

## OUT OF BREATH: TEACHER GUIDE

**Subject:** Earth Science; Adaptable to Life Science (ex. Respiratory System, Ecology)

**Grade Level:** Middle School

**Last Updated:** 1/2/11

### Case Summary

A high school student is crushed when she is told that she should not play basketball with her friends at their local park because of her asthma. Her sensitivity to pollutants and toxics in the air means that she can no longer enjoy one of her favorite pastimes! Because she has spent most of her life in a city, it is suggested that her asthma is aggravated, possibly even caused, by the poor air quality in her city.

### Credits

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This case is adapted from “The Fading Basketball Star,” from the Environmental Education Outreach Program (EEOP) Air Quality Curriculum Project (AQCP) Case Studies.

Air Quality Curriculum Project. (2005). Asthma case studies: The fading basketball star. Retrieved June 17, 2006 from the Environmental Education Outreach Program (EEOP) Problem-Based Learning Web site: [http://www4.nau.edu/eeop/aqcp/bball\\_star.asp](http://www4.nau.edu/eeop/aqcp/bball_star.asp)

### Learning Objectives

At the end of the case, students should be able to:

1. Identify sources of air pollution in Atlanta.
2. Determine the time(s) of day and day(s) of the week in which air pollution is at its highest and explain why, by monitoring local air quality indices, weather conditions and meteorological maps and traffic reports (or archives).
3. Determine whether season of the year affects pollution levels and explain climatic and human-induced reasons why.
4. Explain how the ozone layer protects the earth’s surface and its inhabitants.
5. Describe the effects of different pollutants (chlorofluorocarbons, aerosols, CO, Freon, and nitrous oxides) on ozone depletion and its environmental and health-related consequences.
6. Describe the symptoms and causes of asthma, *emphasizing* air pollutants as a significant cause.
7. Differentiate and document different emissions quality in vehicles (new cars, old cars, hybrid vehicles, school bus, MARTA bus) through a “white sock” activity.

## Georgia Performance Standards

*SCSh1*. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science. (NSES Content Standard A)

*S6E5*. Students will investigate the scientific view of how the earth's surface is formed. (NSES Content Standard D)

i. Describe methods for conserving natural resources such as water, soil, and air.

*S6E6*. Students will describe various sources of energy and with their uses and conservation. (NSES Content Standard D and F)

b. Identify renewable and nonrenewable resources.

## Assessment

Students will work in groups on the scenes, brainstorming and researching for the case, but they will work individually to create two truly *real* products: the **first** is an informative brochure that outlines common sources of air pollutants in Atlanta and Decatur, and ways that people can monitor and improve their air quality. Those brochures that received an A grade were then photocopied so that every student received ten brochures to distribute in their neighborhoods, at the mall, or elsewhere (with parental supervision, of course). Students were guided to [www.mybrochuremaker.com](http://www.mybrochuremaker.com), a great website that provides brochure templates and user-friendly instructions. For their **second** task, each student wrote a formal letter to a local or state official of their choice in which they expressed their informed concerns regarding air quality issues in their city. To help them with this task, the students' language arts teacher gave a lesson on formal letter writing in their language arts class (this also helped students recognize the interconnectivity of their subjects).

Overall grading for the case is based on their combined grades for their box charts and products. Grading will be based on a 5-point scale (5=excellent, 4=very good, 3=good, 2=fair, 1=poor) that will be converted into a percentage and from there into total points depending on the weight of the assignment, for each of three criteria:

- Accuracy and depth of product components; attention to grammar and mechanics
- Individual contribution/participation within the team
- Individual research ability and effort – online, print, investigative questioning

The second and third criteria (participation, individual effort) will be judged not only by facilitator observations, but also by student evaluations to be completed at the end of the case (*See sample **Self-Evaluation Worksheet** in Student Materials document*).

## Implementation Strategy

This case is designed to take place over one 60-minute class session and four 90-minute class sessions. It has three scripted scenes. This case can be facilitated by two facilitators or even a single teacher, because rather than placing a facilitator with every group, the students spend time brainstorming with their group and then as a whole class.

