

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.SI.1
- 7.RP.1
- 7.TT.1
- 7.L.2.3
- 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)



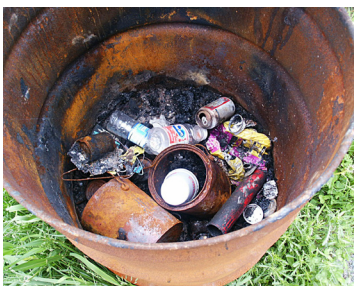
BACKGROUND

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 (NO_x), 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".

MORE RESOURCES AND REFERENCES:

Web links and resources are available at:

- North Carolina Division of Air Quality website: www.ncair.org (look for the "open burning" tab).
- <http://ncdenr.org/web/airquality/openburning/resources>