NORTH CAROLINA AIR AWARENESS PROGRAM

AIR QUALITY EDUCATION

6-8 Curriculum & Activity Guide

North Carolina Division of Air Quality

www.NCAIR.org

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A project of the North Carolina Air Awareness Program

NC Division of Air Quality Mission

The Division of Air Quality (DAQ) works with the state's citizens to protect and improve outdoor, or ambient, air quality in North Carolina for the health, benefit and economic well-being of all. To carry out this mission, the DAQ has programs to operate a statewide air quality monitoring network to measure the level of pollutants in the outdoor air, develop and implement plans to meet future air quality initiatives, assure compliance with air quality rules, and educate, inform and assist the public with regard to air quality issues.

Open Burning Outreach Team

Several years ago, the North Carolina Department of Environment and Natural Resources (DENR) Division of Air Quality, initiated an outreach team to communicate to the public the dangers of open burning, or burning trash in an open fire or burn barrel. The Open Burning Outreach Team (OBOT) in addition to working with multiple agencies, fire departments, and local groups, tries to spread a simple message; burning man made trash is dangerous, produces unhealthy air pollution, and is illegal.

Acknowledgements

This project was the result of a collaborative effort between the Open Burning Outreach Team (OBOT) and the NC Air Awareness Program team. Many thanks go to all staff members who helped with this project.

NC Air Awareness Program

The NC Air Awareness Program of the DAQ began air quality public outreach, including forecasting of ground-level ozone levels, in 1997. The DAQ is responsible for protecting and improving outdoor air quality in North Carolina. The DAQ currently faces the environmental challenge of reducing harmful tailpipe emissions that greatly contribute to poor air quality in much of our state. The primary goal of this program is to educate the public, reduce air pollution and improve air quality for the benefit of all North Carolina citizens.

Division of Air Quality
DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
www.ncair.org

OVERVIEW

Breathe, Don't Burn! OBOT Classroom Activities

Greetings!

We need your help to keep our air clean and healthy for everyone in the great state of North Carolina. Several years ago the Division of Air Quality (DAQ) initiated an outreach team to communicate to the public the dangers of open burning, or burning trash in an open fire or burn barrel. The Open Burning Outreach Team (OBOT), in addition to working with multiple agencies, fire departments, and local groups, tries to spread a simple message; burning man made trash is dangerous, produces unhealthy air pollution, and is illegal. These materials include everything from household wastes to old tires, plastics, and construction debris. OBOT is comprised of employees from the DAQ's seven regional air quality offices across the state who work to reduce air pollution and keep North Carolinians healthy. Illegal open burning is a serious issue in North Carolina.

These classroom activities which fit into the middle school essential standards and common core, are fun ways to bring new and exciting projects into your classroom that also send an important message. We need outstanding teachers to try these activities and then let us know what they think. Free materials, handouts, and other fun items for your students and parents can be made available to those willing to give these lessons a try.

Go to *www.ncair.org* or *http://ncdenr.org/web/aq/openburning/education* to learn more!

Thank you,

Jeffrey L. Bouchelle

Senior Environmental Specialist

INTRODUCTION

Breathe, Don't Burn! OBOT Classroom Activities

Welcome! We need your help to keep our air clean and healthy for everyone in our state. Several years ago the Division of Air Quality (DAQ) initiated an outreach team to communicate to the public the dangers of open burning, or burning trash in an open fire or burn barrel. The Open Burning Outreach Team (OBOT), in addition to working with multiple agencies, fire departments, and local groups, tries to spread a simple message; burning man made trash is dangerous, produces unhealthy air pollution, and is illegal. These materials include everything from household wastes to old tires, plastics, and construction debris. OBOT is comprised of employees from the DAQ's seven regional air quality offices across the state who work to reduce air pollution and keep North Carolinians healthy. Illegal open burning is a serious issue in North Carolina.

These classroom activities which fit into the middle school essential standards and common core are fun ways to bring new and exciting projects into your classroom that also send an important message. We need energetic, engaged, teachers to try these activities out, and then let us know what they think. Free materials, handouts, and other fun items for your students and parents can be made available to those willing to give these lessons a try. Go to http://ncdenr.org/web/aq/openburning/education to learn more! The three activities include;

Classroom Activity #1: Smoldering Nasty Stuff

Examining our household trash and learning the dangers of burning different materials.

- Students will learn that burning trash produces dangerous air pollution that harms human health and that burning trash is illegal.
- Students will evaluate amounts and types of materials typically discarded and consider alternatives to disposal. They will have a chance to look at, and report on, their household trash to see what could be recycled instead, and why burning trash could be harmful to their family's health.

Classroom Activity #2: Burning Issues

Creating research-based posters for presentation

- In this lesson, students examine the effects of air pollution and open burning, as well as ways in which North Carolina regulates and controls open burning violations.
- Students will use research to create informative or persuasive posters about open burning and air pollution. Posters can be posted in hallways or groups can present to other classes.

Classroom Activity #3: Heated Conversations

Skits too improve communication skills and explain the dangers of open burning / air pollution.

- Have some fun and let your students perform skits to learn about open burning.
- Burning household trash, and other synthetic or manmade materials contributes to air, soil, and water pollution. It is against North Carolina law to burn them.
- What are the consequences to the environment and human health caused by burning trash and synthetic materials?

BACKGROUND

Each day, every person in the United States creates an average of 4.4 pounds of trash.[1] In many parts of North Carolina and the United States, burning has been the traditional way to get rid of trash. However, burning trash or any other manmade material is illegal in North Carolina.

Burning trash and all other man-made materials outdoors has been prohibited since 1971 under North Carolina's open burning rule, one of North Carolina's oldest air quality regulations. ***Open burning*** is any type of burning in which the smoke is released directly into the air, without passing through a chimney or smokestack. Examples of open burning include burning trash in a barrel, and burning leaves in a pile. Under the open burning rule, it is always illegal to burn trash and other ***non-vegetative*** materials. Leaves, branches and other plant growth can be burned only under certain conditions.

Why do people burn trash? In North Carolina, most residential trash burning (about 90%) happens in rural counties.[2] In many of these areas, especially outside of city or town limits, trash pick-up is not provided. Households have to hire a private trash hauler, or take their own trash to a landfill, sometimes paying a tipping fee. However, air quality inspectors have noticed that it's not just the cost or inconvenience of proper disposal that causes people to burn their trash. Often, people in rural areas burn their trash because it's the only disposal method they've ever known, and it's the way their families have disposed of trash for generations.

What can and can't be burned legally? A good rule to remember is: **"If it doesn't grow, don't burn it!"** All manmade or non-vegetative materials are illegal to burn in North Carolina. Even lumber is considered a man-made material and cannot be legally burned.

Vegetative material such as leaves, brush, and tree limbs may be legally burned only in areas where public pick-up for these materials is not provided. Even in areas without public pick-up, local laws may restrict or prohibit burning of vegetative material.

In counties with an air quality forecast, all open burning is banned on ***Air Quality Action Days.*** These are days when the forecasted air quality is Code Orange (unhealthy for sensitive groups), Code Red (unhealthy), or Code Purple (very unhealthy).

What kind of pollution is caused by burning trash, and how is it harmful? Smoke is a mixture of gases and tiny particles. The gases in smoke, from both vegetative and non-vegetative materials, include carbon monoxide, carbon dioxide, nitrogen oxides (NOx), and volatile organic compounds (VOCs). Household trash typically contains plastics, chemically treated paper, and other ***synthetic*** materials that, when burned, emit toxic chemicals into the air. These chemicals can include dioxins, furans, hexachlorobenzene, lead, mercury, and many others. The chemicals released by burning trash can harm people when they breathe the smoke, or when they are exposed through contamination of plants, land and water.

Health effects from breathing smoke: The health effects of breathing smoke can include lung and eye irritation, coughing, headaches, dizziness, asthma attacks, heart attacks, and even death. Exposure to smoke from burning trash could have long-term consequences, as some of the toxic chemicals are probable or known human carcinogens and have other health effects.

The tiny particles in smoke are called ***particulate matter or particle pollution.*** These particles, whether from burning natural or synthetic materials, travel deep into the lungs and can cause serious respiratory and heart problems. While breathing particle pollution is harmful to everyone, it is especially dangerous for people with existing respiratory disease like asthma or emphysema, or existing heart problems. Breathing particle pollution can cause asthma attacks and acute bronchitis, and may increase the risk of respiratory infections. For people with heart disease, the particle pollution in smoke can cause heart attacks and cardiac arrhythmias (irregular heart rhythm). Numerous studies have linked elevated particle levels to increased hospital admissions, emergency room visits, and even death from heart and lung disease.[3]

Burning trash contributes to regional air pollution. But the greatest impact of burning trash – and even leaves and brush – is to people living nearby, who may be exposed to concentrated smoke and high levels of pollutants. Smoke from burning trash can be a serious health threat for you, your family, and your neighbors, especially for anyone with a respiratory or heart condition.

Health effects from plant, soil and water contamination: Burning household trash is the largest known source of dioxins in the nation.[4] Dioxins are highly toxic, long-lasting chlorinated organic compounds. They are dangerous even at extremely low levels and have been linked to cancer and developmental and reproductive disorders. Dioxins produced by burning trash settle on plants and into water. Meat and dairy animals eat the plants, and store the dioxins in their fatty tissue. People are exposed to dioxins primarily by eating meat, fish, and dairy products, especially those high in fat.

