

Data Submitted (UTC 11): 8/13/2024 1:43:39 AM

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August 12, 204

US Forest Service

160 A Zillicoa Street

Asheville, NC

Re: Grandfather, Appalachian, & Pisgah (GAP) Restoration project #62992

To All Whom This Concerns:

The GAP Restoration project #62992 carries significant public health impacts from prescribed burning. Prescribed burn smoke contains highly injurious fine particulates, formaldehyde, benzene, dioxins, carbon monoxide, and acrolein. The USFS has an overwhelming amount of evidence regarding the public health hazards of controlled burn smoke, and a responsibility for the resulting injuries and death. It is incumbent that the USFS develop a comprehensive plan to inform the public of these hazards and develop an effective means to protect public health and safety prior to any new burning of land managed by the USFS.

1. EPA report on health effects of particulates

<http://www.epa.gov/airnow/particle/pm-color.pdf>

Short-term exposures to particles (hours or days) can aggravate lung disease, causing asthma attacks and also known acute bronchitis. In people with heart disease, short-term exposures have been linked to heart attacks and arrhythmias.

2. US Forest Service - How Smoke Affects Your Health: [http://www.fs.fed.us/air/health\\_impacts.htm](http://www.fs.fed.us/air/health_impacts.htm)

Those who are most sensitive to exposure to particulate matter include people with heart or lung disease, children, and the elderly. For sensitive individuals smoke can aggravate lung disease leading to asthma attacks or acute bronchitis and can also increase the susceptibility to respiratory and cardiovascular illness.

3. Gaseous and particulate emissions from prescribed burning in Georgia

<http://www.chem.uci.edu/rowlandblake/publications/lee.pdf>

Forest fires, both wildfire and prescribed burning, are important sources of primary air pollutants and precursors of secondary pollutants. In the southeastern United States, forest fires contribute about 20, 8, and 6% of nonfugitive primary fine particulate matter (PM<sub>2.5</sub>), CO, and volatile organic compound (VOC) emissions.

4. Short-term exposure to fire smoke, especially particulate matter with an aerodynamic diameter less than 2.5 µm (PM<sub>2.5</sub>), 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<sub>2.5</sub> 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 need 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. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6651061/>

5. Fires emit PM directly along with hundreds of gaseous compounds. The gaseous compounds include nitrogen oxides (NO<sub>x</sub>), carbon monoxide (CO), methane (CH<sub>4</sub>), 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 (O<sub>3</sub>) and secondary organic aerosol (SOA).

6. Study shows firefighters' exposure to smoke increases disease risk

After collecting data from wildland firefighters in the field, a group of researchers concluded that firefighters' exposure to smoke can increase the risk of mortality from lung cancer, ischemic heart disease, and cardiovascular disease. In this first section we cover what is in vegetation fire smoke, and after that we have details about the additional mortality risk faced by firefighters who can't help but breathe the toxic substances. In 2004 Timothy E. Reinhardt and Roger D. Ottmar found a witches' brew of methyl ethyl bad stuff that firefighters are breathing. All of these are hazardous to your health:

\*Aldehydes (volatile organic compounds); can cause immediate irritation of the eyes, nose, and throat, and inhalation can cause inflammation of the lungs. Short-term effects include cough, shortness of breath, and chest pain. The most abundant aldehyde in smoke is formaldehyde. When formaldehyde enters the body, it is converted to formic acid, which also is toxic.

\*Sulfur dioxide (SO<sub>2</sub>); causes severe irritation of the eyes, skin, upper respiratory tract, and mucous membranes, and also can cause bronchoconstriction. It forms sulfuric acid in the presence of water vapor and has been shown to damage the airways of humans.