The brainstorming session described below involves students reading, discussing and taking notes in their groups in 10 minute blocks (totaling about 25 minutes per scene), then reconvening as a whole class to volunteer their observations, questions, hypotheses and learning issues (learning issues are things that students say they need to know or look up to define unknown terms, answer their questions, and/or test their hypotheses) at the end of every 10-minute block. During the group brainstorming, the teacher/facilitators float from group to group, checking progress and helping students with any stumbling blocks they may have. During the whole-class volunteering time, the teacher/one of the facilitators takes notes on an overhead or with a Smart Board. In this way, students can learn to work as a team while still benefiting from sharing their information as a whole class or even competing with other groups for volunteering, while the teacher can make sure that all students are at the same point in the case at each step.

### *Implementation Schedule*

Day 1 (Thurs/Fri) 120 minutes total

Read Scene 1; Box Charts; Research (30 minutes/lunch/40 minutes)

Read Scene 2; Box Charts (45 minutes)

Divide Scene 2 Learning Issues for Homework (5 minutes)

*Weekend Homework:* Research Scene 2 Learning Issues

Day 2 (Monday) 60 minutes total

Share Learning Issues research from weekend homework; catch-up

Day 3 (Tues/Wed) 120 minutes total

Read Scene 3; Box Charts; Research (30 minutes/lunch/60 minutes)

*Car Lab:* (30 minutes) Students will go outside and each group, under teacher supervision, will attach a clean white gym sock to the exhaust pipe of one of the following: old car, new car, gas/electric hybrid, diesel school bus; record observations, recording observations after idling each for 5-10 min.

*Homework:* Construct design/content blueprint or outline for brochure; write letter

Day 4 (Thurs/Fri) 120 minutes total

Complete 1 brochure per group with intent to copy and disseminate (100 minutes total).

Case Evaluation form; wrap up (20 minutes)

### **Case Notes**

*What Went Well:*

1. The premise: Careful attention was paid to creating a story setting that was accurate to Atlanta and Decatur and involved phrasing and activities that the students would relate to. We had the students act out the scenes and they seemed to really get into the story.
2. The Web site: As always, the Web site is extremely helpful in helping to guide students' online research, and the students seem to get a lot out of it. This, of course, assumes that

the computer lab is available and that the computers are all working (See *What Could Have Gone Better*)

3. The brochures and letters: at the end of the third scene, we asked for a show of hands from students who have asthma or know someone who does, and how many of those individuals grew up in Decatur, Atlanta or another city. When almost every hand went up, we impressed upon them that this was not just a story, it was a real-life issue that affects urban dwelling kids like them every day. This seemed to really motivate students to create quality products, and knowing that they'd actually mail their letters and pass out their brochures seemed to provide a real incentive.

*What Could Have Gone Better:*

1. End-of-case time management: We hadn't fully appreciated how much time it would take us to proofread and edit the students' letters for grammar, mechanics and content, so it took a lot longer to actually get them in the mail than we'd originally intended. Also, because of her own time- and curricular constraints, the students' language arts teacher was unable to spend very much time on formal letter writing, that end of the case also fell squarely on us.
2. Computer Lab: During at least one class period, we experienced difficulties in the computer lab with machines not working and Internet speeds comparable to cold molasses, which understandably slowed progress. In classrooms where all the students have Internet access at home, this is not an issue since the Web site can be accessed from any system, but if there are students who do not have Internet access outside of school, perhaps creating backup packets of printed material from those same online sources would be a good idea in the event that Web research needs to be done outside of class.

## Facilitator Guide:

Scenes with key concepts underlined:

### Scene 1

Alexis sat with a couple of her friends at the park, watching her boyfriend DeAndre and their friends play basketball. It was summertime in Decatur, and the late afternoon sun shone through the haze that lingered in the blazing hot air. Alexis gazed around at her neighborhood from where she sat in the shade. A few blocks up from the park, construction crews were busily cutting down a bunch of trees so they could build another row of apartment buildings, making the afternoon traffic even worse. Off in the distance, she heard the whistle of a freight train as it chugged its way across the city. She thought about how polluted the city had become over the years, how sad it made her. She turned her attention back to the court. The game was pretty exciting! Her friend Janice jogged over to the sidelines from where she'd been playing point guard and grabbed her water bottle.

