

Data Submitted (UTC 11): 11/6/2022 12:00:00 PM

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Comments: PM 2.5 and Other Dangerous Prescribed Burning Emissions

Fires emit PM directly along with hundreds of gaseous compounds. The gaseous compounds include nitrogen oxides (NO_x), carbon monoxide (CO), methane (CH₄), and hundreds of volatile organic compounds (VOCs), including a large number of oxygenated VOCs (OVOCs). This chemical complexity makes wildfire smoke very different from typical industrial pollution. A key challenge for understanding fire impacts on air quality is the large variability from fire to fire in both the quantity and composition of emissions. Emissions can vary as a function of the amount and type of fuel (Prichard et al. 2019a

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7932990/#R336>), meteorology, and burning conditions. These variations give rise to large uncertainties in the emissions from individual fires (Larkin et al. 2012

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7932990/#R220>). Once emitted, wildfire smoke undergoes chemical transformations in the atmosphere, which alters the mix of compounds and generates secondary pollutants, such as ozone (O₃) and secondary organic aerosol (SOA).

In the U.S., prescribed burning is very popular, but its practice entails air pollution concerns. Biomass burning emissions remain as one of the largest sources of PM_{2.5} in the U.S., with an estimated 14% of total primary PM_{2.5} emissions coming from prescribed burning. US EPA 2014 National Emissions Inventory (NEI) Documentation."

Prescribed burn smoke poses a danger for everyone but is particularly hazardous to children, the unborn and the elderly. Approximately 80 to 90 percent of wood smoke particles are 2.5 microns or smaller, and EPA studies show that the tiny dagger-shaped particles are particularly harmful to children since they are able to go deep into the lungs and other organs. These particles pass through the lungs into the blood stream, attacking vital organs including the umbilical cord where they can travel to unborn children. Stroke and heart attack are among the results of particulate matter in the bloodstream.

Besides fine particulate matter, smoke from prescribed burns contains volatile organic compounds like formaldehyde, benzene, carbon monoxide, ozone, acrolein and numerous other toxins and literally thousands of chemicals. One example is mercury when it ends up in waterways, where it can transform into methyl mercury and move up the food chain, becoming more concentrated. Mercury causes its greatest damages to unborn fetuses and newborns, including developmental defects, reduced IQ, mental retardation, learning disabilities, behavioral problems and chronic neurological diseases.

Research on PM 2.5 is extensive and conclusive.

EPA report on Health and Environmental Effects of Particulate Matter (PM)

<https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm>

Among the vast and uncontested research of the harm of PM 2.5 is a study of the impacts of prescribed burning on public health: "Studies of short-term exposure to fire smoke, especially particulate matter with an aerodynamic diameter less than 2.5 [micro]m (PM_{2.5}), is associated with adverse health effects. In order to quantify the impact of prescribed burning on human health, a general health impact function was used with exposure fields of PM_{2.5} from prescribed burning in Georgia, USA, during the burn seasons of 2015 to 2018, generated using a data fusion method. A method was developed to identify the days and areas when and where the prescribed burning had a major impact on local air quality to explore the relationship between prescribed burning and acute health

effects. The results showed strong spatial and temporal variations in prescribed burning impacts. April 2018 exhibited a larger estimated daily health impact with more burned areas compared to Aprils in previous years, likely due to an extended burn season resulting from the decision to burn more areas in Georgia. There were an estimated 145 emergency room (ER) visits in Georgia for asthma due to prescribed burning impacts in 2015 during the burn season, and this number increased by about 18% in 2018. Although southwestern, central, and east-central Georgia had large fire impacts on air quality, the absolute number of estimated ER asthma visits resulting from burn impacts was small in these regions compared to metropolitan areas where the population density is higher. Metro-Atlanta had the largest estimated prescribed burn-related asthma ER visits in Georgia, with an average of about 66 during the reporting years." The Impacts of Prescribed Fire on PM2.5 Air Quality and Human Health: Application to Asthma-Related Emergency Room Visits in Georgia, USA
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6651061/#:~:text=In%20the%20U.S.%2C%20prescribed%20burning,for%2016%25%20%5B10%5D>.