Smoke from burning synthetic trash deposits other hazardous chemicals like furans, mercury, and hexachlorobenzene onto land and water. Like dioxins, these chemicals enter the food chain and are ultimately consumed by people. These pollutants can have long-term health effects such as nervous system or organ damage, or reproductive or developmental disorders.[5]

The ash from burning, which is often dumped onto the ground, can contain lead, cadmium, mercury, chromium, arsenic and other toxic substances. These leach into the soil to be taken up by plants (including food plants) and seep into groundwater, or run off into streams, rivers and lakes. Children can accidentally swallow toxic chemicals from dirt on their hands while playing near discarded ash.[5]

What happens to trash when it's burned? Does it all go up in smoke? The Law of Conservation of Mass states that matter cannot be created or destroyed. When an item is burned, it doesn't just go away. Rather, the item is changed into other substances through the process of ***combustion.*** Combustion is a chemical reaction between a fuel and oxygen that gives off heat. When the fuel is ignited,

oxygen combines with the chemical components of the fuel, converting them into different combustion products. In general, when the reaction uses more oxygen, it reaches a higher temperature and the fuel undergoes more complete combustion, meaning greater oxidation of the fuel's components.

When trash is burned in a pile or burn barrel, the fire doesn't get much oxygen and burns at a relatively low temperature, resulting in ***incomplete combustion,*** which produces more smoke and toxic emissions. For example, dioxins are produced by burning items that contain even tiny amounts of chlorine, and nearly all household waste contains chlorine. The relatively low combustion temperatures of burn barrels produce significant amounts of dioxins, whereas very high temperatures such as those reached by waste incinerators (typically over 2,000 degrees F) destroy dioxins by converting them into other compounds which can then be captured by pollution control equipment.

What are alternatives to burning?

REDUCE: the amount of trash you make. Try to buy products that use less packaging. Containers and packaging make up the largest portion (30%) of trash generated by Americans.[1] Carry re-usable bags when shopping. Store food in re-usable containers (for example, pack sandwiches in re-usable containers instead of foil or plastic bags).

RE-USE: Use plastic yogurt tubs (and other containers) to store food or other items. Use old newspapers as mulch (but not the glossy inserts, because those inks can contain heavy metals).

RECYCLE: Even if your community doesn't have curbside pickup, recycling stations may exist at your local landfill and other locations. Some recyclable items, such as plastic bottles, are banned from North Carolina landfills. Many North Carolina businesses process recycled items or manufacture new items from them, so when you recycle, you support these businesses by providing them with "raw material." Visit **http://p2pays.org/localgov/ncwaste.html** to find recycling contact information for your community.

COMPOST: Let nature turn your leaves, grass clippings, and small branches into wonderful mulch. Not sure how? Visit **www.p2pays.org/compost/** for a "Composting 101."

PROPERLY **DISPOSE** of the rest. Some stuff has to be thrown away. Materials such as solvents, pesticides, oil-based paints, and many other chemicals should be taken to a hazardous waste facility. You can find information on disposal facilities in your area at **http://p2pays org/localgov/ncwaste.html.** Some materials, such as computer equipment and mercury-containing thermostats, are banned from North Carolina landfills. For more information on banned materials and how to dispose of or recycle them, visit **http://ncdenr.org/web/deao/recycling/banned-materials.**

Is open burning ever good? Forestry and wildlife agencies sometimes set prescribed burns to keep forests healthy. This is open burning on a large scale and while it does produce pollution, it is essential to the health of ***fire-dependent ecosystems*** such as the longleaf pine forest of the North Carolina Sandhills region. In fact, species such as the red-cockaded woodpecker, the St. Francis' satyr butterfly, and the longleaf pine itself depend on regular burning for the species to survive. Prescribed burns should only be set by forestry and wildlife professionals, who are trained in fire safety and management.

ACTIVITY ONE:
SMOLDERING NASTY STUFF

SUMMARY

Students will learn that burning trash produces dangerous air pollution that harms human health, and that burning trash is illegal. Students will evaluate amounts and types of materials typically discarded, and consider alternatives to disposal.

OBJECTIVES

(7.E.1.6) Conclude that the good health of humans requires: monitoring the atmosphere, maintaining air quality and stewardship.

TIME NEEDED

Preparation: See Appendix One

Pre-Activity Research and Discussion: 30 minutes

Activity Part A: 15 minutes

Activity Part B: 20 minutes

Post-Activity Discussion: 10 minutes (or homework)

A project of the North Carolina Air Awareness Program

"STUDENTS EXAMINE THE EFFECTS OF BURNING HOUSEHOLD TRASH AND EXPLORE ALTERNATIVES TO BURNING."

SUMMARY

Burning household trash contributes to air, soil, and water pollution, and is illegal in North Carolina. Students will investigate:

- The contents of household trash
- The "ingredients" of common trash items
- The pollution caused by burning trash
- Alternatives to burning proper disposal, recycling, re-use, and composting.

KEY TAKE-AWAYS

- Burning trash and other man-made materials is harmful to human health and the environment, and is illegal.
- We can reduce the human and environmental impact of our trash by generating less waste, re-using and recycling items, and choosing other disposal methods.

Teacher Tips

Materials

- ☐ Several clean "trash" items (suggested list provided)
- ☐ Clean receptacle(s) such as kitchen trash can or metal drum/barrel
- ☐ Student Activity Sheet A: "What's in the Barrel?"
- ☐ Student Activity Sheet B: "What comes out?"

COMMON CORE & ESSENTIAL STANDARDS

- 7.E.1.6
- 7.L.2.3
- 7.TT.1
- 7.RP.1
- 7.SI.1
- 7.G.1.1

*Multiple correlations to English LA Common Core requirements

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PREPARING FOR THE ACTIVITY

1. Gather clean "trash" and at least one container to represent a burn barrel, as described in Appendix One on page 8. Be sure to follow the safety precautions listed.

2. Print activity sheets A and B for each student.

3. Decide if you want students to complete Activity Parts A and B in small groups or as a class.

Pre-Activity Part One: Independent Thinking

Prior to the activity, assign student to come up with their own answers to the following questions in small groups, or independently at home. Students should record their answers in their journals or notebooks.

- What is open burning?
- How might it be harmful to humans?
- How might it be harmful to the environment?

Pre-Activity Part Two: Class Discussion

Students share their answers and discuss with the class how open burning and the resulting air pollution might directly and indirectly affect them. As a class, develop a master list and record in notebooks or journals. After initial independent thinking and discussion, groups or students should review printed brochures and materials from the NC Division of Air Quality on open burning to learn the basics. If computer and internet access is available, go to ***http://ncdenr.org/web/aq/openburning/education.***

Pre-Activity Part Three: Class Discussion about Burning Trash

1) Ask students some of the following questions:

- How does your family get rid of garbage?
- How many of you have a burn barrel at home? (Show of hands).
- How many of you have friends or grandparents with a burn barrel or burn pile?
- How many of you help your family or friends burn?
- What have you seen burned in burn barrels or burn piles? (Let students give examples).
- Why do people burn their trash?
- Is burning trash legal in North Carolina?
- How many of you know someone with asthma or another lung disease?
- Are there other possible health effects from breathing the smoke from burning trash that we haven't already discussed? (Heart attacks from particle pollution, cancer from toxic chemicals, etc).
- Discuss background information with students, especially:
- Although it may be convenient, trash burning produces pollution that can hurt those who burn, their families, and their neighbors.
- Trash burning is illegal. The purpose of the law is to protect human health and the environment.
- Trash contains a lot of manmade materials that produce toxic chemicals when burned.

ACTIVITY

Activity Part A: What's In the Barrel?

Have each student select five items from the burn barrel and fill out Activity Sheet A. For each item, the student will itemize the components or ingredients of the items, and consider alternatives to disposal. This will take some guesswork, which is acceptable. The goal is for students to realize that

even a cereal box, for example, contains not just paper but is printed with inks and coated with a varnish.

As the students examine their trash items, have them "discard" the trash items in sorted piles (a single set of piles for the entire class): recyclable, re-usable, compostable, and "has to be thrown away." Roughly, what fraction or percentage of their "trash" has the class diverted from the landfill or burn barrel? What percentage or fraction of the original "trash" pile really has to be thrown away?

Activity Part B: What Comes Out of the Barrel?

1) Inform students that the average American produces 4.4 pounds of trash per day. (Although some of this total is discarded while away from home, for the purposes of this activity we will assume that the entire total is discarded at home).

2) Ask students to guess how many pounds of trash:
   - o they personally throw away during a day.
   - o their household throws away during a day.
   - o their household throws away during a week.

3) Using either the national average of **4.4 pounds/person/day,** OR their own estimates, students will complete Activity Sheet B ("What Comes Out?") to calculate how much trash their family discards in a week, and what emissions result from burning that trash. (See Appendix Two for more detail on these emission factors).

4) If time allows, select one student's activity sheet (or ask a student to volunteer). Write the weekly pollutant totals on the board. Ask the students to guess how many households in their community burn trash. Multiply the single-household weekly total on the board by this number to calculate the estimated total weekly emissions for their community. Then multiply this number by 52 to estimate the total yearly emissions from their community.

CLASS **DISCUSSION**

- o If your grandfather burned trash 30 or 40 years ago, would his trash pile have been any different? What about trash that your great-great-grandfather might have burned in the 1920s or earlier? Are there more plastics in today's trash than in previous decades? Which would probably produce larger amounts of toxic emissions: a burn barrel containing mostly paper and metal, or one containing paper, metal, and large quantities of plastic?

- o Besides plastics, did you come across items that are especially dangerous to burn? (Examples: treated wood contains arsenic, which is emitted during burning. Aerosol cans can explode and the resulting metal shrapnel can injure or kill anyone standing nearby).

- o Even if you're only burning paper, or even just leaves, is the smoke "safe" for you, your family, and your neighbors? (Answer: No; all smoke can cause respiratory problems and even heart problems. Paper is not just wood, but contains chemicals from the paper manufacturing process, including chlorine which causes dioxin formation).

- o Do individuals and families throw away more trash today than they did 30 years ago? 50 years? 100 years?

- o Is curbside recycling available in your community? What about recycling drop-off sites? What items in the trash piles could be recycled in your community?

