



GRADES: 7-11

SUBJECTS: Social Science, Biology, Science, Geography, Health, Environmental Studies, Civics and Government

TIME: 4 Hours; 2 2/3 Blocks or 5 Periods.

STATE STANDARDS:

Civics Standard 3 - Citizenship, P.I. C.416 - Grades 9-11

Geography Standard 1 - Maps, G.402 - Grades 9-11

Geography Standard 2 - Environment, G.406, G.408 - Grades 9-11; 7.422, 8.422 - Grades 7-8

History Standard 1 - Chronology, P.I. H.401, H.402 - Grades 9-11; 7.427, 8.428 - Grades 7-8.

History Standard 1 - Interpretation, P.I. H.408 - Grades 9-11

Science Standard 1 - Nature and Application of Science and Technology (Science as Inquiry) 1.11

Science Standard 6 - Life Processes (Health and Technology Applications) 6.41

Science Standard 8 - Ecology (Interaction of Humans within Eco systems) P.I. 9.75 - Grades 9-11

7

WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

OVERVIEW OF THE LESSON

Scope and Purpose of the Lesson:

This lesson contains a variety of activities that provide a conclusion to the Air Quality Lessons. Students will examine the health symptoms caused by specific pollutants.

◆ Topics Addressed:

Health impacts of air pollution
Segments of the population that are most at risk
Particulate matter
Carbon monoxide
Ozone
Health symptoms
Lead
Nitrogen Oxide
Sulfur Dioxide

Synopsis of the Lesson:

This lesson contains three activities that are focused on the health symptoms caused by specific pollutants. In the heart of this lesson students engage in a Questioning Game activity of analyzing a series of case studies.

LEARNING OBJECTIVES

Students will be able to:

- ◆ Identify what segments of the population are most at risk from air pollution
- ◆ Understand that healthy teenagers and adults can be affected by severe air pollution
- ◆ Summarize the health effects of exposure to high concentrations of particulate matter (PM₁₀)
- ◆ Summarize the health effects of exposure to high concentrations of carbon monoxide (CO)
- ◆ Summarize the health effects of exposure to high concentrations of Ozone (O₃)
- ◆ Apply this knowledge in analyzing a series of case studies to determine the specific pollutant(s) likely to have caused a given set of symptoms



BACKGROUND

The heart of this activity is a questioning game in which the class interviews a “patient” who is experiencing a health problem that may be related to air pollution. The class goal is to ask questions that clarify the patient’s symptoms and deduce the probable cause. Seven such cases are included on the “Symptom Scenario” cards.

The Symptom Scenarios, although based on fictional characters, are realistic examples of well-documented health effects of exposure to specific pollutants.

LESSON PROCEDURE

INTRODUCTION OF LESSON Start the lesson with a Warm-up, Mind Set, or Anticipatory Set on the overhead or chalk board. The WARM UP and the DISCUSSION should take about **10 minutes**.

1. WARM UP, MIND SET OR ANTICIPATORY SET - Do you think that air pollution levels in Delaware could be high enough to affect people’s health? Explain why or why not. Give students **3 to 4 minutes** to respond in writing.

2. LARGE GROUP DISCUSSION - Conduct a class discussion about the health effects of pollution from the Warm Up. Should take about **5-6 minutes**.

3. LESSON OBJECTIVES - The lesson objectives should be presented on an overhead or on the chalk board. These should be read and explained to the class. (**2-3 minutes**)

OPTION: You may want the students to copy the lesson objectives in their notebooks.

ACTIVITY 1: Reading

1. Description/Overview of Activity:

Students will work individually to complete Reading #1 and Student Worksheet #1 to develop a background and understanding of the health impacts of air pollution.

2. Materials Needed:

Reading #1
Student Worksheet #1

3. Performance Indicators of the Activity:

Geography P.I. G.406, G.408; 7.422, 8.422
History P.I. H.401, H. 402; 7.427, 8.428

4. Preparation for Activity:

Make copies of Reading #1 and Student Worksheet #1.

5. Activity Outline and Directions to the Teacher:

STEP 1: Students will now complete **Reading #1** to develop a better background and understanding of the health impacts of air pollution. Give the students **Reading #1** and **Student Worksheet #1** and ask them to complete both the reading and the worksheet individually. (**10 minutes**)

STEP 2: CLASS DISCUSSION - Have the class briefly discuss Reading #1 and their answers to Student Worksheet #1—see answer sheet in Teacher Materials (**10 minutes**).

ACTIVITY 2: Questioning Game

1. Description/Overview of Activity:

Students will be engaged in a Questioning Game activity of analyzing a series of case studies to determine the specific pollutants likely to have caused a given set of health symptoms.

2. Materials Needed:

Photocopies of Criteria Pollutants chart - 1 per student
Photocopies of Group Task Cards - 7 copies, or 1 per group
Photocopies of Student Worksheet #2 - 1 per student
Photocopies of Symptom Scenarios 1, 2, 3, 4, 5, 6, 7 - 1 set only
Reading #1 (from Lesson 1)
Student Worksheet #1 (from Lesson 1)

3. Performance Indicators of the Activity:

Geography P.I. G.406, G.408; 7.422, 8.422
Science P.I. 9.75
History P.I. H.401, H. 402; 7.427, 8.428

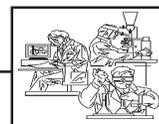
4. Preparation for Activity:

Make copies of Criteria Pollutants Chart, Group Task Cards, Student Worksheet #2, and Symptom Scenarios. Students should also have their copy of Reading #1 and Student Worksheet #1. Divide the class into Cooperative Learning Groups of four students each arranged heterogeneously by gender, race, and ability.

5. Activity Outline and Directions to the Teacher:

STEP 1: Divide the class into groups of four students each. Give each student a copy of the Criteria Pollutants chart. Ask the students to also get out their copy of Student Worksheet #1 and Reading #1. Ask students to take a few minutes to review this material (**3 minutes**).

STEP 2: Give each group one copy of the Symptom Scenario Cards (different card to each group) and a copy of Student Worksheet #2. Using Reading #1, Student Worksheet #1, and the Criteria Pollutants Chart, discuss and



come to agreement on the probable cause of your patient's symptoms. Then answer the one set of questions on Student Worksheet #2 that pertain to your group's scenario. Students will need to apply information from Reading #1, Student Worksheet #1, and the Criteria Pollutants Chart. Encourage students to refer freely to these throughout the activity **(10 minutes)**.