"Alexis, why aren't you playing today? We need your three-point shot out there!" Janice said between big gulps of water.

Alexis replied, "I don't know, my asthma has been acting up every time I go outside to play basketball, so I figured I'd sit this one out." In fact, she was feeling short of breath right now. Alexis had had asthma for a few years now. Her family had been really surprised when she'd been diagnosed, since she had no family history. However, she was the first member of her family to grow up in a city; her parents had moved to Decatur from southern Georgia when she was a baby.

Janice shrugged and said, "Okay. Feel better soon!"

As Janice turned to go back to the game, Alexis grabbed her arm. Janice saw that Alexis was gasping for breath and was starting to turn red. "Alexis, what's wrong?"

"I can't... can't breathe... I think I need a doctor."

Janice turned around and yelled, "DeAndre! Get over here, Alexis is having an asthma attack, and I think it's serious!"

### Scene 2

Alexis sat in her doctor's office, relieved to be breathing normally again. Her new inhaler was stronger and worked much faster than the old one, which was great. "Thanks for the new inhaler, I feel much better," she said to Dr. Harris. "So when can I play basketball again?"

Dr. Harris sighed. "Well, Alexis, I'm afraid you might not be able to play basketball anymore, at least not outside."

"No more basketball?!" Alexis cried. "But my friends and I love to play at the park; it's our favorite thing to do all summer long!"

"Unfortunately," Dr. Harris replied, "the smog is really bad during this time of year. People who are very sensitive to air pollutants like ground-level ozone, nitrous oxides, sulfates and nitrates, should avoid strenuous activity outside. This is especially the case with people who have asthma or allergies. In fact, some studies are suggesting that air pollution is what causes asthma in some people. I know you love to play basketball in the park, but you could adversely affect your health. Furthermore, since you have such bad asthma, you should check the AQI every time you go outside for any sort of physical activity."

Alexis hung her head, devastated. She'd had no idea that the traffic, construction, even the summer weather were so unhealthy!

### Scene 3

Janice gave Alexis a hug and said, “You can’t play basketball with us anymore? Aw Alexis, that’s awful!”

DeAndre agreed. “This totally stinks. And it’s the smog that might be doing it? That’s ridiculous. Can’t we do something about this?”

Alexis said, “I don’t know. Anyway, it’s not your problem, I’ll just have to sit on the sidelines, I guess.” Just then a diesel MARTA bus roared by, leaving a cloud of stinky exhaust behind it.

Janice shook her head. “It is our problem. If the air pollution caused your asthma, it could happen to lots of other kids, like my baby brother or even one of us. And it’s pollutants like that bus exhaust and other nasty stuff in the air that’s the problem. We need to get people in our neighborhoods to get involved with this so we can help improve our air quality.”

DeAndre nodded. “She’s right. Let’s do this!”

Facilitator Box Charts With Key Concepts/Issues Included:

Scene 1 Facilitator Box Chart

Facts	Questions
<ol style="list-style-type: none"> <li>1. Park in Dectaur</li> <li>2. Summertime, hazy, blazing hot</li> <li>3. Basketball game going on</li> <li>4. Freight train rumbles by</li> <li>5. Construction cutting down trees</li> <li>6. Alexis not playing because of asthma</li> <li>7. Alexis has had asthma for a few years, but no family history.</li> <li>8. Alexis is only one in her family to grow up in the city.</li> </ol>	<ol style="list-style-type: none"> <li>1. What is a freight train?</li> <li>2. What is a family history?</li> <li>3. Why is she the only one in her family with asthma?</li> <li>4. Does Alexis have an inhaler?</li> <li>5. Did anyone call 911?</li> </ol>
Hypotheses	Learning Issues
<ol style="list-style-type: none"> <li>1. Freight train = train with no passengers, carries cargo</li> <li>2. When trees are cut down, it causes air pollution and makes the summer heat worse</li> <li>3. Growing up in a city increases the risk of asthma</li> </ol>	<ol style="list-style-type: none"> <li>1. Asthma and asthma attacks: causes, symptoms, treatment, prevention.</li> <li>2. What does cutting down trees have to do with pollution and asthma?</li> <li>3. Effects of heat and haze on asthma?</li> <li>4. Effects of urban dwelling on asthma risk</li> </ol>