- o Are all of your trash items really "trash"? Or are some of them actually valuable resources? What items in your trash pile could be re-made into useful new items?
  - Besides avoiding burning, landfilling or littering, in what ways does recycling these items help the environment?
  - Examples: making aluminum beverage cans from recycled cans uses 95%

less energy than making cans from aluminum ore. This reduces pollution caused by energy production. It also reduces the need to mine aluminum ore (bauxite), which causes environmental damage. Many plastic items can be made into new bottles, toothbrushes, and even clothing. This saves some of the energy used in manufacturing, and also reduces pollution from extracting, transporting and refining petroleum and other raw materials that would otherwise be used to make new products.

EXTENSION ACTIVITIES

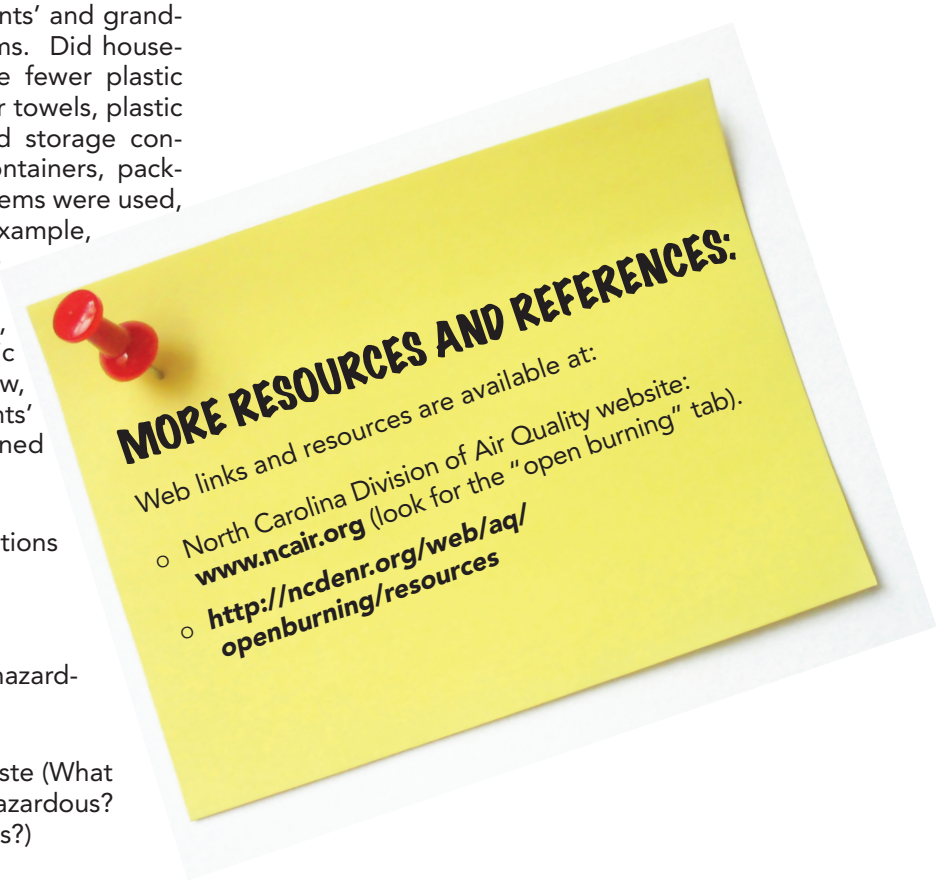
1) Have students interview their parents and grandparents about their family's use of disposable items when they were children and young adults. Ask parents and grandparents if they remember their own parents' and grandparents' use of disposable items. Did households throw away less? Were fewer plastic items used? What about paper towels, plastic storage bags, disposable food storage containers, restaurant take-out containers, packaging, etc.? If fewer of these items were used, what was used instead? (For example, their grandparents may have used a Mason jar or non-disposable dish to store leftovers, rather than a disposable plastic container). In the same interview, students may ask if their parents' parents or grandparents burned trash.

2) Have students research what options exist in their community for:
   - Recycling (what, where?)
   - Disposing of regular (non-hazardous) trash.
   - Disposing of hazardous waste (What materials are considered hazardous? Where are disposal facilities?)
   - Disposing of yard waste, tree limbs, brush, etc.

   For each of these options, consider factors that might affect whether people are likely to use these options, such as convenience (number and location of facilities, driving distance, hours of operation) and cost (tipping fees or other disposal costs).

   This information may be available via the internet, or from your town or county solid waste agency.

3) Have students track, to the extent practical, what their household throws away over the course of one to three days. Students may create a chart or checklist to post near the "main" trash can in their house (usually in the kitchen).



APPENDIX ONE: *BUILDING A BURN BARREL*

You will need:

- One or more containers to represent a burn barrel. You can use a clean trash can (kitchen-type can or larger), or an actual clean drum or barrel if you have access to one (most burn barrels are old 55-gallon oil drums). You can even use a large cardboard box – be creative! If students will be divided into groups, provide a "burn barrel" for each group if possible.
- An assortment of clean garbage items. See below for suggestions. You might:
  - Gather the trash yourself (ask friends and other teachers for donations too!)
  - ***With the consent of your administrator,*** have students bring trash items from home as a pre-activity assignment.

Whether you or your students collect trash items, make sure to emphasize these safety and hygiene precautions:

- No nails protruding from pieces of lumber
- No "sharps" (needles), glass, or sharp edges on metal cans
- Containers, wrappers, and disposable utensils should be thoroughly cleansed of residue and dry. (Damp items may grow mold if stored.)
- Items such as teabags and paper towels should be unused and dry.
- No confidential information on receipts or mail
- No fluid residues in paint cans or glue / caulk tubes (dried residue is fine)
- And of course, disposable diapers should be unused!

- Assemble trash items into cans/barrels The lists below offer suggestions for trash mixes. You may assemble separate barrels for residential, construction, and demolition/clean up trash, or you can mix these types. In actual open burning violation investigations, these three types are often found mixed.

Residential:

Cereal box
Bread loaf bag
Newspaper
Disposable diapers
Corrugated boxes
Tea bags
Potato chip bag
Plastic or "play" food, or pictures of food (representing real food)
Magazines
½ gallon milk jug
Soup / vegetable cans
Aluminum drink cans
Junk mail
Shoe box
Akaline batteries
2-liter soda bottles
Paper towels
Receipts
Gift wrap
Lunchmeat and cheese packages

Construction:

Plywood scraps
Vinyl siding scraps
Empty paint or adhesive cans
Drink cans / bottles
Treated lumber scraps
Corrugated boxes
Newspaper
Pieces of wire
Non-pressure treated lumber
Plastic sheeting and wrap
Glue or caulk tubes
Shingle scraps
Lunch wrapping and bags

Demolition/Clean-up:

Tires (old bicycle/ wheelbarrow tires)
Paint cans
Tables
Old carpet pieces
Chairs
Mattresses
Sofas
Painted lumber

APPENDIX TWO: *NOTES ON EMISSION FACTORS FOR ACTIVITY SHEET B, "WHAT COMES OUT?"*

The emission factors (EFs) used in this worksheet come from the following resource:

U.S. EPA, 2001. Emission Inventory Improvement Program, Technical Report Volume 3: Area Sources; Chapter 16: Open Burning; Table 16.4-1: Emission Factors for Open Burning of Municipal Refuse. This document is found at: ***http://www.epa.gov/ttn/chief/eiip/techreport/volume03/iii16_apr2001.pdf.***

The following notes may help the instructor better understand what these factors represent:

PM2.5: This factor represents particulate matter of 2.5 micrometers (microns) or less in diameter. This is the particle size fraction of greatest health concern. These microscopic particles are less than 1/25 the width of a human hair, which is about 70 microns in diameter.

VOCS: These are "reactive" volatile organic compounds that contribute to ground-level ozone formation. The individual VOCs measured and grouped for this EF include 1,3-butadiene, 2-butanone (methyl ethyl ketone), benzene, chloromethane (methyl chloride), ethyl benzene, naphthalene, styrene, and toluene. All of these chemicals are also listed as hazardous (toxic) air pollutants by the U.S. EPA and the N.C. Division of Air Quality: **http://www.epa.gov/ttnatw01/187polls.html, http://www.ncair.org/rules/rules/D1104.pdf.**

TOXIC POLLUTANTS: This EF includes factors for the following component chemicals: chlorobenzenes (includes di-, tri-, tetra-, penta-, and hexachlorobenzenes), phenol, total polycyclic aromatic hydrocarbons (PAHs; see EPA 2001 source document for list of component PAHs), total polychlorinated dibenzo-p-dioxins (PCDDs, or dioxins), total polychlorinated dibenzo furans (PCDFs, or furans), total polychlorinated biphenyls (PCBs), hydrogen chloride, and hydrogen cyanide.

Note that all of the VOCs are classified as toxic; however they are listed separately from toxic pollutants because of their potential to contribute to ground-level ozone formation. Therefore students could combine the VOC and toxic pollutant factors for a better estimate of toxic emissions.

No chemicals have been "double counted". If a chemical is included in one EF, it does not appear in another. For example, the EPA 2001 source document includes naphthalene in total PAHs and in VOCs, but for this exercise naphthalene has been removed from the PAH component of the toxic pollutant EF, and appears only in the VOC EF.

WHAT'S MISSING? Burning trash releases emissions of many toxic metals and metalloids into the air. These can include arsenic, cadmium, chromium, lead and mercury, among others. Numerous other toxic chemicals may be emitted beyond those included in the VOC and toxic pollutant EFs. Because reliable emission factors for these emissions have not been identified, those pollutants have not been included in this activity.

EMISSION FACTOR SCALING: The EPA 2001 source document draws emission factors from two resources. EFs for SO_2, CO, CH_4, and NOx were derived from total refuse weight and have been transferred unaltered to this activity, which estimates emissions based on total refuse weight. EFs for all other emissions were derived from only the refuse that actually burned. Because typically about 20% of refuse is non-combustible (such as metal or glass), these emission factors were multiplied by 80% to scale them more accurately for this activity.