STEP 3: Give each group a copy of the Group Task Cards. Explain that each member of the group will choose and assume a specific responsibility, as defined on the Group Task Cards. Explain that each group will do an oral presentation of their Symptom Scenario. The group members that chose to be the patient and second patient or family member will introduce themselves based on the information on the Symptom Scenario. The information at the bottom of the Symptom Scenario will be used to answer class questions only. Give groups a few minutes to prepare **(5 minutes)**.

STEP 4: The groups will take turns presenting their Symptom Scenario to the class. The class will begin asking questions of the patients similar to a doctor. The presenting group will answer questions based on the information at the bottom of their Symptom Scenario. Each group will attempt to arrive at a conclusion as to the cause of the illness and a prevention. It is important that students not be allowed to arrive too quickly and confidently at the conclusion that a given pollutant is "the" cause of a patient's symptoms. First, encourage thorough questioning; be sure that students have asked questions about other aspects of the patient's life that could also be an influence. Second, be sure students recognize that even when air pollution is a primary factor, many other factors still influence our health. Finally, when a causative pollutant is initially proposed, you may wish to ask the class to vote on whether they are sure of the cause or whether they need to affirm it with further questioning (Would a physician or scientist announce a diagnosis based on a first guess or seek additional information to confirm that diagnosis?). **(1 1/2 hours)**

ACTIVITY 3: Culminating Activity - Essay

1. Description/Overview of Activity:

Students will write an essay explaining whether we as individuals can accept full responsibility for the extent to which our health is impacted by air quality, or whether government and industry must also assume some responsibility.

2. Materials Needed:

Handout #1
Scoring Rubric

3. Performance Indicators of the Activity:

Geography P.I. G.402
Science P.I. 9.75
History P.I. H.408
Civics P.I.C.416

4. Preparation for Activity:

Make copies of Handout #1.

5. Activity Outline and Directions to the Teacher:

STEP 1: Explain to the students that they will write an essay as a culminating activity for this lesson. Their instructions and paper for their rough draft is on Handout #1. Give each student a copy of Handout #1 and the Scoring Rubric. Tell students that this essay will be graded based on the scoring rubric that you gave them. Students will first write a rough draft in class and then complete their final essay for homework or in a computer lab. Essays are to be two pages in length, typed, and double spaced **(3 minutes)**.

STEP 2: Explain to students to be sure to support their views with evidence from their research and readings. Now students will begin to work on their rough draft **(45 minutes)**.

STEP 3: Students could be taken to a computer lab to type their essays—two typed pages that are to be double spaced. **(45 minutes)**.

CONCLUSION:

1. Review the lesson objectives to see if the students have mastered the lesson expectations.

EXTENDED ACTIVITIES

1. PROJECT - Students would write a "History of Air Pollution Events" as a useful supplement to this lesson. (See Appendix A)

OPTION: Students could focus on the "History of Air Pollution Events" in Delaware (See Annual Air Quality Report for the state of Delaware at (http://www.dnrec.state.de.us/air/aqm_page/reports.htm))

2. RESEARCH PAPER - Students could research and write a paper on the "History of Air Pollution Legislation" as the foundation for a government lesson on how the public experience of the health and environmental effects of air pollution influenced government action. (See Appendix A)



© VERHEAD TRANSPARENCIES

Introduction of Lesson 7



OVERHEAD TRANSPARENCY: WARM-UP



Do you think that air pollution levels in Delaware could be high enough to affect people's health? Explain why or why not!



OVERHEAD TRANSPARENCY:
LESSON 7 OBJECTIVES

- ◆ Identify what segments of the population are most at risk from air pollution
- ◆ Understand that healthy teenagers and adults can be affected by severe air pollution
- ◆ Summarize the health effects of exposure to high concentrations of particulate matter (PM_{10})
- ◆ Summarize the health effects of exposure to high concentrations of carbon monoxide (CO)
- ◆ Summarize the health effects of exposure to high concentrations of Ozone (O_3)
- ◆ Apply this knowledge in analyzing a series of case studies to determine the specific pollutant(s) likely to have caused a given set of symptoms



STUDENT MATERIALS

Lesson 7 Activity 1



High School and Middle School Air Quality Education Program



WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 - Symptom Scenarios

Reading 1

Air Pollution and Everyone

Air pollution is something we can't escape. We breathe it every day. In fact, every minute of everyday, we breathe six to ten liters of air. If the air around us carries pollutants, those pollutants enter our bodies and can affect us in many ways. The Environmental Protection Agency estimates that four out of ten Americans live where the air is often unhealthy to breathe. Enough people are affected, and affected badly enough, that just in Delaware, the health impacts of air pollution costs us millions of dollars every year.

Air pollution is especially harmful to the very young and old. Infants and young children are at risk because their lungs are not fully developed and because they breathe faster. The elderly are at risk because their bodies are no longer as effective at dealing with environmental stress.

Of course, since the respiratory system comes in direct contact with the air we breathe, it is the body system most likely to be affected by air pollutants. So people who already have asthma, emphysema, or other respiratory conditions, people with heart or circulatory problems, and cigarette smokers are especially susceptible to the effects of air pollution.

People who are young and healthy can be affected by pollution too. Air pollution can affect anyone. Even healthy teenagers, young adults, and strong athletes can suffer negative effects from high pollution levels, especially when exercising outdoors.

A Tricky Question

It's a real challenge for scientists to study the health effects of different air pollutants. It wouldn't be ethical for researchers to just put people in a lab and expose them to high levels of a pollutant. Outside the lab, people who live in heavily polluted areas are exposed to not just one

pollutant but to many pollutants. Also, the concentration of each pollutant is changing all the time, in some cases independently of other pollutants. All of this makes it difficult to separate out the effects of each pollutant.

In addition, how susceptible people are to the effects of air pollutants can vary widely. Think about a roomful of healthy people who are all exposed to the same cold virus. Some will develop a bad cold, others a mild cold, and others no cold at all. In a similar way, susceptibility to pollutants can vary greatly even among a group of healthy individuals.

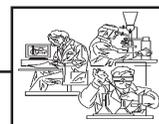
Finally, there are always many influences on our health. If you develop symptoms that might be caused by air pollution, it's often difficult to be sure that pollution was "the" cause. Just as with other health problems, there are likely to be several factors affecting your health.

How Much Do We Know?