Scene 2 Facilitator Box Chart

Facts	Questions
<ol style="list-style-type: none"> <li>1. Alexis at Doctor’s office</li> <li>2. Dr. says no more basketball outside</li> <li>3. Alexis upset because she plays all summer long</li> <li>4. Dr. says smog is worse in summer</li> <li>5. People sensitive to ground-level ozone, nitrous oxide, nitrates and sulfates should avoid phys. activity outside</li> <li>6. Studies suggest that air pollution causes asthma</li> <li>7. Alexis should check the AQI before phys. activity outside</li> </ol>	<ol style="list-style-type: none"> <li>1. What kind of new inhaler does she have? How is it stronger &amp; faster?</li> <li>2. Will she listen to the doctor’s advice?</li> </ol>
Hypotheses	Learning Issues
<ol style="list-style-type: none"> <li>1. The new inhaler has more/better medicine</li> <li>2. Inhalers work by opening the respiratory passages</li> <li>3. Ground-level ozone, nitrous oxide, smog, etc. are what pollute the air</li> <li>4. Summer makes air hotter, more pollution in hot air</li> </ol>	<ol style="list-style-type: none"> <li>1. What are ground-level ozone, nitrous oxide, nitrates, and sulfates? What are their current levels in Atlanta?</li> <li>2. What’s smog, why is it worse in summer?</li> <li>3. Why do sensitive people need to avoid physical activity outside?</li> <li>4. How does air pollution cause asthma?</li> <li>5. What is AQI? How do you check it?</li> <li>6. Why are traffic, construction and hot weather so unhealthy?</li> </ol>

### Scene 3 Facilitator Box Chart

Facts	Questions
<ol style="list-style-type: none"> <li>1. Alexis can't play basketball anymore</li> <li>2. Smog might be cause of Alexis' asthma</li> <li>3. Diesel MARTA bus drives by, leaves cloud of exhaust</li> <li>4. Janice thinks if air pollution caused Alexis' asthma, it could happen to other kids (but doesn't say adults)</li> <li>5. Janice thinks that the "nasty stuff" in the air and the MARTA buses are the problem</li> <li>6. The kids need people in their neighborhood to get involved in improving air quality</li> </ol>	<ol style="list-style-type: none"> <li>1. Why is Janice worried about other kids?</li> <li>2. Isn't mass transit better for the environment?</li> <li>3. How will they get the community involved?</li> </ol>
Hypotheses	Learning Issues
<ol style="list-style-type: none"> <li>1. MARTA is better for the environment than driving because fewer cars means better air</li> <li>2. Kids are more vulnerable to asthma from pollution than are adults</li> <li>3. The community can improve air quality by planting trees, carpooling, biking, MARTA, resisting city building</li> <li>4. Inhalers work by opening the respiratory passages</li> <li>5. Ground-level ozone, nitrous oxide, smog, etc. are what pollute the air</li> <li>6. Summer makes air hotter, more pollution in hot air</li> </ol>	<ol style="list-style-type: none"> <li>1. What is diesel?</li> <li>2. What is exhaust? What are the components of exhaust?</li> <li>3. How does air pollution cause asthma?</li> <li>4. Does mass transit (like MARTA) improve or worsen urban air pollution? How?</li> <li>5. How can communities take action to improve local air quality and prevent childhood asthma?</li> <li>6. Who could the kids talk to about helping them to mobilize the community for these purposes?</li> </ol>



## Resources

We found that assembling the most useful of the following online sources as links on a website that the students can access in the computer lab or at home is a very efficient way to structure group or independent research. Also, the students should be encouraged to utilize their textbooks or other resources. These are some helpful resources; a selection of these was included on the “Out of Breath” page of the PRISM website under 8<sup>th</sup> grade Cases ([www.prism.emory.edu/columbia](http://www.prism.emory.edu/columbia)).