ACTIVITY TWO:
BURNING ISSUES

SUMMARY

Burning household trash contributes to air, soil and water pollution, and is illegal in North Carolina. In this activity, students will:

- Research the effects of air pollution and open burning, as well as ways in which North Carolina regulates and controls open burning.
- Use their research to create informative and/or persuasive posters or other media about open burning and air pollution.
- Educate others and gain presentation skills by displaying posters and/or giving presentations to other classes.

OBJECTIVES

Students will: (1) learn about open burning and air pollution caused from open burning; (2) learn what can and cannot be legally burned in North Carolina; (3) create informative and persuasive posters or other presentation media about open burning and alternative methods of waste disposal.

TIME NEEDED

Research and Review: 30-45 min
(Class/Part #1)
Create and Present: 45-60 min
(Class/Part #2)

Homework: Reflection and journaling about "What did you learn from the research?" "Why is this topic important?"

"STUDENTS CREATE RESEARCH-BASED POSTERS OR OTHER PRESENTATION MEDIA TO EDUCATE OTHERS ABOUT THE DANGERS OF BURNING TRASH."

KEY TAKE-AWAYS

- Burning trash and other man-made materials is harmful to human health and the environment, and is illegal.
- We can reduce the human and environmental impact of our trash by generating less waste, re-using and recycling items, and choosing other disposal methods.

COMMON CORE & ESSENTIAL STANDARDS

- 7.E.1.6
- 7.RP.1
- 7.L.2.3
- 7.SI.1
- 7.TT.1
- 7.G.1.1

Teacher Tips

Materials

- ☐ Student journals / notebooks / paper
- ☐ Paper / scissors / glue / tape
- ☐ Old magazines or other sources of images
- ☐ Pens / pencils / markers
- ☐ Informational brochures and information from the NC Division of Air Quality
- ☐ Poster board and/or foam core board
- ☐ Computers with internet access (at least one per small group)

BACKGROUND

Each day, every person in the United States creates an average of 4.4 pounds of trash.[1] In many parts of North Carolina and the United States, burning has been the traditional way to get rid of trash. However, burning trash or any other manmade material is illegal in North Carolina.

Burning trash and all other man-made materials outdoors has been prohibited since 1971 under North Carolina's open burning rule, one of North Carolina's oldest air quality regulations. ***Open burning*** is any type of burning in which the smoke is released directly into the air, without passing through a chimney or smokestack. Examples of open burning include burning trash in a barrel, and burning leaves in a pile. Under the open burning rule, it is always illegal to burn trash and other ***non-vegetative*** materials. Leaves, branches and other plant growth can be burned only under certain conditions.

Why do people burn trash? In North Carolina, most residential trash burning (about 90%) happens in rural counties.[2] In many of these areas, especially outside of city or town limits, trash pick-up is not provided. Households have to hire a private trash hauler, or take their own trash to a landfill, sometimes paying a tipping fee. However, air quality inspectors have noticed that it's not just the cost or inconvenience of proper disposal that causes people to burn their trash. Often, people in rural areas burn their trash because it's the only disposal method they've ever known, and it's the way their families have disposed of trash for generations.

What can and can't be burned legally? A good rule to remember is: **"If it doesn't grow, don't burn it!"** All manmade or non-vegetative materials are illegal to burn in North Carolina. Even lumber is considered a man-made material and cannot be legally burned.

Vegetative material such as leaves, brush, and tree limbs may be legally burned only in areas where public pick-up for these materials is not provided. Even in areas without public pick-up, local laws may restrict or prohibit burning of vegetative material.

In counties with an air quality forecast, all open burning is banned on ***Air Quality Action Days.*** These are days when the forecasted air quality is Code Orange (unhealthy for sensitive groups), Code Red (unhealthy), or Code Purple (very unhealthy).

What kind of pollution is caused by burning trash, and how is it harmful? Smoke is a mixture of gases and tiny particles. The gases in smoke, from both vegetative and non-vegetative materials, include carbon monoxide, carbon dioxide, nitrogen oxides (NOx), and volatile organic compounds (VOCs). Household trash typically contains plastics, chemically treated paper, and other ***synthetic*** materials that, when burned, emit toxic chemicals into the air. These chemicals can include dioxins, furans, hexachlorobenzene, lead, mercury, and many others. The chemicals released by burning trash can harm people when they breathe the smoke, or when they are exposed through contamination of plants, land and water.

Health effects from breathing smoke: The health effects of breathing smoke can include lung and eye irritation, coughing, headaches, dizziness, asthma attacks, heart attacks, and even death. Exposure to smoke from burning trash could have long-term consequences, as some of the toxic chemicals are probable or known human carcinogens and have other health effects.

The tiny particles in smoke are called ***particulate matter or particle pollution.*** These particles, whether from burning natural or synthetic materials, travel deep into the lungs and can cause serious respiratory and heart problems. While breathing particle pollution is harmful to everyone, it is especially dangerous for people with existing respiratory disease like asthma or emphysema, or existing heart problems. Breathing particle pollution can cause asthma attacks and acute bronchitis, and may increase the risk of respiratory infections. For people with heart disease, the particle pollution in smoke can cause heart attacks and cardiac arrhythmias (irregular heart rhythm). Numerous studies have linked elevated particle levels to increased hospital admissions, emergency room visits, and even death from heart and lung disease.[3]

Burning trash contributes to regional air pollution. But the greatest impact of burning trash – and even leaves and brush – is to people living nearby, who may be exposed to concentrated smoke and high levels of pollutants. Smoke from burning trash can be a serious health threat for you, your family, and your neighbors, especially for anyone with a respiratory or heart condition.

Health effects from plant, soil and water contamination: Burning household trash is the largest known source of dioxins in the nation.[4] Dioxins are highly toxic, long-lasting chlorinated organic compounds. They are dangerous even at extremely low levels and have been linked to cancer and developmental and reproductive disorders. Dioxins produced by burning trash settle on plants and into water. Meat and dairy animals eat the plants, and store the dioxins in their fatty tissue. People are exposed to dioxins primarily by eating meat, fish, and dairy products, especially those high in fat.

Smoke from burning synthetic trash deposits other hazardous chemicals like furans, mercury, and hexachlorobenzene onto land and water. Like dioxins, these chemicals enter the food chain and are ultimately consumed by people. These pollutants can have long-term health effects such as nervous system or organ damage, or reproductive or developmental disorders.[5]

The ash from burning, which is often dumped onto the ground, can contain lead, cadmium, mercury, chromium, arsenic and other toxic substances. These leach into the soil to be taken up by plants (including food plants) and seep into groundwater, or run off into streams, rivers and lakes. Children can accidentally swallow toxic chemicals from dirt on their hands while playing near discarded ash.[5]

What happens to trash when it's burned? Does it all go up in smoke? The Law of Conservation of Mass states that matter cannot be created or destroyed. When an item is burned, it doesn't just go away. Rather, the item is changed into other substances through the process of ***combustion.*** Combustion is a chemical reaction between a fuel and oxygen that gives off heat. When the fuel is ignited, oxygen combines with the chemical

components of the fuel, converting them into different combustion products. In general, when the reaction uses more oxygen, it reaches a higher temperature and the fuel undergoes more complete combustion, meaning greater oxidation of the fuel's components.

When trash is burned in a pile or burn barrel, the fire doesn't get much oxygen and burns at a relatively low temperature, resulting in ***incomplete combustion,*** which produces more smoke and toxic emissions. For example, dioxins are produced by burning items that contain even tiny amounts of chlorine, and nearly all household waste contains chlorine. The relatively low combustion temperatures of burn barrels produce significant amounts of dioxins, whereas very high temperatures such as those reached by waste incinerators (typically over 2,000 degrees F) destroy dioxins by converting them into other compounds which can then be captured by pollution control equipment.

What are alternatives to burning?

REDUCE: the amount of trash you make. Try to buy products that use less packaging. Containers and packaging make up the largest portion (30%) of trash generated by Americans.[1] Carry re-usable bags when shopping. Store food in re-usable containers (for example, pack sandwiches in re-usable containers instead of foil or plastic bags).

RE-USE: Use plastic yogurt tubs (and other containers) to store food or other items. Use old newspapers as mulch (but not the glossy inserts, because those inks can contain heavy metals).

RECYCLE: Even if your community doesn't have curbside pickup, recycling stations may exist at your local landfill and other locations. Some recyclable items, such as plastic bottles, are banned from North Carolina landfills. Many North Carolina businesses process recycled items or manufacture new items from them, so when you recycle, you support these businesses by providing them with "raw material." Visit **http://p2pays.org/localgov/ncwaste.html** to find recycling contact information for your community.

COMPOST: Let nature turn your leaves, grass clippings, and small branches into wonderful mulch. Not sure how? Visit **www.p2pays.org/compost/** for a "Composting 101."

PROPERLY DISPOSE of the rest. Some stuff has to be thrown away. Materials such as solvents, pesticides, oil-based paints, and many other chemicals should be taken to a hazardous waste facility. You can find information on disposal facilities in your area at **http://p2pays.org/localgov/ncwaste.html.** Some materials, such as computer equipment and mercury-containing thermostats, are banned from North Carolina landfills. For more information on banned materials and how to dispose of or recycle them, visit **http://ncdenr.org/web/deao/recycling/banned-materials.**

Is open burning ever good? Forestry and wildlife agencies sometimes set prescribed burns to keep forests healthy. This is open burning on a large scale and while it does produce pollution, it is essential to the health of ***fire-dependent ecosystems*** such as the longleaf pine forest of the North Carolina Sandhills region. In fact, species such as the red-cockaded woodpecker, the St. Francis' satyr butterfly, and the longleaf pine itself

depend on regular burning for the species to survive. Prescribed burns should only be set by forestry and wildlife professionals, who are trained in fire safety and management.