One way to study the relationship between air pollution and health is to compare hospital records and death records to pollutant levels. Researchers have found that during extreme air pollution events, hospital admittances for respiratory problems increase. Death rates also increase, especially among the elderly and those who already have respiratory problems.

Another type of research involves evaluating the effects of long-term exposure to pollutant levels that are high but not extreme. In one study, scientists analyzed medical records of several thousand people who lived in an area where pollutant levels went above the National Ambient Air Quality Standards for 42 days or more. These people were 33 percent more likely to have bronchitis, 74 percent more likely to have asthma, and 37 percent more likely to have lung cancer than people who lived in an area with clean air. Other studies have found these kinds of results as well.

Finally, being affected by air pollutants is not just an "either/or" question. People can suffer from pollution to varying degrees. Although they may not be diagnosed



with a specific disease, their health may be affected on a long-term basis in a way that reduces their quality of life.

In general, we know that long-term exposure to irritants in the air can cause swelling and constriction of the airways, increased production of mucous, and paralysis of bacteria-destroying cells. Normally, the cilia of the epithelial cells that line the airways make sweeping movements to keep the airways clean. The cilia move mucous, along with germs and dirt caught in the mucous, out of the respiratory tract. Air pollutants can irritate the cilia, so that their protective action slows down or even stops. This leaves sensitive tissues unprotected. Then microorganisms and bits of foreign matter in the air are more likely to remain in the lungs. Here they can cause infections, lead to the development of lung diseases like chronic bronchitis and emphysema, and increase the chances of lung cancer.

Although the part of our bodies most affected by air pollutants is the respiratory system, the circulatory system works in close relationship with the respiratory system, so it can be affected too. If the respiratory system is damaged or diseased, then it will not be as effective at exchanging gases with the blood. With less oxygen in the blood, the heart must work harder, pumping more blood to deliver the same amount of oxygen to the body. In this way, the heart and arteries can be stressed.

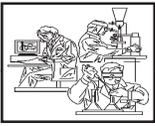
The Criteria Pollutants chart (see Handout 1) summarizes the health effects of the criteria pollutants. Each of them has different effects. For example, when we inhale

particulate matter (PM_{10}), these tiny bits of foreign matter travel deep into the lungs where they become lodged in the alveoli. These small, balloon-like sacs are the point in our bodies at which oxygen exchange occurs. This is where the lung removes carbon dioxide from the blood and replaces it with oxygen from the air. Very tiny particulates, those less than one micron, can stay trapped here for years. They can irritate the alveoli, reducing their ability to work properly, and cause long-term chemical and structural damage to the lungs.

In contrast, carbon monoxide is unusual in that it has no direct effect on the lungs but is absorbed by the blood. Carbon monoxide readily combines with hemoglobin in red blood cells, taking the place of some of the oxygen that should be entering the bloodstream.

Every moment, we are interacting with the air around us. Our bodies are constantly exchanging molecules with the atmosphere. Just as breath is essential to life, so too is the quality of the air we breathe essential to good health and the quality of our lives.

Source: *Students For Clean Air*. Clean Air Program. Pima County Department of Environmental Quality. Tucson, Arizona



WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 Activity 1 - Symptom Scenarios STUDENT WORKSHEET 1

1. Explain how much air we breathe every minute: _____

2. What fraction of the American people live where the air is often unhealthy to breathe? _____

3. Which body system is most likely to be affected by air pollutants? _____

4. Who is affected by air pollution? _____

5. Why is it difficult to determine the health effects of different air pollutants? _____

6. Briefly explain how researchers study the health impacts of air pollution: _____

7. Which system, besides the respiratory system, can be affected by air pollution? _____
8. Describe the health effects of particulate matter: _____

9. Describe the health effects of carbon monoxide: _____



TEACHER MATERIALS

Lesson 7 Activity 1



High School and Middle School Air Quality Education Program

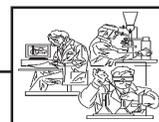


WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 Activity 1 - Symptom Scenarios

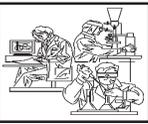
Answer Key to Student Worksheet 1

1. Explain how much air we breathe every minute: **Every minute of everyday, we breathe six to ten liters of air.**
2. What fraction of the American people live where the air is often unhealthy to breathe? **The Environmental Protection Agency estimates that four out of ten Americans live where the air is often unhealthy to breathe.**
3. Which body system is most likely to be affected by air pollutants? **Since the respiratory system comes in direct contact with the air we breathe, it is the body system most likely to be affected by air pollutants.**
4. Who is affected by air pollution? **People who are young and healthy can be affected by pollution too. Air pollution can affect anyone. Even healthy teenagers, young adults, and strong athletes can suffer negative effects from high pollution levels, especially when exercising outdoors.**
5. Why is it difficult to determine the health effects of different air pollutants? **It wouldn't be ethical for researchers to just put people in a lab and expose them to high levels of a pollutant. People who live in heavily polluted areas are exposed to not just one pollutant but to many pollutants. Also, the concentration of each pollutant is changing all the time, in some cases independently of other pollutants. All of this makes it difficult to separate out the effects of each pollutant. In addition, how susceptible people are to the effects of air pollutants can vary widely.**
6. Briefly explain how researchers study the health impacts of air pollution: **One way to study the relationship between air pollution and health is to compare hospital records and death records to pollutant levels. Researchers have found that during extreme air pollution events, hospital admittance for respiratory problems increase. Death rates also increase, especially among the elderly and those who already have respiratory problems. In one study, scientists analyzed medical records of several thousand people who lived in an area where pollutant levels went above the National Ambient Air Quality Standards for 42 days or more. These people were 33 percent more likely to have bronchitis, 74 percent more likely to have asthma, and 37 percent more likely to have lung cancer than people who lived in an area with clean air.**
7. Which system, besides the respiratory system, can be affected by air pollution? **Circulatory system**
8. Describe the health effects of particulate matter: **When we inhale particulate matter (PM₁₀), these tiny bits of foreign matter travel deep into the lungs where they become lodged in the alveoli. These small, balloon-like sacs are the point in our bodies at which oxygen exchange occurs. This is where the lung removes carbon dioxide from the blood and replaces it with oxygen from the air. Very tiny particulates, those less than one micron, can stay trapped here for years. They can irritate the alveoli, reducing their ability to work properly, and cause long-term chemical and structural damage to the lungs.**
9. Describe the health effects of carbon monoxide: **Carbon monoxide is unusual in that it has no direct effect on the lungs but is absorbed by the blood. Carbon monoxide readily combines with hemoglobin in red blood cells, taking the place of some of the oxygen that should be entering the bloodstream.**