(S1=Scene 1; S2=Scene 2; S3=Scene 3; F=Facilitators Only)

### S1 Symptoms of Asthma

WebMD, Inc. (2005). Asthma health center. Retrieved August 18, 2005 from [http://www.webmd.com/diseases\\_and\\_conditions.asthma.htm](http://www.webmd.com/diseases_and_conditions.asthma.htm)

### S2 Air Quality and Ozone

AIRNow Cross-Agency Program. (2005). Quality of air means quality of life. Retrieved August 18, 2005 from <http://airnow.gov>

### S2 AQI Brochure from EPA

US Environmental Protection Agency Air and Radiation Unit. (2003). Air quality index: A guide to air quality and your health. Retrieved August 18, 2005 from [http://www.epa.gov/airnow//aqibroch/AQI\\_2003\\_9.3.pdf](http://www.epa.gov/airnow//aqibroch/AQI_2003_9.3.pdf)

### F Air Quality in the UK

NETCEN. (2005). Air quality archive: The UK national air quality information archive. Retrieved August 18, 2005 from <http://www.airquality.co.uk/archive/index.php>

### S2 Air Toxics and Pollutants

US Environmental Protection Agency. (2004). Pollutants and sources. Technology transfer network air toxics website. Retrieved August 18, 2005 from <http://www.epa.gov/ttn/atw/pollsour.html>

### S2 Criteria Air Pollutant Report by county, zip code, state or specific facilities in a state:

Green Media Toolshed and GetActive Softward. (2005). Scorecard: The pollution information site – Pollution locator/search engine. Retrieved August 18, 2005 from <http://www.scorecard.org/env-releases/>

### F Interesting and multifaceted educational site on Air Quality

Environmental Education Outreach Program. (2005). Air quality curriculum project. Retrieved February 22, 2006 from <http://www4.nau.edu/eeop/aqcp/index.asp>

## F Ozone

US Environmental Protection Agency. (2004). Brief questions and answers on ozone depletion. Retrieved August 18, 2005 from [http://www.epa.gov/ozone/science/q\\_a.html](http://www.epa.gov/ozone/science/q_a.html)

## S2 Air pollution may trigger asthma in young athletes

Weiner, J. (2002). Air pollution may trigger asthma in young athletes [press release]. Retrieved August 18, 2005 from [http://www.eurekalert.org/pub\\_releases/2002-01/uosc-apm013002.php](http://www.eurekalert.org/pub_releases/2002-01/uosc-apm013002.php)

## S1 Air Quality and Asthma

Centers for Disease Control, Air Pollution and Respiratory Health Branch. (2005). Basic facts about asthma. Retrieved August 18, 2005 from <http://www.cdc.gov/asthma/faqs.htm>

## S2 Air Quality and Asthma, Including an Online Petition to Send to Your Senator:

American Lung Association. (2005). State of the air 2005. Retrieved August 18, 2005 from <http://lungaction.org/campaign/stateoftheair2005>

American Lung Association. (2005). Treatment options and support – School programs.

Retrieved August 18, 2005 from

<http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=23014>

## S2 Ozone info

Pathfinder Science. (2004). Keeping an eye on ozone. Retrieved August 18, 2005 from

<http://pathfinderscience.net/ozone/>

## S3 Local Officials for Decatur, GA and surrounding areas (as of fall 2005)

Vernon Jones – CEO of Dekalb County

Shirley Franklin – Mayor of Atlanta

Saxby Chambliss – Senator of Georgia

Stan Watson – District Representative

Sonny Perdue – Governor of Georgia