PREPARING FOR THE ACTIVITY

1. Consider the types of educational media you might suggest your students create in Activity Part 2, and how your students might share them. Possible media include:
   - Posters (display in school hallway or lobby; present to own class or to other classes, post images on school website)
   - PowerPoint presentations (post on school website, present to own class or to other classes)
   - Oral presentations using props or other visual aids (present to own class or to other classes)
   - Skits (present to own class or to other classes)
   - Short videos; for example, students could create, perform and film a skit (post on school website)
   - Newspaper articles (post on school website, include in school newsletter, submit to community newspaper)
   - Be creative and ask students to come up with their own ideas!

2. Decide how many small groups to divide your class into. For each group, gather:
   - A set of informational brochures on open burning from the North Carolina Division of Air Quality. Contact information to order brochures free of charge appears at the end of this activity.
   - Art supplies as suggested in "Materials" on page one, if creating posters.

Activity Part 1: Research and Review

1. Asking questions: journaling

Form the students into small groups. Before doing any research or studying references, students respond to the following questions in their journals or notebooks. Questions can be written on the board prior to class, or assigned beforehand as homework.

- What is open burning?
- How might it be harmful to humans?
- How might it be harmful to the environment?

Students then share their answers and discuss with their small groups and/or the whole class how open burning and the resulting air pollution might directly and indirectly affect them. As a class, come up with one master list of answers and record in notebook or journal.

2. Read / Review / Record

Groups should then review the printed brochures and materials on open burning from the N.C. Division of Air Quality to learn the basics. The following questions may help you guide their discussion.

- What is open burning?
- How might air pollution or open burning affect the people of North Carolina locally and across the state?
- Who might be in favor of open burning and why?
- What laws or regulations have been enacted to restrict open burning?
- When is it legal to open burn?
- What materials are illegal to burn?

3. Continue research online

Keeping students in small groups, seat each group at a computer with Internet access (provide list of printed links and references from NC Division of Air Quality materials). Tell students that they will be going on an Internet scavenger hunt: each

group needs to find three credible, unique Web sites that provide some answers and information about open burning. Use the questions below to guide their research. Students can rotate between operating the computer and recording the information found online. When students find an appropriate Web site to answer a question, they should write down the URL (Web address) and the title of the Web site, as well as the answer to the question. Students should answer each question with a different Web site. Here are some questions to consider:

- What substances or chemicals in the air are considered pollutants?
- What are some of the causes of air pollution?
- How does air pollution affect people and the environment?
- What types of fines can be associated with open burning violations?
- What is the name of an organization that investigates open burning violations in North Carolina?
- What are other ways of disposing of household waste (manmade trash) and yard waste (leaves and brush)?
- What materials can be recycled in your community? Is curbside recycling pickup provided? Where can people take recyclables if curbside pickup is not provided?

Tip - Stations: Groups can rotate between printed research and online research. Each computer can have a different website already displayed, and each "no-computer" group can have a different brochure to examine. Move groups between stations every 5-10 minutes.

By the end of the research and review phase of the activity, students should have answers to the majority of the questions. Also have students write down their own questions to ask the entire class.

If time allows, ask students if they think their information sources (printed and online) were credible and reliable. Why? Could there be bias from any of their sources about the topic, and why?

Activity Part 2: Create and Present

Keep students divided into small groups. Each group will create a poster or presentation to educate others, based on their research. The group's members will decide on the topic of their presentation, and what type of presentation to create (see "Preparing for the Activity" for suggestions). Each presentation should focus on one aspect of open burning, such as what is and isn't legal to burn, pollutants/chemicals released by burning, possible human health and environmental effects, alternatives to burning, etc. The overall objective for the class presentations is to inform the students' peers and the public about open burning, why it is dangerous, that burning manmade materials is illegal, and what people can do with trash or yard waste instead of burning it.

As possible and practical, students can educate the school community and the larger community, and gain speaking skills, by sharing their presentations. "Preparing for the Activity" suggests ways to share students' presentations with their own class, other classes, parents, and the community through oral presentations, the school website, newspapers, etc.

Electronic media such as PowerPoint presentations, videos, articles, and images of posters can be submitted to the North Carolina Division of Air Quality (NCDAQ; contact info at end of activity) for possible posting on the NCDAQ website.

Further Questions for Discussion:

- How would you define "pollution"?
- What is air pollution, and what causes it?
- Besides open burning, what else do humans do that pollutes the air? Do other polluting activities also involve burning? (For example, we burn fuel for transportation and electricity production.)
- Besides not burning trash, what are other ways that students and adults can reduce air pollution?

Evaluation / Assessment:

Students will be evaluated based on their initial written journal responses, participation in group and class discussion, ability to find correct answers on the Internet, appropriate compilation of Web sites, participation in group creation of presentation, and content accuracy / topic comprehension displayed in the group's presentation.

Extension Activity (Individual or Group)

Students can create presentations that may be too involved or time-consuming to complete in the class time allocated to this activity. Students might create a video, write an editorial for their community newspaper, or design an educational advertisement for their community newspaper to inform community members about open burning.

For printed brochures and resources on open burning:

Contact the North Carolina Division of Air Quality at (919) 707-8400, or email **air.awareness@ncdenr.gov**. Some brochures may be downloaded from the links under "More Resources and References".

ACTIVITY THREE:

HEATED CONVERSATIONS

SUMMARY

Burning household trash and other manmade materials contributes to air, soil, and water pollution, and is illegal in North Carolina. What are the consequences to human health and the environment of burning trash and synthetic materials? What are the possible legal consequences? What are alternatives to burning? Students will answer these questions while engaging in fun and entertaining skits and short performances. Students can follow the provided scripts or create their own.

OBJECTIVES

Students will learn that burning trash produces dangerous air pollution that harms human health, and that burning trash is illegal. Students will perform and/or create their own skits to learn about open burning and educate their classmates.

TIME NEEDED

Classroom Time: 45-60 minutes

A project of the North Carolina Air Awareness Program

"STUDENTS PERFORM AND/OR CREATE SKITS TO IMPROVE COMMUNICATION SKILLS AND EXPLAIN THE DANGERS OF OPEN BURNING / AIR POLLUTION."

KEY TAKE-AWAYS

- Burning trash and other man-made materials is harmful to human health and the environment, and is illegal.
- We can reduce the human and environmental impact of our trash by generating less waste, re-using and recycling items, and choosing other disposal methods.

COMMON CORE & ESSENTIAL STANDARDS

- 7.E.1.6
- 7.E.1.1
- 7.RP.1
- 7.L.2.3
- 7.SI.1
- 7.TT.1
- 7.G.1.1

Teacher Tips

Materials

- ☐ Burn pile materials (collect "clean trash"; see "Smoldering Nasty Stuff" activity for details)
- ☐ Costume props: fun clothes, hats, sunglasses, clipboard, official-looking hat and/or jacket (affix paper label reading "NCDAQ", "Air Quality Inspector", etc.)
- ☐ Several clean "trash" items (suggested list provided)
- ☐ Clean receptacle(s) such as kitchen trash can or metal drum/barrel
- ☐ Student Activity Sheet A: "What's in the Barrel?"
- ☐ Student Activity Sheet B: "What comes out?"

BACKGROUND

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COMPOST: Let nature turn your leaves, grass clippings, and small branches into wonderful mulch. Not sure how? Visit **www.p2pays.org/compost/** for a "Composting 101."

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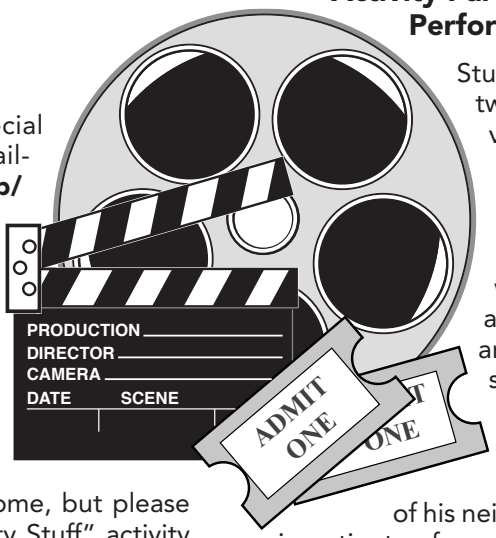
Is open burning ever good? Forestry and wildlife agencies sometimes set prescribed burns to keep forests healthy. This is open burning on a large scale and while it does produce pollution, it is essential to the health of ***fire-dependent ecosystems*** such as the longleaf pine forest of the North Carolina Sandhills region. In fact, species such as the red-cockaded woodpecker, the St. Francis' satyr butterfly, and the longleaf pine itself depend on regular burning for the species to survive. Prescribed burns should only be set by forestry and wildlife professionals, who are trained in fire safety and management.

PREPARING FOR THE ACTIVITY

Show students the video "Special Report: Open Burning", available at **http://ncdenr.org/web/aq/openburning/video,** or on DVD *(free of charge)* from the NC Division of Air Quality (see contact information at end of activity).

- Gather props as suggested on page one and in the included scripts. Students can bring props, clothes and "clean trash" from home, but please see the "Smoldering Nasty Stuff" activity for important safety precautions for collecting clean trash.

- Copy script pages for students.



Activity Part 1: Research and Review

First, learn the basics about air quality. Students can do a preliminary review of NC Division of Air Quality's brochures *(ordering information at end of activity)* or complete online research if computers are available at **www.ncair.org.** As a class, reflect on and answer some of the following:

- What is open burning?
- How might it be harmful to humans?
- How might air pollution or open burning affect the people of North Carolina locally and across the state?
- Who might be in favor of open burning and why?
- What laws or regulations have been enacted to restrict open burning?
- When is it legal to open burn?
- What materials are illegal to burn?

Activity Part 2: Dramatic Performance

Students act out the following two scenarios (scripts provided) for their classmates. A different group of actors should perform each scenario. In Activity Part 3 *(optional),* students can write their own scripts, creating their own characters and scenarios, or using the suggestions provided.