STUDENT MATERIALS

Lesson 7 Activity 2



THE CRITERIA POLLUTANTS: THEIR ORIGINS AND EFFECTS

Lesson 7 Activity 2 Handout 1

POLLUTANT	SOURCES	EFFECTS ON HUMANS	OTHER EFFECTS	COMMENTS
Particulate matter (PM ₁₀)	<ul style="list-style-type: none"> ◆ dust stirred up by vehicles ◆ motor vehicle exhaust ◆ construction & earth-moving ◆ agriculture & mining ◆ industrial plants & burning of coal for power ◆ natural sources: wind-blown dust, forest fires, volcanoes 	<ul style="list-style-type: none"> ◆ irritates nose & throat ◆ damages lung tissue & reduces lung function ◆ lowers resistance to respiratory infection ◆ aggravates existing lung & heart disease ◆ increases incidence of lung diseases & cancers 	<ul style="list-style-type: none"> ◆ reduces visibility ◆ soils & discolors statues, buildings, painted surfaces ◆ corrodes metal ◆ interferes with photosynthesis, may damage crops ◆ may alter climate 	<ul style="list-style-type: none"> ◆ includes particulates less than 10 microns(1 micron = 1/1,000,000 of a meter) ◆ 75% is from motor vehicles
Carbon monoxide (CO)	<ul style="list-style-type: none"> ◆ incomplete combustion of fossil fuels from vehicles & power plants ◆ burning of wood ◆ natural source: forest fires 	<ul style="list-style-type: none"> ◆ reduces oxygen reaching brain, heart, body tissues ◆ reduces alertness & ability to perform tasks ◆ impairs perception & thought, slows reflexes ◆ most serious for those with cardiovascular disease ◆ high levels cause drowsiness, unconsciousness, death 	<ul style="list-style-type: none"> ◆ at high concentrations, toxic to animals 	<ul style="list-style-type: none"> ◆ colorless, odorless gas ◆ 85% is from vehicles ◆ same sources also emit carbon dioxide (CO₂) which some scientists believe works to increase the Earth's temperature
Ozone (O ₃)	<ul style="list-style-type: none"> ◆ a secondary pollutant formed when nitrogen oxides and hydrocarbons react in sunlight ◆ natural source (of precursors): plants 	<ul style="list-style-type: none"> ◆ chest pains, coughing, wheezing, labored breathing, shortness of breath, nausea ◆ irritates respiratory system ◆ sensitizes to other irritants ◆ damages lung tissue, reduces lung function, even in healthy people ◆ aggravates existing lung & heart diseases, allergies, asthma ◆ exposure for months or years accelerates aging of the lungs 	<ul style="list-style-type: none"> ◆ deteriorates rubber, paint, some building materials ◆ damages fruits and seeds ◆ injures crops and trees ◆ affects whole ecosystems by altering wildlife habitat 	<ul style="list-style-type: none"> ◆ 50% of the precursor pollutants are from motor vehicles ◆ .120 ppm of ozone during 1 hour or .08 ppm over 8 hours is considered unhealthy



POLLUTANT	SOURCES	EFFECTS ON HUMANS	OTHER EFFECTS	COMMENTS
Nitrogen dioxide (NO ₂)	<ul style="list-style-type: none"> ◆ combustion of fossil fuels in motor vehicles and at power plants and industries ◆ natural source: lightning 	<ul style="list-style-type: none"> ◆ irritation of the lungs, especially in people with asthma ◆ lowered resistance to respiratory infections such as influenza ◆ in children, frequent exposure to high levels may cause increased incidence of acute respiratory disease ◆ effects of short-term exposure still unclear ◆ causes algal blooms ◆ damages eggs of fish and amphibians 	<ul style="list-style-type: none"> ◆ reduces visibility ◆ reacts with atmospheric moisture to form acid rain ◆ deteriorates statues & buildings ◆ damages natural vegetation & crop plants ◆ reduces plant growth & seed production 	<ul style="list-style-type: none"> ◆ almost 50% is from motor vehicles ◆ a very difficult pollutant to control ◆ one of two precursor pollutants from which ozone forms ◆ nitrogen oxide is a related pollutant
Sulfur dioxide (SO ₂)	<ul style="list-style-type: none"> ◆ coal and oil-burning power plants/industries ◆ oil refineries ◆ natural source: volcanoes 	<ul style="list-style-type: none"> ◆ at high concentrations, affects breathing ◆ reduces the lung's ability to defend against disease ◆ aggravates existing respiratory and cardiovascular disease ◆ asthmatics and others with existing problems most susceptible ◆ children and the elderly also especially susceptible ◆ stunts plant growth, damages vegetation 	<ul style="list-style-type: none"> ◆ reduces visibility ◆ reacts with atmospheric moisture to form acid rain ◆ deteriorates statues & buildings ◆ discolors slate, marble mortar & limestone ◆ damages & fades rubber, leather, paper, paint & some fabrics 	
Lead (Pb)	<ul style="list-style-type: none"> ◆ motor vehicle exhaust, especially from leaded fuel ◆ metal smelting & processing factories ◆ dust & flakes from old paint 	<ul style="list-style-type: none"> ◆ accumulates in blood, bone & soft tissues ◆ affects kidneys, liver, nervous system & blood-forming organs ◆ relatively low doses - nervous system damage, lowered learning ability, blindness in children ◆ high exposure - seizures, behavioral disorders, mental retardation 	<ul style="list-style-type: none"> ◆ can become part of the soil and affect plants & animals living in the soil ◆ affects other mammals much like it does humans 	<ul style="list-style-type: none"> ◆ a toxic heavy metal ◆ phasing out leaded gasoline has reduced airborne lead levels 87% ◆ a success story in U.S. pollution control efforts



WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 Activity 2 - Group Task Cards



GROUP TASK CARD

PATIENT

You will play the role of the primary character described on the Symptom Scenario card. Using information on the card, you will introduce yourself to the class and then answer questions from the class. A second patient or a member of your family will be helping you answer questions. After some time, if you feel that there is important information on your Scenario card that has not been covered by the questions you may decide to volunteer that information.



