TEACHER BACKGROUND

Environmental tobacco smoke (ETS) is the third leading cause of preventable death in the United States, killing 53,000 non-smokers every year. Over 3,000 lung cancer deaths occur each year and the risk of death from coronary heart disease increases by up to 30% for those exposed to ETS either at home or at work. For children, data indicate that 6,200 preventable deaths occur each year contributed to by ETS. According to the World Health Organization, 88% of all non-smokers in the United States are exposed to ETS. These are alarming statistics and can be frightening to your students. However, they also point to a situation that is all too common among our students. This activity and the background contained in this section are intended to provide enough information for students to be aware of their surroundings, make informed choices not only not to use tobacco products, but to choose where to spend their time, and to help others in their environment to become aware of the dangers associated with ETS.

Environmental Tobacco Smoke, also called secondhand smoke, is a combination of two types of smoke resulting from burning tobacco products: (1) sidestream smoke – smoke that occurs between puffs of a burning cigarette, pipe or cigar and (2) mainstream smoke that is exhaled by the smoker. Both the Environmental Protection Agency and the National Toxicology Program of the U.S. Department of Health and Human Services classify secondhand smoke as a known human carcinogen. As well as being a cause of increased respiratory disease, asthma in children, eye and ear infections in children, and low birth weight and the risk of SIDS in infants, exposure to secondhand smoke increases the likelihood that children will become smokers later in life. According to the Florida Department of Health, "exposure to ETS is the second most powerful risk factor for current and lifetime use, next to having 2 or more friends who smoke."

Health effects associated with secondhand smoke exposure are put into four categories by the National Cancer Institute.

- Developmental effects include low birth weight and Sudden Infant Death Syndrome (SIDS)
- Respiratory effects include the onset of asthma in children, chronic respiratory problems in children, and middle ear infections in children as well as eye and nose irritation in adults.

- Carcinogenic effects include lung cancer and nasal sinus cancer.
- Cardiovascular effects include an increased risk of heart disease mortality and acute and chronic coronary heart disease morbidity.

Secondhand smoke contains over 4000 chemical compounds and at least 40 carcinogens. Some of the poisons include: hydrogen cyanide, sulfur dioxide, ammonia, formaldehyde, and arsenic. Students know of these chemicals and they are well known to be dangerous. The skull and crossbones still appears on ammonia bottles, students have heard of formaldehyde as a preservative used in science classrooms in the past, and arsenic is a well known poison that is present in murder mysteries, as well as in drinking water in third world countries. Secondhand smoke is a dynamic complex mixture and only now are studies beginning to be reported in the literature.

In November 2002, voters in Florida passed a constitutional amendment banning smoking in public places. This prohibition has caused a great deal of controversy among merchants, restaurant owners and operators, and smokers. The complete text of Article X, Section 20 to the Florida Constitution can be found on the *Science, Tobacco & You* Website in the section on Looking and Thinking, Tobacco and You, Tobacco and the Environment. Individual cities, such as New York and Boston, have also enacted clean air regulations and workplace smoking restrictions that continue to cause debates among those who support rights of individuals over the common good.

ACTIVITY OVERVIEW

The model proposed in this activity, although simple in its execution, has been well researched using information gathered from the Florida Department of Health, the Centers for Disease Control and Prevention, articles from *Indoor Air*, and the American Medical Association. Research on this subject is ongoing, a portion of it paid for by Tobacco Companies. Have students talk about why they think big tobacco companies are willing to pay for research that is likely to condemn their product.

The classroom itself, the students in it, and other environmental influences provide the background to create this model of how the chemicals in sidestream and mainstream smoke diffuse. **Diffusion** is the propensity of molecules and ions to move toward areas of lower concentration until the concentration is uniform throughout the system (or room). [For an activity on diffusion, see Module 2, Activity 4, Diffusion Dance.] Diffusion is a relatively slow process, so students will need a second task to complete while waiting for the "smoke" to diffuse. Any of the extensions are appropriate for this time. Or, you can let the secondhand smoke model develop while students are doing other classwork.

The first step in this activity is to make sure that students know what Environmental Tobacco Smoke is and that it is a description used interchangeably with "secondhand smoke." Most students will have heard the terms and it is here that misconceptions, myths, and misinformation can be corrected or

clearly articulated. The term "environmental tobacco smoke" was originally coined by tobacco companies to make people think that the phenomenon is less harmful that it is. In addition, it is deceptively vague and removed from the human element. Tobacco companies have spent decades deceiving children and adults through the clever use of images and words. The supposed interchangeability of the words "environmental tobacco smoke" with "secondhand smoke" is yet another purposeful deception.

Materials:

Bottle of perfume, nail polish remover, or other strong smelling liquid that will not irritate
Yarn or string
Tape measures and/or meter sticks
Graph Paper
Science, Tobacco & You Website, Looking and Thinking, Tobacco and You, Tobacco and the Environment for resources and information