In each scenario, a citizen has been reported by one of his neighbors for burning trash. An investigator from the North Carolina Division of Air Quality, the state's air quality enforcement agency, visits him just as he's about to set the trash on fire. Curious neighbors overhear the conversation between the investigator and the citizen.

In the first scenario, the investigator isn't in a good mood. The investigator isn't rude, but just quotes the law and talks about the fines violators can be assessed for breaking the open burning law.

In the second scenario, we try again, but with a different investigator, different citizen, and different curious neighbors. This time, without threatening the would-be violator with a civil penalty *(a fine for violating the law),* how can the investigator persuade the citizen not to burn these synthetic materials?

After acting out both of the following scenarios, discuss with the class how they felt about the different scenarios. In each scenario, do students think the "burner" will really stop burning trash? In which scenario was the investigator's message more effective to stop open burning, both in the near and long term? How did the citizen feel? How did the neighbors feel? Would you be sympathetic for the citizen or angry with him/her? Did the investigator do a good job of addressing the situation?

HEATED CONVERSATIONS: SCENARIO 1

Characters:

NARRATOR 1

NARRATOR 2

RUSTY GATES: A retired homeowner

BILL PATIO:
An inspector for the North Carolina Division of Air Quality (DAQ), the state government agency that enforces open burning regulations.

CURIOUS NEIGHBORS (TWO OR MORE):
These neighbors have seen the state car in Rusty's driveway and have come over to see what's going on.

Suggested props: Open burning brochure (or folded sheet of paper); clipboard (can be used to conceal script); official-looking hat and/or jacket emblazoned with "NCDAQ" or "Air Quality Inspector"; barrel or trash can; newspapers, magazines, and "clean trash" in barrel; empty match box; and fun clothes. Set the scene with available props as described by NARRATOR 1.

START SCRIPT

NARRATOR 1: In the scene before us, an old rusty 55-gallon drum sits on concrete blocks at the end of Rusty Gates' driveway. Mr. Gates has piled a week's worth of household trash, some newspapers, and magazines into the drum.

Enter RUSTY holding a box of matches. BILL enters from the other stage direction, holding a clipboard and wearing official hat and/or jacket.

NARRATOR 2: Division of Air Quality inspector Bill Patio drives into the driveway of homeowner Rusty Gates. Mr. Gates' name, address, and phone number were given to Mr. Patio by a neighbor, who wishes to remain anonymous. The neighbor, knowing about the open burning rule, called the regional office of the North Carolina Division of Air Quality. Mr. Patio took the call and tried to contact Mr. Gates by phone, but the answering machine picked up each time. No violation of the open burning rule has happened today - so far!

BILL: (Polite but not friendly; matter-of-fact and official-sounding) Good morning. I'm Bill Patio with the North Carolina Division of Air Quality. How are you doing today?

RUSTY: I was doing fine. What can I do for you?

BILL: Are you Rusty Gates? And do you live here at 2603 Campbell Post Office Road?

RUSTY: I suppose so... I hope you're here about the factory down the road and that awful noise they make every morning about one. Wakes me up every time.

BILL: No sir, the Division of Air Quality is responsible for protecting ambient air quality, not dealing with noise. We've received a report that you might be burning trash here in your yard.

RUSTY: Well, I haven't burned anything just yet. What in the world is ambient air?

BILL: Ambient air is the air outside that moves around with the wind and that everybody breathes. I see you've got a box of matches in your hand, and there's a barrel full of what looks like trash sitting there at the end of your driveway. Are you getting ready to burn that trash?

NEIGHBORS start gossiping: "Rusty's been doing that for years" … "I'm amazed he hasn't gotten caught until now" … "What's the problem with burning trash?"

RUSTY: It's over eight miles to the county dump and they charge you for every load you bring in there. My family has been here for three generations. My grand-daddy used to take the garbage and kitchen scraps out to the back side of the garden and once a week he'd burn what the hogs didn't get. The ashes made the tomatoes and squash grow real good.

BILL: Mr. Gates, since the early 1970's there has been a state law that prohibits burning trash. I'm seeing newspaper, magazines, plastic bottles, drink cans, hot dog packages, Styrofoam meat trays and no telling what else in that barrel over there. If you burn that you will be in violation of the North Carolina Open Burning rule. Do you understand that you could be fined up to $25,000 dollars for burning your trash?" Didn't you know it's illegal to burn anything man-made?

RUSTY: Twenty-five thousand dollars! I can't believe you're telling me I can't burn my old newspapers and magazines here on my own land! It isn't hurting anything and you would fine me twenty-five thousand dollars! I don't have twenty-five thousand dollars!"

NEIGHBORS react: "$25,000 for burning?"… "Rusty can't even afford to fix his truck".. "Who has that kind of money?" etc.

NEIGHBOR: *(Under his/her breath)* I won't be doing that in my backyard anymore.

BILL: I'm not saying that you would get an automatic fine. I'm just letting you know that if enforcement were recommended, you could be fined up to that amount.

RUSTY: Well what am I supposed to do with this stuff if I can't burn it? I ain't gonna drive sixteen miles to the dump and back and then have to pay to get rid of it! The Government's out to get what little retirement savings I've got, one way or another!

BILL: *(Hands RUSTY a brochure.)* Here's a brochure that explains what can and what can't be burned and when. Read it. It tells about recycling and tells you to contact your county government about solid waste disposal. Do you understand the rule and that you cannot burn this trash?

NEIGHBORS murmur (ad lib) about the awful noises: "Yeah those noises" … "Oh yeah that's terrible."

RUSTY: Well I suppose. . . I promise I'm not gonna burn this trash now. I'll figure out something to do with it later.

BILL: I'm glad to hear it. There hasn't been a violation this time, because you haven't actually burned anything that I've seen. I'll be going, but you will be getting an information letter to remind you about my visit today and to find another way to dispose of your trash and synthetic materials. Here is my business card. Call me if you have any questions.

BILL turns, gets into his car and drives away.

HEATED CONVERSATIONS: SCENARIO 2

Characters:

NARRATOR 1

NARRATOR 2

BERNARD MIDDEN: A homeowner

JEFFREY CLINE:

An inspector for the North Carolina Division of Air Quality (DAQ), the state government agency that enforces open burning regulations.

CURIOUS NEIGHBORS (TWO OR MORE):

These neighbors have seen the state car in Bernard's driveway and have come over to see what's going on.

Suggested props: Folded paper for "Forestry permit"; business card or small piece of paper; clipboard (can be used to conceal script); official-looking hat and/or jacket emblazoned with "NCDAQ" or "Air Quality Inspector"; fun clothes for other characters, tree branches and "junk" as described by NARRATOR 1.

Suggestion: students can create a *"pile of stuff" and label items with paper with "couch cushion", "broken bicycle", etc. written in marker in large letters.*

Set the scene with available props as described by NARRATOR 1.

START SCRIPT

NARRATOR 1: In this back yard, we see a pile of pine branches. On top of the pile are some old sofa cushions, fertilizer bags, corrugated boxes, old shoes, scrap lumber, broken lawn chairs, and a bent-up bicycle.

Enter BERNARD holding a box of matches. He starts organizing the pile and piling everything up a little higher.

NARRATOR 2: Division of Air Quality inspector Jeffrey Cline drives into the driveway at the home of Bernard Midden. *(JEFFREY starts slowly entering from other stage direction, holding a clipboard. BERNARD, with his back turned to JEFFREY, continues organizing the pile.)* Mr. Midden's name, address, and phone number were given to Mr. Cline by a neighbor, who wants to remain anonymous. The neighbor got worried when he saw Mr. Midden piling junk up in his backyard. Jeffrey took the call and tried to contact Mr. Midden by phone, but the Midden's answering machine picked up each time. No violation of the open burning rule has happened today, yet.

JEFFREY: *(Pleasant)* Good morning. *(BERNARD, surprised and startled, turns to face JEFFREY.)* I'm Jeffrey Cline with the North Carolina Division of Air Quality. How are you doing today?

BERNARD: Fine, I guess. What can I do for you?

JEFFREY: This is 123 Mockingbird Lane. Are you Bernard Midden?

BERNARD: That's me.

JEFFREY: Mr. Midden, I'm out here following up on a report that you may be burning household trash here in your backyard. Have you been?

BERNARD: Well, I haven't burned anything just yet, but there's some stuff I got out of my shed and there's some downed limbs from that storm back in January. You can see where I've piled them up close to where I can get to 'em with the garden hose in case it tries to get away. I figured I'd get rid of it all by burning it at the same time. I went down to the store on the corner and got a burn permit. That's okay, isn't it?

BERNARD takes the a Forestry Permit from his shirt pocket and hands it to JEFFREY.

NEIGHBORS whisper (ad lib): "What's a burn permit?"…"I've heard of that before but never got one", etc.

JEFFREY: You know what? I'm glad I got to you when I did. You were about to make a serious mistake. You have a Forestry Permit there, but that's only good for burning the brush in that pile.

BERNARD: What? I thought this was good for burning anything.

JEFFREY: Mr. Midden *(hands the permit back to BERNARD),* if you look closely at that permit, you'll see where you signed it, it says your signature means that you've read the Air Quality Open Burning rules and that you understand them. Those rules are printed on the back of the permit. Did you read them?

BERNARD: *(Squinting at the permit)* Well, I guess I didn't. Honestly, I need my glasses to read anything this small. What do the rules say?

JEFFREY: *(In an understanding tone)* A lot of people don't read them. Basically, they say that you can't burn anything manmade, like all that stuff on top of your brush pile.

BERNARD: No kidding! But so, if I can't burn this stuff from my shed, what else can't I burn?

JEFFREY: Well it's pretty straight forward. What we say is: If it didn't grow there, you can't burn it. If it's logs or branches from yard clean-up, it can't be over six inches in diameter. In addition to when the Forest Service puts out an advisory against burning, you can't burn on Air Quality Action days that are Code Orange, Red, or - heaven forbid - Purple.