GROUP TASK CARD

FAMILY MEMBER OR SECOND PATIENT

Depending on the Symptom Scenario assigned to your group, you will play the role of a second patient or someone in the patient's family. Using information on the Scenario card, you will introduce yourself to the class and then help answer questions from the class. If questions are asked which are not answered on the Scenario card, you will consult with the patient about how to best answer the questions (in a way that would not alter the conclusion reached by the class).



GROUP TASK CARD

CLASS MONITOR

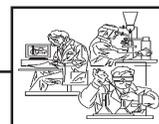
It is your responsibility to maintain order and designate whose turn it is to ask a question. Call on those with their hand raised so that they can ask questions one at a time and everyone can hear the answers. You will want to pace the questions so that the Scribe has time to write the answers on the board.



GROUP TASK CARD

SCRIBE

You are responsible for writing information on the board as the patient and his or her family member answer questions from the class. Making a list of this information will make it easier for the class to focus on what they know so far, choose pertinent questions to ask next, and determine the cause of the patient's symptoms.



WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 Activity 2 - Symptom Scenarios SYMPTOM SCENARIO 1

First Patient: MARY MILLER

Second Patient: MARTIN MILLER

Use this information to introduce yourselves:

My name is Mary Miller, and this is my husband Martin. When we woke up this morning, we both felt really terrible. Martin just called the doctor and made an appointment for us to see her, but now our car won't start. It seems to be out of gas.

Use this information to answer questions:

- ◆ Mary is 68, Martin is 64
- ◆ Both have always been very healthy for their age
- ◆ Neither has ever smoked cigarettes
- ◆ Retired from working as secretary (Martin) and bookkeeper (Mary)
- ◆ Neither has a history of respiratory, circulatory, or other major health problems
- ◆ Hobbies include seeing lots of movies and volunteering at the Dover Botanical Gardens
- ◆ Live in Wilmington, on the east side of town
- ◆ Had planned to go to a movie last night, but went to bed early instead
- ◆ What happened last night: It was cold, so Martin went out to start the car. He was going to start it and then opened the garage door. But as soon as he started the car, Mary called him back inside to help her find her glasses. Then the phone rang. It was a friend calling, who really needed to talk about something that had upset him. After that, they would have been late for the movie, but they both felt tired anyway, and so decided not to go.
- ◆ Slept longer than usual but both woke up still feeling tired
- ◆ Both felt really bad upon waking up in the morning
Martin felt so awful that it seemed like he couldn't think clearly; deciding to call the doctor, looking up the number, and making the call seemed hard to do

Source: *Students For Clean Air*. Clean Air Program. Pima County Department of Environmental Quality. Tucson, Arizona



High School and Middle School Air Quality Education Program



WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 Activity 2 - Symptom Scenarios

SYMPTOM SCENARIO 2

Patient: F. GRIJALVA

Family Member: JORGE GRIJALVA (cousin)

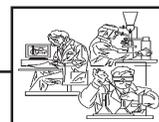
Use this information to introduce yourselves:

My name is Francisco (or Francesca) Grijalva. I used to be a runner years ago. I stopped for a few years, but took it up again last year. Lately I've been feeling short of breath in the middle of my run. This is my cousin Jorge, who is also my roommate. He'll tell you that I'm a pretty serious runner.

Use this information to answer questions:

- ◆ 34 years old
- ◆ Lives and works in central Dover
- ◆ Works as a computer programmer
- ◆ Works with a small, independent company
- ◆ The office building he works in is well-ventilated
- ◆ Running is an important personal interest
- ◆ Other hobbies include hiking, bird-watching, and surfing the Net
- ◆ Smoked from age 14 to 16, but "I quit when I got smart enough to know better"
- ◆ Roommate smokes, but only outside, so Francisco is not breathing Jorge's smoke
- ◆ Ran pretty regularly from age 20 to around age 30
- ◆ Started running again last year, in December
- ◆ Ran in the early morning, about 6:00 to 6:30 a.m., all winter
- ◆ In April, started working an early schedule and running after work, around 2:00 p.m.
- ◆ Last winter, felt refreshed and really "up" after running, just like years ago
- ◆ Has been running very regularly and is confident he's in good shape
- ◆ Lately has been feeling short of breath only halfway through a run
- ◆ By the end of the run, often gets a tight, uncomfortable feeling in the chest area
- ◆ He also notices that he seems to cough and need to spit while running, which didn't happen before
- ◆ Has never had any lung or respiratory problems in the past
- ◆ Cousin Jorge will vouch that Francisco has been running as regularly as he says—five or six times a week, for over a year—so this can't be happening because he's in poor shape

Source: *Students For Clean Air*. Clean Air Program. Pima County Department of Environmental Quality. Tucson, Arizona



WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 Activity 2 - Symptom Scenarios SYMPTOM SCENARIO 3

Patient: RANDY CHU

Family Member: ELIZABETH SMITH (mother)

Use this information to introduce yourselves:

My name is Elizabeth Smith. This is my son Randy. I'm very worried about Randy's eyes. Our optometrist is worried too. Every few months, Randy needs new glasses—stronger and stronger glasses.

Use this information to answer questions:

- ◆ Randy is 6 years old
- ◆ The optometrist can't figure out why Randy's eyes keep getting worse
- ◆ He started kindergarten this year
- ◆ The teacher tells his mom that he's a very active child
- ◆ She also says he seems to be a little behind the rest of the class
- ◆ He never went to preschool
- ◆ He's gone to work with his mother for years
- ◆ Now she picks him up at her lunch break and takes him to work
- ◆ His eyes don't itch or hurt or bother him in any way
- ◆ He has no apparent physical or medical eye problems, other than declining vision
- ◆ He's just learning how to read, so he doesn't spend a lot of time reading
- ◆ He watches TV less than an hour a day, and always sits across the room
- ◆ Sometimes he plays outside in the evening, after he and his mom get home from work
- ◆ During the day, he brings his favorite toys and plays while his mom works
- ◆ Elizabeth works as a carpenter
- ◆ Her specialty is restoring the woodwork in old houses
- ◆ She sands the old paint off the walls and door frames, repairs them, and refinishes the old wood

Source: *Students For Clean Air*. Clean Air Program. Pima County Department of Environmental Quality. Tucson, Arizona



High School and Middle School Air Quality Education Program



WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 Activity 2 - Symptom Scenarios

SYMPTOM SCENARIO 4

Patient: J. JACKSON

Family Member: PAUL PETERS (stepfather)

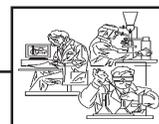
Use this information to introduce yourselves:

My name is Jay Jackson. I've had asthma since I was little, although not all that bad compared to some people. Lately it seems to be getting worse. This is my stepdad Paul here with me today.

