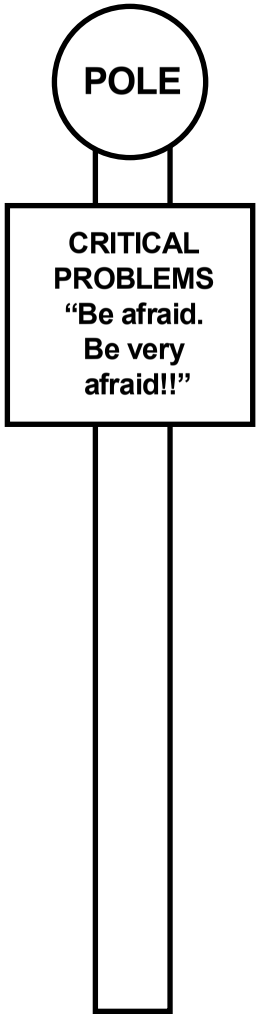


SCALE OF BELIEFS

FROM DENIAL THAT PROBLEMS ARE SERIOUS . . . . . .TO ANXIETY THAT PROBLEMS ARE CRITICAL

Belief	Belief	Belief	Belief	Belief
Problems exist but are greatly overstated.	Problems exist, but what you don't know won't hurt you.	Problems exist, but they affect only a few people.	Problems are serious, but the general public is not responsible	Problems are critical, immediate action is required of everyone.
Example	**Example**	**Example**	**Example**	**Example**
Opponents of global warming theories who insist that humans are not causing all of the problems. "Cycles such as these are natural and have happened many times before."	Citizens and politicians who prefer not to get involved or support clean air measures. "Don't ask, don't tell."	Localized places where toxics were found, i.e., Love Canal, NY, and Times Beach, MO. "Too bad, but it's not my problem."	Shifting the blame to others. Making the problem a dichotomy of Polluters/Victims "Them and Us"	Environmental activists warning us that humans are seriously harming the planet. "The earth is telling us something."



America's Clean Air Quiz

TEACHER ANSWER KEY

What Do You Know About The History Of Clean Air Laws?
True/False Test Answers

1. The United States was the first nation to pass laws regulating air pollutants.

   FALSE: In 1306, King Edward I of England banned the use of sea coal in London because of the smoke it generated.

2. Some cities in the United States passed clean air regulations long before the federal government did.

   TRUE: Such large cities as Chicago, Cincinnati, and St. Louis began passing clean air regulations decades before the first federal law was enacted.

3. Once clean air regulations are passed, they cannot be changed, modified, or reversed by other elected officials.

   FALSE: Laws and regulations made by lawmaking bodies may be revoked, invalidated, or repealed by other lawmaking bodies at later times.

4. Factories and other industrial facilities are by far the greatest source of air pollutants in America.

   FALSE: Over one-half of all air pollution in America comes from automobiles and other vehicles.

5. The U.S.Environmental Protection Agency (USEPA) has the authority to enforce clean air regulations.

   TRUE: The legislation establishing the USEPA calls for, "The establishment and enforcement of environmental protection standards consistent with national environmental goals . . .."