BERNARD: *(Squinting closer at the burn permit)* This synthetic material I keep seeing mentioned in the rule - what is it?

JEFFREY: That refers to any man-made or human-processed material. If you think about what's in plastic, the foam in furniture cushions, and things like that, those materials can give off some very toxic chemicals when you burn them – chemicals that can cause cancer and other problems. Some very dangerous pollution can come just from burning your kitchen trash. You don't want to breathe those chemicals, and I'm sure you don't want your family or your neighbors breathing those chemicals either!

NEIGHBOR: *(To other neighbors)* Oh my gosh, I've been burning my kitchen trash, and I've got a little girl at home!

BERNARD: I appreciate what you're telling me! That's scary! But, there's so little of this stuff compared to the tons and tons of garbage that gets burned in those big incinerators and places they burn garbage to make electricity that I've heard about.

JEFFREY: But the thing is, those large facilities burn waste at very high temperatures that break down most of the pollution, and they have millions of dollars worth of emission control devices that capture most of what's left before it can be released. A smoldering burn pile from a single family's trash can put more pollution into the air than one of these giant systems you're talking about.

BERNARD: Okay, so I won't burn this synthetic stuff. But what should I do with it?

NEIGHBOR: *(To other neighbors)* Hey, maybe we could sell our stuff to that strange guy down the road.

Another NEIGHBOR: *(Responding to first neighbor)* Yeah, he's got all sorts of junk in his yard!

JEFFREY: Well, you might consider recycling some of it. Scrap aluminum and other metals are valuable. A lot of things we treat as trash can be made into other things, so they're really re-useable resources. Even that ice storm brush could be piled up on the back of your property for wildlife shelters.

BERNARD: *(Sticks out his hand and shakes JEFFREY'S hand)* I'm glad I met you today. I've stayed out of trouble and have smarter places to send my trash that won't pollute the air. Where can I find out more?

JEFFREY: *(Hands BERNARD a business card.)* At the bottom of my business card, you'll find a web address for the North Carolina Division of Air Quality. Go on the internet and check it out. I'm glad I met you too, and I hope you have a good day.

JEFFREY turns and walks away. He gets into his car and waves as he drives away.

Script

ACTIVITY PART 3

(OPTIONAL OR EXTENSION): CREATE YOUR OWN SCRIPTS

Now that students have acted out some of the concepts and issues, they can try their hand at writing their own scripts. The following suggestions can be used to inspire students to create their own characters and scenarios. One idea is to create characters, print the names and attributes of each character on a card or sheet of paper, and have students select a character (selecting the character of their choice, or "drawing from a hat" at random). Students can then "ad-lib" scenarios involving these characters.

Name: **Ima Burner**
Gender: Female
Age range: 50-64
Character attributes: Ima is suspected of conducting illegal open burning at her residence. She is married and lives in rural NC on a fixed income and is nearing retirement age. She is pleasant, friendly and has a solid work ethic. She burns household trash in a burn barrel because she has no public trash pick-up. She has been disposing of her trash this way all of her life and sees nothing wrong with it. For her, burning her family's trash is simply an economical way of disposal, and avoids a trip to the landfill. She is a straightforward type of person and is simply unaware of the government's open burning rules, and unaware of the harmful health effects of burning synthetic materials. She is the type of person who will probably stop burning if she is made aware of the rules, because she's respectful of the rules and doesn't want to harm anyone.

Name: **Debbie Smith**
Gender: Female
Age range: 25-45
Character attributes: Debbie has two young children and one of them has asthma. She lives next to Ima on their rural road, and has a really good relationship with her neighbor. In fact, Ima helped Debbie a lot when Debbie was a new mother. Debbie likes and respects Ima and doesn't want to get her in trouble, or harm their relationship. But Debbie is getting more and more worried about the effects of Ima's trash burning on her children. There are days when Debbie feels she can't let her children play outside, and sometimes she smells the smoke (which smells really bad) inside her house. Debbie is pretty sure that her child's asthma gets worse on days when Ima is burning and the wind direction brings the smoke to their house.

Other possible characters: Another neighbor, Debbie's husband, air quality inspector.

POSSIBLE SCENARIO:

Debbie talks with her husband or another neighbor for advice on whether to confront Ima, call the Division of Air Quality, or do nothing. Her husband/neighbor doesn't really like the burning either, but isn't sure it could really be that bad, since so many people do it, and people have been doing it so long. Besides, shouldn't Ima have a right to do what she wants on her own property? What might Debbie say to her husband or other neighbor to convince them of the seriousness of the problem? What's more important: that the burning is illegal, or that it could be harming their and their children's health? What will Debbie end up doing? If she confronts Ima, what might she say to convince Ima not to burn? If Debbie calls the NC Division of Air Quality, what will happen when an air quality inspector visits Ima?

IDEAS FOR SCRIPTS OR CLASS DISCUSSION:

Air quality inspectors often hear something like: "My grand-daddy and his grand-daddy before him burned their household trash, so I should be allowed to burn my trash." What's wrong with that today? Have the materials in household trash changed, and how? When packaging was even used at all before about 1930, how was it different from the packaging for products we buy today?

Might trash burning have been harmful to human health 100 years ago? Would it have been more or less harmful than burning today's trash? What options did people 100 years ago have for getting rid of their trash? How has our knowledge of burn barrel emissions and health impacts changed?

In 1900, North Carolina's population was about 2 million people. By 1950 that population was about 4 million, and by the year 2000 our state's population had doubled again to about 8 million. How does population relate to solid waste production, resource consumption, and air pollution?

BACKGROUND SECTION REFERENCES:

For printed brochures and resources on open burning:

Contact the North Carolina Division of Air Quality at (919) 707-8400, or email **air.awareness@ncdenr.gov.** Some brochures may be downloaded from the links under "More Resources and References".

BACKGROUND
SECTION REFERENCES:

1. U.S. Environmental Protection Agency: Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010. **http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw_2010_rev_factsheet.pdf**

2. N.C. Division of Air Quality Enforcement Data: Statewide data for calendar year 2012.

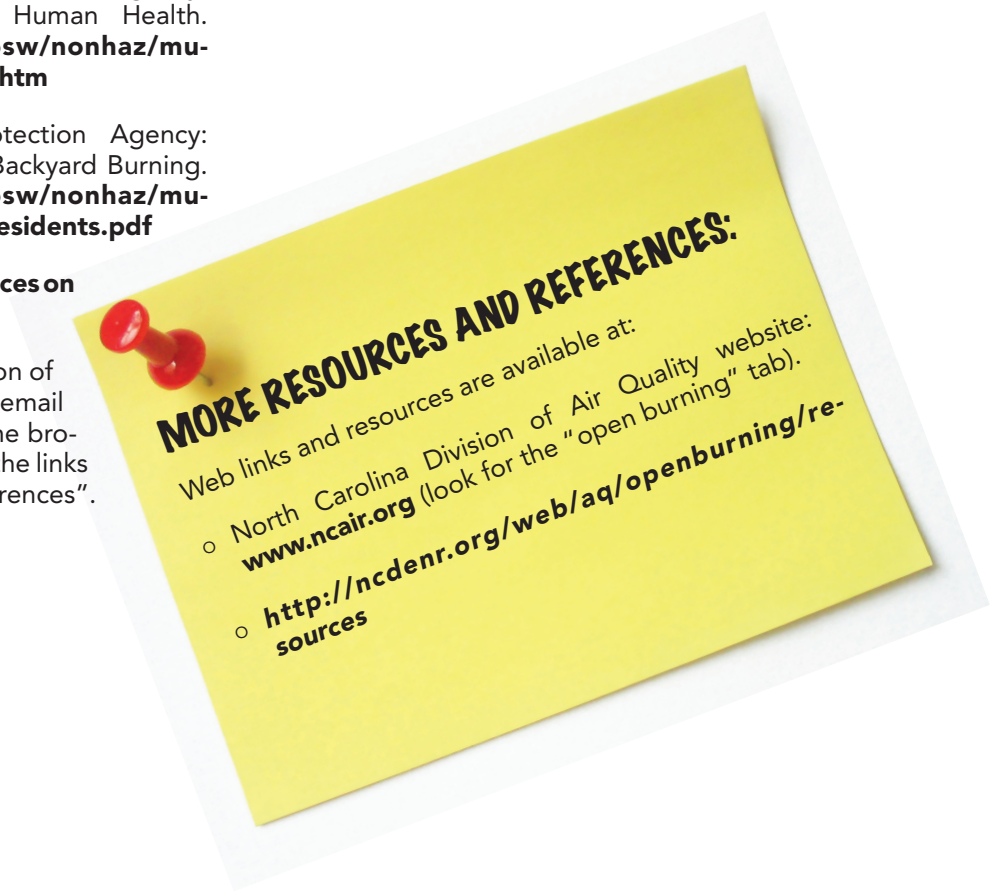
3. U.S. Environmental Protection Agency: Particle Pollution and Your Health. **http://www.airnow.gov/index.cfm?action=particle_health.index**

4. U.S. Environmental Protection Agency: Backyard Burning and Human Health. **http://www.epa.gov/osw/nonhaz/municipal/backyard/health.htm**

5. U.S. Environmental Protection Agency: The Hidden Hazards of Backyard Burning. **http://www.epa.gov/osw/nonhaz/municipal/backyard/pubs/residents.pdf**

For printed brochures and resources on open burning:

Contact the North Carolina Division of Air Quality at (919) 707-8400, or email **air.awareness@ncdenr.gov.** Some brochures may be downloaded from the links under "More Resources and References".



DIVISION OF AIR QUALITY FACT SHEET

NCDENR

Sheila Holman, Director

Mission:

To protect and improve outdoor air quality in North Carolina for the health, benefit and economic well-being of all.