Use this information to answer questions:

- ◆ 16 years old
- ◆ Born in Milford, Delaware and grew up in Laurel, Delaware
- ◆ Main personal interest is rollerblading
- ◆ Other interests include following Blue Hen basketball, reading, and writing stories—especially stories about horses and about basketball
- ◆ Rollerblading is his main form of exercise
- ◆ Family just moved from Laurel to Middletown, Delaware
- ◆ They live in an apartment complex in Middletown (on a paved road, with paved parking)
- ◆ He can't think of any particular way his life has changed since moving to Middletown; still spends about the same amount of time skating, reading, and so on
- ◆ He has been feeling pretty nervous about being in a new school
- ◆ He thinks cigarettes stink and says he would never smoke one even if he didn't have asthma
- ◆ Stepfather smokes, but because of Jay's asthma, for many years he's smoked only outside the house
- ◆ Asthmatic reactions seem to be happening more often than they used to, and the reactions seem to be stronger a lot of the time

Source: *Students For Clean Air*. Clean Air Program. Pima County Department of Environmental Quality. Tucson, Arizona



WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 Activity 2 - Symptom Scenarios SYMPTOM SCENARIO 5

First Patient: KERRY KOLSCHOWSKI

Second Patient: JOE SANCHEZ

Use this information to introduce yourselves:

My name is Kerry Kolschowski and this is my friend Joe Sanchez. All of a sudden tonight, in the middle of the game, it seemed like we both just started dragging. We have no idea why we've suddenly lost our touch.

Use this information to answer questions:

- ◆ Playing a game of ice hockey
- ◆ Kerry is 20 years old
- ◆ Joe is 21 years old
- ◆ Both in excellent health
- ◆ Both work out regularly
- ◆ Play hockey with Ice Cats
- ◆ Kerry's other interests include anthropology (his major), rollerblading, and surfing the internet
- ◆ Joe's other interests are mathematics (his major), music, and his girlfriend
- ◆ Don't smoke cigarettes
- ◆ This all started just after the first intermission
- ◆ The game is at an indoor arena
- ◆ Until a few minutes ago, they both felt great and felt like they were playing well
- ◆ So after a break at the end of the first period, they expected to come back even stronger
- ◆ Both are suddenly playing poorly and have missed the puck on what should have been easy shots
- ◆ Kerry is having trouble concentrating on the game, and is moving so slow that he's not much good to the rest of the team
- ◆ Joe says he feels really out-of-it, says he's suddenly tired instead of energetic and alert like he was a little while ago; and says that trying to explain any more about how he feels would be hard to do
- ◆ Between periods, the ice was resurfaced by the Zamboni (a gas-powered ice resurfacing machine)
- ◆ The temperatures in the rink and arena are about what they usually are; the spectators are wearing sweaters, but the players still get hot while playing the game

Source: *Students For Clean Air.* Clean Air Program. Pima County Department of Environmental Quality. Tucson, Arizona



High School and Middle School Air Quality Education Program



WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 Activity 2 - Symptom Scenarios

SYMPTOM SCENARIO 6

Patient: CHRIS CHAPMAN

Family Member: ROSE CHAPMAN (his wife)

Use this information to introduce yourselves:

My name is Chris Chapman. My doctor just told me that I have a pre-cancerous growth in my lungs. This is a very serious diagnosis. My wife Rose and I are both stunned and upset by what the doctor said. My health has always been pretty good, so I feel upset and confused.

Use this information to answer questions:

- ◆ Chris is 62 years old
- ◆ He retired early, at age 50
- ◆ Never smoked cigarettes or anything
- ◆ Used to work for the city as a technician installing and repairing traffic lights
- ◆ They live in the city of Wilmington because they like living near their children and grandchildren
- ◆ Love kids
- ◆ Every Monday through Friday, ever since retiring, Chris volunteers as a school crossing guard at a busy intersection, helping kids get across the street
- ◆ He does this for an elementary school and a middle school, that start at two different times, so he's out there almost two hours each morning and two hours each afternoon
- ◆ Likes to wear white shirts, even though they always look really dirty after doing the crossing guard work
- ◆ They live in an apartment near the same intersection
- ◆ His hobbies include bowling, going to grandchildren's soccer and softball games, babysitting for the youngest granddaughter, and staying in close touch with world news
- ◆ Not really into exercise or working out
- ◆ Rose and Chris take a walk around the neighborhood a couple of times each week, usually right after he finishes crossing guard duty

Source: *Students For Clean Air*. Clean Air Program. Pima County Department of Environmental Quality. Tucson, Arizona



WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 Activity 2 - Symptom Scenarios SYMPTOM SCENARIO 7

Patient: JERRY WOLAK

Second Patient: DOT WOLAK

Use this information to introduce yourselves:

My name is Jerry Wolak and this is my partner Dot. We live together in Lewes, Delaware. We came back from our afternoon walk feeling just awful.

Use this information to answer questions:

- ◆ She's 48 years old
- ◆ He's 58 years old
- ◆ They take a brisk walk together almost every day, in mid-afternoon
- ◆ Usually walk two miles, along a local canal, where it's quiet and there's no traffic
- ◆ Jerry's interests include cooking, woodworking, and fishing
- ◆ Dot's interests include painting and playing drums with a jazz band
- ◆ Today was a beautiful sunny day and the first really hot day of spring
- ◆ Today they took a different route than usual
- ◆ The traffic was backed up for several blocks on Kings Highway, and they were curious why, so they decided to turn up that road and see for themselves
- ◆ Ended up sitting by the road for an hour in the middle of the walk, talking with a friend who was stuck in the giant traffic jam
- ◆ Near the end of the walk, both Jerry and Dot started wheezing and coughing
- ◆ Dot was feeling some nausea
- ◆ Jerry felt like his asthma was acting up for the first time in years, and he even had chest pains

Source: *Students For Clean Air*. Clean Air Program. Pima County Department of Environmental Quality. Tucson, Arizona



High School and Middle School Air Quality Education Program



WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 Activity 2 - Student Worksheet 2

Name: _____ Date: _____

Class: _____ Period or Block: _____

Problem:

How is human health affected by specific air pollutants?