1. Place desks in rows. Each desk (or student place) is represented on the graph paper by one square. Be sure to have students leave squares for the distance between the desks, rows, and any empty space in the room.
2. Explain to students that each person will monitor his or her own space (you may want to have others standing in the front of the room, back of the room, or other places where there are no student desks). Explain that you are going to open a bottle of strong-smelling perfume that will act as a model for smoke being exhaled by a smoker or by a cigarette left burning in an ashtray and that students will note the time when they smell the perfume in the box on the graph paper.
3. Before opening the bottle, all students should record the start time of the experiment and their distance from the bottle of perfume. Students can measure the distance either ahead of time, or you can have them stretch string or yarn from the bottle to their desks and then measure.
4. Open the bottle. As the smell of the perfume or other substance that you are using becomes apparent to each student, he or she should record this on his or her paper. Record the time that the observation was made and the distance from the bottle.
5. Students subtract the time they first noticed the odor from the start time of the experiment to determine how much time it took the odor to reach them. This becomes the model for chemicals in sidestream or mainstream smoke to reach them.
6. At the conclusion of the activity, have students record their observations, reflections, and questions in their science notebooks.
7. Once all students have smelled the "smoke," conclude the activity with a discussion of this as a model for diffusion of chemicals in secondhand smoke. Conduct a large group discussion of what students can do to protect themselves against the effects of secondhand smoke (for example, avoid restaurants that have smoking sections or encourage those who do smoke to do so away from children and pets).
8. Have students predict whether the same pattern would exist if the experiment were repeated. Once the predictions are recorded in their science notebooks, repeat the experiment.

9. Students should respond to the following in their science notebooks: How does this activity relate to secondhand smoke? Can you predict, from your results, how quickly or slowly a person's cigarette smoke will get to you? From the results of this experiment, design a model to determine how long the secondhand smoke remains in the air.

Tying It All Together

Have students research chemicals in secondhand smoke. It is significant that Food and Drug Administration (FDA) regulations implemented in August 1996 and designed to protect children did not include cigars and pipes. Because there was no available evidence that exposure to these particular uses of tobacco related to children and adolescents, the FDA only recommended gathering evidence. The 1996 regulations put into place prohibition of sales of tobacco products to children under the age of 18 and for retailers to request photographic identification to verify the age of all persons under the age of 27 who attempt to purchase tobacco products.

Resources

Science, Tobacco & You Website, Looking and Thinking, Tobacco Past Present and Future. See this Website for a new section with links to the CDC timeline of significant events related to health and tobacco.

Environmental Tobacco Smoke, 1998-1999: Percentage of People Protected by Smoking Policies. Unpublished data, National Cancer Institute and Centers for Disease Control and Prevention.

Florida Constitution, Article X, Section 20. Find this article at the *Science, Tobacco & You* Website, Looking and Thinking, Tobacco and You, How Does Tobacco Effect the Environment.

Environmental Tobacco Smoke Information. Florida Department of Health Website.

Standards

Florida Sunshine State Standards:

Science: SC.A.1.2.2, SC.A.2.2.1, SC.F.1.2.1, SC.G.2.2.3, SC.H.1.2.1, SC.H.1.2.2, SC.H.1.2.3, SC.H.1.2.4, SC.H.1.2.5, SC.H.3.2.2, SC.H.3.2.4

Health: HE.A.1.2, HE.A.2.2, HE.B.1.2, HE.B.2.2, HE.B.3.2, HE.C.2.2

Social Studies: SS.A.1.2.1, SS.A.4.2.4, SS.A.6.2.3, SS.B.2.2.3, SS.C.1.2.1, SS.C.2.2.2, SS.C.2.2.5, SS.D.1.2.1, SS.D.1.2.2, SS.D.1.2.3, SS.D.1.2.4, SS.D.2.2.1, SS.D.2.2.2, SS.D.2.2.4

Language Arts: LA.A.2.2.1, LA.A.2.2.4, LA.A.2.2.5, LA.A.2.2.8, LA.B.2.2.3, LA.B.2.2.4, LA.B.2.2.6, LA.C.3.2.1, LA.C.3.2.2, LA.C.3.2.3, LA.C.3.2.5, LA.C.3.2.6, LA.D.2.2.3, LA.D.2.2.4

Mathematics: MA.A.1.2.3, MA.A.3.2.2, MA.B.1.2.1, MA.B.1.2.2, MA.B.2.2.1, MA.B.3.2.1, MA.B.4.2.2, MA.C.1.2.1, MA.D.1.2.1, MA.E.1.2.1, MA.E.2.2.2

National Science Education Standards: Content Standard A, Content Standard D, Content Standard G

Extensions

Divide students in three groups to conduct a debate: Group 1 will be the audience and, at the end of the debate, will provide input to both debating groups; audience members will also develop questions that will guide Groups 2 and 3 in their research. Group 2 will provide the "pro" side of using human subjects for testing and Group 3 will provide the "con" side of human subject testing. At the present time, big tobacco companies are providing funding for human subject testing related to environmental tobacco smoke. How do students feel about this? Is there justification for human subject testing for any reason based on the "greater good?"

Use the *Science, Tobacco & You* Website to learn about the economic ramifications of current and pending statutes and legislation. Go to Looking and Thinking, Tobacco & You, How Does Tobacco Affect the Economy to learn about theories of general economics and specifically how the economy is affected by and affects the use of tobacco products.

Literature Links

The Big Burn by Jeanette Ingold (2002, Scholastic Books, ISBN 0-15-204746-8. This fictional account of one of the biggest wildfires in the twentieth century involves three teenagers and their experiences as they are caught up in the events. Students can make connections between the diffusion activity and how fires disseminate chemicals into the air as well and how these chemicals affect life around the fireline.

Smoke Screen by Amy Goldman Koss (2000), Pleasant Company Publications, ISBN 1-58485-201-1. Mitzi, a middle school student, deals with her mother's attempts to quit smoking. The story does a good job of accurately portraying how adolescent girls deal with middle school while providing some thought-provoking issues regarding use of tobacco products.