Major air quality issues:

- Ozone
- Particle pollution
- Sulfur dioxide
- Nitrogen oxides
- Mercury and other toxics
- Acid deposition
- Impaired visibility or haze
- Odors from industry, animal operations
- Smoke from outdoor burning

Customers:

- 9.7 million North Carolina citizens
- Local governments in 97 counties
- 2,650+ permitted sources of air emissions
- Sources not required to have permits but subject to state and federal air rules

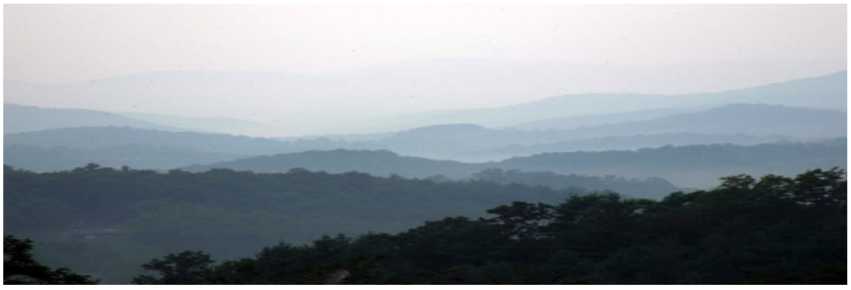
Staff:

DAQ has 259 permanent positions, with 141 located in the Raleigh central office and 118 in regional offices across the state.

Activities:

- Facility inspections
- Complaint investigations
- Permitting of air emissions sources
- Technical assistance
- Air quality monitoring
- Air quality forecasts
- Planning and rule development
- Education and outreach
- Reducing emissions from cars and other mobile sources

Division of Air Quality
919.707.8400
www.ncair.org



The Division of Air Quality (DAQ) works with citizens to protect and improve outdoor air quality in North Carolina for the health, benefit and economic well-being of all. To carry out this mission, DAQ operates a statewide air quality monitoring network to measure the level of pollutants in outdoor air; develops and implements plans to meet air quality initiatives; assures compliance with air quality rules; and educates, informs and assists the public with regard to air quality issues. To provide localized service, DAQ operates regional offices in Asheville, Fayetteville, Mooresville, Raleigh, Washington, Wilmington and Winston-Salem.

DAQ enforces state and federal air pollution regulations, while providing staff assistance in the development of state rules. The N.C. General Assembly enacts state air pollution laws, and the Environmental Management Commission (EMC) adopts most rules dealing with air quality. In addition, the U.S. Environmental Protection Agency (EPA) has designated DAQ as the lead agency for enforcing federal regulations dealing with air pollution in North Carolina. Local air programs enforce air quality regulations in three counties: Buncombe, Forsyth and Mecklenburg. DAQ does not deal with indoor air pollution issues such as workplace safety (Department of Labor), and mold, second-hand smoke, asbestos contamination and radon and radiation problems (Department of Health and Human Services).

Organizational Information

DAQ is part of the N.C. Department of Environment and Natural Resources. The division is organized into five sections: Administration, Ambient Monitoring, Permits, Planning, and Technical Services. Key responsibilities for these sections include:

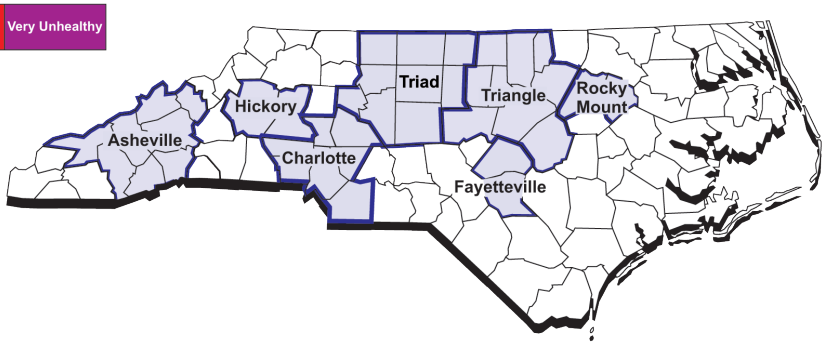
- **Administration** is responsible for the overall operations of the division, including management, budgeting and public information.
- **Ambient Monitoring** is responsible for measuring levels of regulated pollutants in outdoor air. The section maintains about 50 monitoring sites across the state, measuring for pollutants such as ozone, particles, nitrogen oxides and sulfur dioxide.
- **Permits** handles the issuance, renewal and modification of air quality permits for sources of regulated air pollution in North Carolina. Currently, about 2,650 facilities hold air quality permits in the state.
- **Planning** performs computer modeling and analyses to determine how to attain air quality standards. The section develops air quality plans to address air quality problems and works with the EMC to develop rules for protecting air quality. Air pollution control strategies are identified and evaluated based on multiple factors, including pollution reduction potential, cost and ease of implementation.
- **Technical Services** is responsible for ensuring compliance with air quality rules through inspections, assistance, education and outreach. The section also ensures that vehicle emissions programs are complying with state and federal rules.

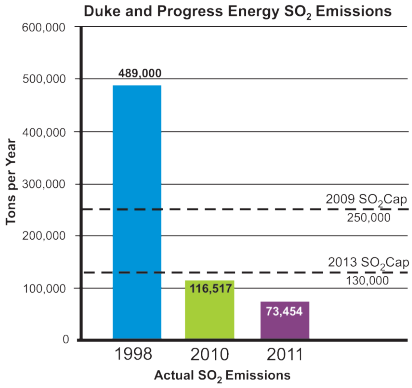
DIVISION OF AIR QUALITY FACT SHEET

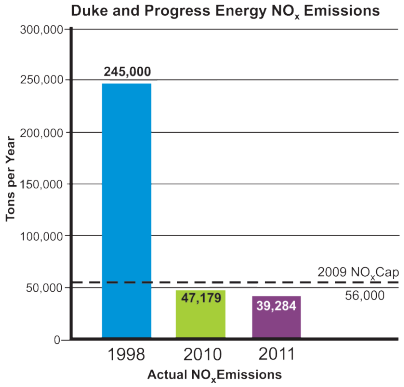
North Carolina Air Quality Forecast Map

Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy

The Division of Air Quality and local air programs issue daily air quality forecasts for ozone and particle pollution in seven metropolitan areas – Asheville, Charlotte, Fayetteville, Hickory, the Triad, the Triangle and Rocky Mount. Forecasts are based on the air quality "color code," in which green means good, yellow is moderate, orange is unhealthy for sensitive groups, red is unhealthy for everyone, and purple is very unhealthy.

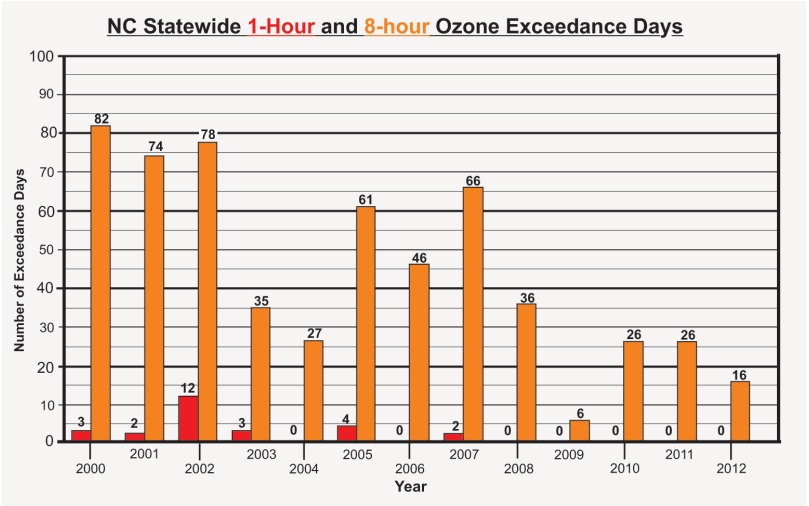






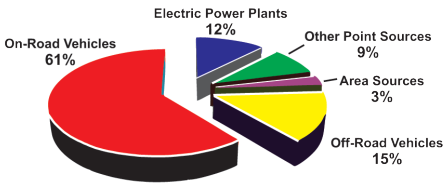
The Clean Smokestacks Act of 2002 required coal-fired power plants in North Carolina to reduce their ozone- and particle-forming emissions by three-fourths over the following decade. Actual emissions have been less than required for both sulfur dioxide (SO_2) and nitrogen oxides (NO_x). SO_2 is unhealthy to breathe and the leading cause of haze, particle pollution and acid deposition. NO_x is the leading cause of ozone and contributes to haze, particle pollution and acid deposition. As a co-benefit, the controls installed under the act also have reduced mercury emissions by more than 70 percent.

Ozone levels have steadily declined across North Carolina over the past decade due to NOx reductions required under the Clean Smokestacks Act as well as other state and federal controls on industry, stricter standards for new cars and trucks, and cleaner gasoline and diesel fuel. Ozone also is influenced by the weather -- with higher levels during hot, dry and stagnant conditions. Ozone exceedance days have become much less frequent in recent years, even during summers with prolonged heat waves.



Sources of Ozone Pollution in North Carolina

Nitrogen oxides (NOx), the main cause of ozone pollution: 2010 emissions



Motor vehicles are the largest source of ozone-forming emissions in North Carolina. Ozone, which is unhealthy to breathe and damages trees and crops, is not emitted directly but forms when nitrogen oxides (NO_x) react with volatile organic compounds (VOCs) in the air on hot, sunny days. Cars, trucks and off-road vehicles such as construction equipment account for about three-fourths of the NO_x emissions in the state. NO_x emissions from electric power plants have declined from nearly half of total statewide emissions to about one-eighth over the past decade, due to reductions required under the Clean Smokestacks Act. Most of the VOC emissions in North Carolina come from trees and other vegetation, so control strategies focus on NO_x for reducing ozone.

Don't try this at home...

NORTH CAROLINA AIR AWARENESS PROGRAM

AIR QUALITY EDUCATION

6-8 Curriculum & Activity Guide

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