Materials (per group):

- ◆ Symptom Scenario card - 1 only
- ◆ Group Task Cards - 1 set of four cards

Procedure:

1. Review Student Worksheet #1 and the Criteria Pollutants chart.
2. As a group, analyze the information on your Symptom Scenario card. Using Reading #1 and the Criteria Pollutants chart, discuss and come to agreement on the probable cause of your patient's symptoms. Then answer the one set of questions below that are specific to your group's scenario.
3. In preparation for presenting your Symptom Scenario to the class, choose roles from the Group Task Cards, with each member of the group assuming a different task.
4. As each group presents their scenario to the class, the remainder of the class will complete the appropriate set of questions below. You may refer freely to the background reading and the Criteria Pollutants chart throughout the activity.
 - ◆ Symptoms - note key symptoms or behaviors in the patient.
 - ◆ Probable cause - Note the pollutant that is most likely to cause these symptoms
 - ◆ Prevention - Note precautions that could have been taken to prevent or decrease the likelihood of this problem arising.

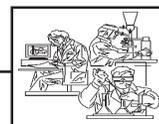
Observation and Conclusions:

1. **Mary and Martin Miller** (retired movie buffs)

Symptoms: _____

Probable Cause: _____

Prevention: _____



2. **F. Grijalva** (young adult runner)

Symptoms: _____

Probable Cause: _____

Prevention: _____

3. **Randy Chu** (kindergarten student)

Symptoms: _____

Probable Cause: _____

Prevention: _____

4. **J. Jackson** (teenager with asthma)

Symptoms: _____

Probable Cause: _____

Prevention: _____

5. **Kerry Kolschowski and Joe Sanchez** (ice hockey players)

Symptoms: _____

Probable Cause: _____

Prevention: _____

6. **Chris Chapman** (crossing guard)

Symptoms: _____

Probable Cause: _____

Prevention: _____

7. **Jerry and Dot Wolak** (middle-aged walkers)

Symptoms: _____

Probable Cause: _____

Prevention: _____



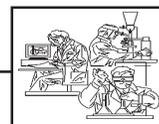
Critical Thinking and Applications:

1. Imagine that you and a friend started working out and running together a few weeks ago, meeting each day at 5:00 p.m. Today your friend proposes trying a new jogging route. One possibility is the Brandywine River, and another is the Delaware Freeway (I-95). Explain which route you prefer and why.

2. Imagine that your family has just moved into a house built in the 1940s. The exterior of the house needs to be painted, and this weekend you will be helping sand and scrape the old, peeling paint to prep for repainting. Explain what pollutant(s) may be of concern and any precautions you would take.

3. Imagine that you have been training for a bicycle race, and the day of the race is here. Ozone levels in Wilmington, where you have come for the race, are at .125 ppm. One group of cyclists is asking the race committee to reschedule the race. Another group of cyclists, many of whom have driven some distance, are upset that the race may be rescheduled. Explain which group you agree with and why.

Source: *Students For Clean Air*. Clean Air Program. Pima County Department of Environmental Quality. Tucson, Arizona



TEACHER MATERIALS

Lesson 7 Activity 2



WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 Activity 2 - Symptom Scenarios

ANSWER KEY TO STUDENT WORKSHEET 2

Problem:

How is human health affected by specific air pollutants?

Materials (per group):

- ◆ Symptom Scenario card - 1 only
- ◆ Group Task Cards - 1 set of four cards

Procedure:

1. Read the background information and review the Criteria Pollutants chart.
2. As a group, analyze the information on your Symptom Scenario card. Using the background reading and the Criteria Pollutants chart, discuss and come to agreement on the probable cause of your patient's symptoms. Then answer the one set of questions below that are specific to your group's scenario.
3. In preparation for presenting your Symptom Scenario to the class, choose roles from the Group Task Cards, with each member of the group assuming a different task.
4. As each group presents their scenario to the class, complete the appropriate set of questions below. You may refer freely to the background reading and the Criteria Pollutants chart throughout the activity.
 - ◆ Symptoms - note key symptoms or behaviors in the patient.
 - ◆ Probable cause - Note the pollutant that is most likely to cause these symptoms
 - ◆ Prevention - Note precautions that could have been taken to prevent or decrease the likelihood of this problem arising.

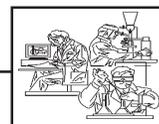
Observation and Conclusions:

1. **Mary and Martin Miller** (retired movie buffs)

Symptoms: tired/drowsy; reduced alertness and reduced ability to think clearly; also decreased ability to perform basic tasks such as calling to schedule an appointment

Probable Cause: carbon monoxide poisoning

Prevention: never run a car or any internal combustion engine in a closed space; even outdoors, avoid breathing exhaust from any engine



TEACHER NOTES FOR DISCUSSION: Carbon monoxide poisoning is obviously the problem here, accounting for both the couple's physical symptoms and the impaired mental clarity reflected in the difficulty of scheduling a doctor appointment.

2. **F. Grijalva** (young adult runner)

Symptoms: feeling short of breath, experiencing tightness in chest, coughing and spitting while running, symptoms occurring during outdoor exercise on summer afternoon

Probable Cause: ozone exposure

Prevention: exercise indoors, or exercise outdoors in the early morning, before ozone levels begin to rise

TEACHER NOTES FOR DISCUSSION: Exposure to high ozone concentrations can affect even healthy teens and adults. In this scenario, the time of day and time of year at which the problem occurs provide clues that ozone, rather than another pollutant, is likely to be responsible.

3. **Randy Chu** (kindergarten student)

Symptoms: not doing well in school, vision is deteriorating on an ongoing basis

Probable Cause: lead poisoning, from breathing lead paint dust

Prevention: Young children should not be present when old paint is being sanded. Anyone present should wear a protective mask or respirator

TEACHER NOTES FOR DISCUSSION: Randy has probably been exposed to high levels of lead by breathing dust from old paint as it is sanded. This could be linked not only with his vision problem but with his behavior and performance at school. Since leaded gasoline has been phased out, lead poisoning from auto exhaust is no longer a problem in the U.S. However, lead poisoning can also occur in young children from breathing lead paint dust, ingesting soil contaminated with lead paint flakes, chewing on woodwork or toys with leaded paint, etc. Although young children are most susceptible, everyone should wear a dust mask or respirator when preparing old painted surfaces for repainting.