\*Carbon monoxide (CO); As CO is inhaled it displaces O<sub>2</sub> as it attaches to red blood cells and forms COHb. COHb reduces the ability of the blood to carry oxygen and causes hypoxia (a condition in which the body does not receive sufficient oxygen). Due to their strenuous work, wildland firefighters often have increased respiratory rates, which will increase the amount of CO being inhaled when smoke is present. COHb has a half-life (the time it takes half of the COHb to dissipate from the body) of about 5 hours. Symptoms of CO exposure include headaches, dizziness, nausea, loss of mental acuity, and fatigue. Prolonged, high exposure can cause confusion and loss of consciousness

\*Particulate matter; Respirable particulates are a major concern as they can be inhaled into the deeper recesses of the lungs, the alveolar region. These particles carry absorbed and condensed toxicants into the lungs

\*Acrolein; may increase the possibility of respiratory infections. It can cause irritation of the nose, throat, and lungs. Long-term effects can include chronic respiratory irritation and permanent loss of lung function if exposure occurs over many years.

\*Benzene; can cause headaches, dizziness, nausea, confusion, and respiratory tract irritation. Although the

human body can often recover and repair damage caused by irritants, prolonged exposure from extended work shifts and poorly ventilated fire camps can overwhelm the ability to repair damage to genes and deoxyribonucleic acid (DNA).

\*In spite of numerous studies confirming that yes, there is smoke where wildland firefighters work, there has been little in the literature that quantifies the effects on a person's health. A new study published in August, 2017 contains a preliminary analysis addressing that question.

\*It is titled Wildland Fire Smoke Health Effects on Wildland Firefighters and the Public - Final Report to the Joint Fire Science Program. The authors are Joe Domitrovich, George Broyles, Roger D. Ottmar, Timothy E. Reinhardt, Luke P. Naeher, Michael T. Kleinman, Kathleen M. Navarro, Christopher E. Mackay, and Olorunfemi Adetona.

\*They used the field data collected in the 2009 to 2012 George Broyles study to extrapolate the physical and health effects on humans. The authors actually came up with numbers that indicate firefighters' relative mortality risk for lung cancer, ischemic heart disease, and cardiovascular disease.

They estimate that after a 10-year career with a project fire crew a firefighter would have a 22 to 24 percent increase in mortality from those three diseases, compared to a person with no smoke exposure. After 20 years the risk is 25 to 39 percent. The risks are lower for those working in environments found at prescribed burns and initial attack.

\*Crystalline silica; can cause silicosis, a noncancerous lung disease that affects lung function. But OSHA classifies it as a carcinogen.

\*Intermediate chemicals; have been shown to cause a variety of health problems including bronchopulmonary carcinogenesis, fibrogenesis, pulmonary injury, respiratory distress, chronic obstructive pulmonary disease (COPD), and inflammation.

One of the more recent research efforts, from 2009 to 2012, was led by George Broyles of the U.S. Forest Service, National Technology and Development Program, in Boise, Idaho. They collected data in 11 fuel models in 17 states on initial attack, prescribed burns, and large project fires. The group measured carbon monoxide (CO) with electronic datalogging dosimeters and particulate matter using air pumps and filters.

[https://wildfiretoday.com/2018/02/06/study-shows-firefighters-exposure-smoke-increases-disease-risk/?fbclid=IwY2xjawEnkh1leHRuA2FibQIxMQABHfhN\\_QWzB1laLhhNhjc43M25QgFwjyLSFKCoeZeQxfHubhVSFKjNykt50A\\_aem\\_vinkUkog7sP9JOCEvT1Jxg](https://wildfiretoday.com/2018/02/06/study-shows-firefighters-exposure-smoke-increases-disease-risk/?fbclid=IwY2xjawEnkh1leHRuA2FibQIxMQABHfhN_QWzB1laLhhNhjc43M25QgFwjyLSFKCoeZeQxfHubhVSFKjNykt50A_aem_vinkUkog7sP9JOCEvT1Jxg)

Research on PM 2.5 is extensive and conclusive.

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 particles are particularly harmful to born and unborn 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.

If the event that the North Carolina USFS. continues to set the forest and animals on fire there is a legal and moral obligation to protect public health. The USFS 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. USFS 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.

Sincerely,

Lonnie M. Crotts III