If the event that the North Carolina U.S.F.S. continues to set the forest and animals on fire there is a legal and moral obligation to protect public health. The U.S.F.S. must warn the public of the dangers of prescribed burn smoke in all communications regarding the use of prescribed fire. In addition to warning the public the N.C. U.S.F.S. must take action to develop and implement a system to protect the public from the harmful effects of smoke when setting fires to include the identification of at-risk individuals and the provision of advance warning sufficient to allow the proper safety precautions and/or provide means for at-risk individual's safety to include relocation if necessary. Every life matters.

The Dangers of Prescribed Burn Smoke and the Need for Public Education

AirNow a national organization in which the USDA Forest Service is a partner provides an excellent example of a well-developed public education program and information site regarding smoke and the dangers of smoke:
<https://www.airnow.gov/wildfires/be-smoke-ready/> and something that could accompany communications about prescribed burning. It is necessary for the USFS to begin operating on the level of transparency when it comes to setting fires. The following is adapted by using "prescribed fire" in place of "

Plan Ahead

If you live in an area where prescribed burning is being performed, take steps now to prepare. Being prepared for is important for everyone's health.

Stock up

Make sure you have several days' worth of medicines you take regularly. Keep a supply of groceries that do not need to be refrigerated or cooked. Consider purchasing supplies such as N95 respirator masks, a portable air cleaner, and replacement filters for your HVAC system and/or portable air cleaner. During a smoke event, it may be hazardous to go outside or drive, and appropriate devices may be in short supply.

Give yourself more time

Make sure you set aside time to plan and prepare for prescribed burn smoke, so you are not worried about planning during a smoke event. Consider how to stay cool at home with doors and windows closed. Talk to your friends and family about your plan. Consider your pets in your plans. Know where they will be allowed to go if there is an evacuation, and take steps to reduce your pet's exposure to smoke as you would reduce your own.

Talk with a healthcare provider

People in high-risk categories or with chronic conditions may be at a greater risk for health impacts. Talk with

your healthcare provider about how to protect yourself against wildfire smoke. Refer to the Know Your Risk section below for information on high-risk groups.

Prepare

As a part of your planning for a potential evacuation, consider developing a family disaster plan at [Ready.gov](https://www.ready.gov). Know what you need to do if you decide to leave the area.

Make a Clean Air Room

During prescribed burning, smoke can enter your home. Setting up a clean air room at home can help reduce your exposure to wildfire smoke while sheltering indoors. Everyone can benefit from spending time in a clean air room during a wildfire, but it may be most helpful for people who are at greater risk such as people with heart disease or lung disease, older adults, children, and pregnant people.

Use a portable air cleaner

Portable air cleaners are designed to filter the air in a single room or area.

Portable air cleaners vary in price and efficiency. Choose an option that is the right size for your room.

Do not use an ozone-generating air cleaner.

Run the air cleaner continuously on the highest fan speed to maximize filtration.

Stock up on HVAC filters

Central furnace or HVAC filters are designed to filter air throughout a home.

You may need to speak to a qualified HVAC professional about different filters and settings you can use to reduce smoke in indoor air.

Stock up on replacement filters. Use a high-efficiency filter (rated MERV 13 or higher) if your HVAC system can safely use one.

During periods of heavy smoke, plan to replace the filter in your air cleaner or HVAC system more often than recommended by the manufacturer. If you notice that filters appear heavily soiled when you replace them, you should consider changing them more frequently.

Stock up on HVAC filters

It's important to prepare now. If you wait until smoke is in the air, supplies may be out of stock or may not arrive in time to be helpful. Make sure you have a way to keep your Clean Air Room cool without pulling in outside air that may be smoky during fires. Window air conditioners or central air conditioners can help you stay cool. Use a portable air cleaner or high-efficiency filter (rated MERV-13 or higher) in the HVAC system to filter the air.