4. **J. Jackson** (teenager with asthma)

Symptoms: asthma problem has increased in frequency and severity, since moving from a small town to the city

Probable Cause: exposure to higher levels of pollutants in general, rather than to a single particular pollutant

Prevention: track pollutant levels given with the weather forecast and avoid outdoor activities on days with unusually high levels, or engage in outdoor activities at times of day when pollutant levels are lowest

TEACHER NOTES FOR DISCUSSION: Particulate matter, ozone, nitrogen dioxide, and sulfur dioxide can all aggravate the condition of those who already have asthma or other lung problems. In this case, it is not possible to single out a particular pollutant as a primary influence. This would be a common situation in real life. Also, although it is very likely that the poorer air quality in Wilmington would aggravate the asthma, emotional stress is also known to influence asthma. It seems likely that both of these would be contributing factors in this case.



5. **Kerry Kolschowski and Joe Sanchez** (ice hockey players)

Symptoms: **feeling tired, having trouble concentrating, being less alert, having slower reflexes, decreased ability to perform familiar tasks, all as evidenced by the players' comments and that they're missing "easy shots"**

Probable Cause: **carbon monoxide poisoning**

Prevention: **internal combustion engines should not be used in enclosed spaces; the arena should be using an electric resurfacing machine**

TEACHER NOTES FOR DISCUSSION: The players' symptoms began just after the ice was resurfaced by a gas-powered Zamboni. The U.S. Center for Disease Control has documented several instances of ice hockey players suffering carbonmonoxide poisoning from gas-powered resurfacing machines used in indoor arenas. Carbon monoxide poisoning has also been documented in individuals employed in ice hockey arenas.

6. **Chris Chapman** (crossing guard)

Symptoms: **long history of exposure to many pollutants through work as a traffic lights technician and a crossing guard at a busy intersection; the white shirt getting dirty hints that particulates rather than just gaseous pollutants are involved**

Probable Cause: **exposure to high levels of air pollutants in general, especially but not exclusively particulates**

Prevention: **avoid ongoing exposure to high levels of pollutants**

TEACHER NOTES FOR DISCUSSION: Increased likelihood of lung cancer is one of several respiratory conditions that have been linked to ongoing exposure to high PM_{10} concentrations. However, much of the research on this topic has involved populations exposed to particulates with high levels of certain metals, such as those released at smelters. Compared to some of the other scenarios presented here, this case is less clearly the result of pollution. Also, it is interesting to note that ambient levels of primary pollutants from motor vehicle exhaust are significantly higher at busy intersections than they are only one city block away.

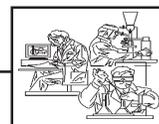
7. **Jerry and Dot Wolak** (middle-aged walkers)

Symptoms: **wheezing and coughing, feeling queasy, chest pain, asthma acting up; and this occurred during mid-afternoon on a warm day, along a busy road with a traffic jam**

Probable Cause: **ozone exposure**

Prevention: **avoid exercising along busy roads, and avoid exercising during the times of day that ozone levels are highest**

TEACHER NOTES FOR DISCUSSION: The time of day and that it's a warm, sunny day are clues that ozone is the problem, in addition to the actual physical symptoms. The situation does not reflect only the patients' ages. Research has shown that even trained endurance athletes can suffer similar symptoms at high ozone concentrations. Effects of ozone exposure documented in athletes include being unable to complete a regular routine, posting slower times in a race, and other performance problems.



Critical Thinking and Applications:

1. Imagine that you and a friend started working out and running together a few weeks ago, meeting each day at 5:00 p.m. Today your friend proposes trying a new jogging route. One possibility is an indoor track at a health club, and another is a major highway. Explain which route you prefer and why.

The health club would be preferable. This would avoid unnecessary exposure to high levels of various air pollutants, primarily from motor vehicles.

TEACHER NOTES FOR DISCUSSION: The notes for scenario 2 apply here as well.

2. Imagine that your family has just moved into a house built in the 1940s. The exterior of the house needs to be painted, and this weekend you will be helping sand and scrape the old, peeling paint to prep for repainting. Explain what pollutant(s) may be of concern and any precautions you would take.

Lead and particulates would be the pollutants of concern. All involved in the work should wear a dust mask or a respirator, depending on the amount of dust generated.

TEACHER NOTES FOR DISCUSSION: Lead-based paints were the norm until 1977, so this house is likely to have multiple coats of leaded paint. If only scraping is involved, dust masks would suffice. If much sanding is being done, so that finer particulates are being created, respirators should be used. Also, drop cloths should be used to collect the bulk of the old paint flakes and dust rather than letting them fall to the soil.

3. Imagine that you have been training for a bicycle race, and the day of the race is here. Ozone levels in Wilmington, where you have come for the race, are at .125. One group of cyclists is asking the race committee to reschedule the race. Another group of cyclists, many of whom have driven some distance, are upset that the race may be rescheduled. Explain which group you agree with and why.

Many athletes would want the race to be rescheduled so that they could avoid exercising at this concentration of ozone.

TEACHER NOTES FOR DISCUSSION: There is no single correct answer to this question. EPA guidelines suggest that the general population avoid outdoor activity at ozone levels above .125 parts per million, as this is the level at which a majority of healthy individuals will experience decreased exercise tolerance. However, irritation symptoms can occur in the normal population at levels over .80. Some people would consider it prudent to avoid exercising at lower levels as well.

Source: *Students For Clean Air*. Clean Air Program. Pima County Department of Environmental Quality. Tucson, Arizona



STUDENT MATERIALS

Lesson 7 Activity 3



High School and Middle School Air Quality Education Program



WHAT ARE THE HEALTH IMPACTS OF AIR POLLUTION?

Lesson 7 Activity 3 - Symptom Scenarios

SCORING RUBRIC FOR ESSAY

- 4 - The essay is clear and well developed
- 3 - The essay is somewhat clear and well developed
- 2 - The essay is vague and somewhat developed
- 1 - The essay is vague and not well developed
- 0 - The essay was not attempted and not developed

	0	1	2	3	4	
1. Explanation of responsibility P.I. C.416	_____	_____	_____	_____	_____	x 5 = _____
2. Supporting details P.I. 9.75 (Science)	_____	_____	_____	_____	_____	x 5 = _____
3. Evidence of research P.I. H.405; 9.75	_____	_____	_____	_____	_____	x 5 = _____
4. Course of action needed P.I. G.404; 9.75; H.408	_____	_____	_____	_____	_____	x 5 = _____
5. Reasons for action proposed P.I. H.408	_____	_____	_____	_____	_____	x 5 = _____

GRADE _____