

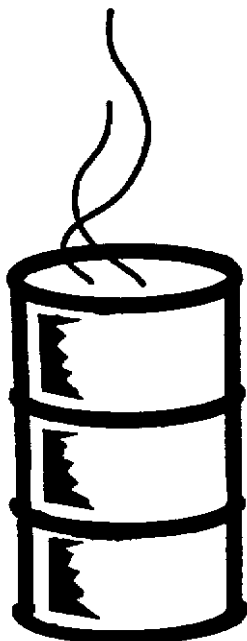


## Open Burning of Trash

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Jamie L. McCoy, Research Technician  
 James W. Garthe, Instructor, Agricultural Engineering

**B**urning is a traditional way of managing waste in rural areas. In open burning, air contaminants are emitted from a fire directly into the outdoor atmosphere. Today's waste is different from the waste of earlier eras, since it may contain many types of plastics and synthetics. Because these new materials emit toxic pollutants, a new awareness of the dangers of open burning has surfaced. Waste that generally is burned in open fires includes paper, metal, yard trimmings, food, plastic, and glass. Burning is most common in rural, less populated areas. According to a survey conducted by the University of Illinois Cooperative Extension Service, people who burn in rural areas do so for convenience, independence, cost savings, and reduced reliance on landfills. People opposed to open burning cite fire hazards, health concerns and environmental pollution as reasons for a ban.



The arguments for and against open burning have been based on speculation for some time. However, combined sources of

open burning have shown to contribute to atmospheric pollution. For example, a study conducted in Illinois estimated that 5,000 tons of air pollution is emitted annually from burn barrels in that state alone. These pollutants come from 700,000 to 900,000 residents in Illinois who burn their waste, a total of 6-8 percent of the population.

Minimizing atmospheric pollutants from open fires would require the end of burning, or fires that achieve complete combustion. Achieving complete combustion in open fires is very difficult, if not impossible, but high temperatures can reduce the amount of harmful emissions associated with open fires.

### Incomplete Combustion Contributes To Air Pollution

Low burning temperatures in open fires can result in products of incomplete combustion, including particulate emissions, heavy metal vapors, acid gases, and carcinogenic tars. An obvious indicator of incomplete combustion is the formation of black smoke, which consists of small particulate materials. The amount of pollution emitted largely depends on the type of waste burned and the method of combustion. Open burning can release a variety of pollutants in amounts that exceed the maximum allowable emissions set by the U.S. Environmental Protection Agency for modern incinerators.

### Polycyclic Aromatic Hydrocarbons

A family of pollutants that has received a lot of attention is the polycyclic aromatic hydrocarbons (PAHs). Some of these compounds are carcinogenic or highly toxic. Carcinogens cause the development of cancerous growths in living tissue. These pollutants are produced at low combustion temperatures, but slowly dissipate as the temperature rises. For example, dioxins, which belong to the PAH family, are well-known by-products of incomplete combustion. They are created naturally by forest fires, lightning, and volcanoes. They also can be produced by metal smelting, incinerators, and open fires. An oxygen-deficient fire is ideal for creating dioxins. The toxicity of dioxin is under considerable debate in the scientific community. Some experts say it has minimal effects on humans, while others maintain that it is one of the most toxic carcinogens. Waste combustion is the largest contribution of 2,3,7,8-tetrachlorodibenzo-p-dioxin to the atmosphere. The EPA calls this compound the most lethal member of the dioxin family.

The most common and most frequently measured PAH found in the incomplete combustion of waste is benzo [a] pyrene. This hydrocarbon is a potent carcinogen. One study revealed that open fire smoke

contains 70 parts per million (ppm) of carcinogenic benzopyrenes, about 350 times more than cigarette smoke. A breakdown of the different sources and the amounts of PAHs emitted can be found in Table 1. In Table 1, the term *emission factor* is the amount of PAHs emitted by a particular combustion technique compared to the amount of waste burned.

## Other Emissions

Table 1. Comparison of PAH Emission Factors.

Source	Typical (mg/kg or ppm)
Incinerators	6.8
Open burning:	
Automobile tires	240
Municipal refuse (trash)	1.4
Forest fire	20
Agricultural burning	20

Adapted from: Bjorseth, A. and T., Ramdahl "Handbook of PAH Vol. 2" (1983), p, 12,

Every fire is different in terms of its fuel source, but estimates suggest a ton of average garden waste gives off 30 kilograms of carbon monoxide. The level of carbon monoxide in the area of such a fire can be as high as an urban street with heavy traffic. Carbon monoxide and other gases are thought to contribute to global warming. Incomplete combustion affects the chain of carbons that make up cellulose, which is the main ingredient of leaves and grasses. These carbon chains break down into short chain and cyclic compounds such as acetic acid and propenal. Propenal is a powerful irritant, and is responsible for the red streaming eyes we experience near open waste fires.

Materials containing chlorine, such as polyvinyl chloride (PVC), can give off highly corrosive and toxic hydrogen chloride when burned. PVC also is a source of dioxin when burned at temperatures below complete combustion. Phosgene also is emitted from the combustion of PVC. This odorless gas can penetrate into the lungs and reduce oxygen intake by damaging the air sacs.

Some plastics contain metal additives used in manufacturing mainly as heat stabilizers, antimicrobials, and colorants. When incinerated, these plastics may emit arsenic and heavy metals such as lead, mercury, cadmium, and chromium. Human exposure to heavy metals can cause nausea, vomiting, abdominal pain, anorexia, and mood disturbances. Long-term exposure to heavy metals can have harmful effects on the neurological and reproductive systems.

## What can you do to reduce these pollutants?

To eliminate pollutants emitted from a trash fire, complete combustion must be achieved. It is difficult to achieve the necessary temperatures for complete combustion with a small trash fire. However, pollutants can be reduced by elevating the temperature. To achieve the highest temperature:

- ☛ **Expose the waste to air, allowing the fire to burn hotter and more efficiently. This can be done by using grates or heavy expanded wire mesh to allow air to enter through the waste material.**
- ☛ **Agitate the waste while burning to make sure all materials are incinerated. Movable grates work well for this purpose.**

These procedures can reduce the health risks associated with open burning. However, performing these steps does not mean that the fire is burning clean or achieving complete combustion. Pollutants are being emitted at lower levels which still may impact human health and the environment. These steps are suggested only to help reduce harmful pollutants.

## Discussion

Thick black smoke indicates incomplete combustion. Achieving a "clean" burn takes work. Leaving the fire to burn and smolder for hours or days is not environmentally sound and can be detrimental to the health of you and your neighbors. Most municipalities in Pennsylvania prohibit open burning. Check local ordinances concerning open burning before you burn. As regulations concerning open burning become more strict, people must look for new ways to dispose of plastics, organic wastes, and other waste by-products. Recycling and converting waste-to-energy are two alternatives that have proven viable in recent years. If you must burn, remember to follow the guidelines in this fact sheet to reduce the amount of pollutants open burning can produce.

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For a copy of our Fact Sheet listing contact:  
 Agricultural and Biological Engineering Extension  
 246 Agricultural Engineering Building  
 University Park, PA 16802  
 (814) 865-7685 FAX (814) 863-1031