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 carbon monoxide 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 PM₁₀ 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.