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Wildland Fire Research to Protect Health and Environment

Researchers lift a monitoring balloon to track smoke from a prescribed fire in Camp Lejeune, N.C.

Fires are increasing in frequency, size, and intensity partly due to climate change and land management practices, yet there is limited knowledge of the impacts of smoke emissions —both short term and long term. EPA is using its expertise in air quality research to fill the gaps in scientific information and to develop tools to prevent and reduce the impact of wildfires and controlled or prescribed burns. The wildland fire research has three main goals:

- Provide new science to understand the impacts of smoke on health, and how this knowledge can instruct smoke management practices and intervention strategies to reduce health impacts.
- Provide essential novel data on smoke emissions to construct the national emission inventory used to understand air quality across the country.
- Improve understanding of how smoke from fires affects air quality and climate change.

Health Effects Research

More intense wildfires are creating the potential for greater smoke production and chronic exposures in the U.S., particularly in the West.

The effects of smoke from wildfires can range from eye and respiratory tract irritation to more serious disorders, including reduced lung function, bronchitis, exacerbation of asthma and heart failure, and premature death. Children, pregnant women, and the elderly are especially vulnerable to smoke exposure. Emissions from wildfires are known to cause increased visits to hospitals and clinics by those exposed to smoke.

Research is being conducted to advance understanding of the health effects from different types of fires as well as combustion phases. Researchers want to know:

- What is the full extent of health effects from smoke exposure?
- Who is most at risk?
- What strategies and approaches are most effective in protecting public health?
- What are the environmental, social and economic impacts of wildfire emissions?

Tools & Technology Development

New scientific tools are needed to better quantify and predict the impact of smoke from wildland fires on public health. EPA research is supporting the development of new air quality monitors to measure wildfire emissions; advancing modeling capabilities to understand the impact of wildfires on air quality and improving wildfire emissions inventories.

Air quality managers are particularly interested in reliable

and accurate tools and technology that can be used to assess the impacts of wildland fires. Improved emissions data and models can be used to better assess the contribution of wildland fires to air pollutants and air toxics that are regulated under the Clean Air Act. Research questions that guide the science to develop new emissions and modeling tools include:

- Does the smoke from vegetation found throughout the country (oak, pine, chaparral, and peat) produce different types and levels of pollution?
- What is the estimated smoke exposure for those near fires, and how does it relate to observed health effects?
- How do prescribed burns contribute to air pollution concerns?

Air Pollution Sensor Systems. Researchers are working to develop and evaluate air pollution sensor systems that can be deployed during active fires and prescribed burns to provide more robust smoke emissions data. Light-weight sensors have a great advantage in that they can be placed on location of a fire event or in balloons and other aerostats to measure air pollution at different locations and altitudes in the fire zone. Sensors are being tested for their ability to measure emissions, including air pollutant concentrations and the dispersion of smoke plumes.

Wildfire Emissions and Emissions Inventories. Measuring emissions from wildland fires is important to advancing our understanding of the impact of the fires on air quality and public health. The 2014 National Emissions Inventory is the first recent national fire inventory to provide estimates of both flaming and smoldering components of wild and prescribed fires involving varied fuel types. Laboratory and field studies are being conducted to provide more wildfire data to the emissions inventory.

Modeling. Models are being used to quantify the different impacts from fire on air pollutants. Researchers are using new emissions data to improve the capabilities of models, such as EPA's Community Multiscale Air Quality Model (CMAQ) to track and evaluate smoke emissions on air quality. The findings can be used to better protect public health and support relevant regulatory demonstrations.

Water & Ecosystem Protection

Wildland fires do not just destroy trees, vegetation, wildlife and structures that get in their paths. They can also severely affect water quality by causing soil erosion, increased flooding and debris flow. At the same time, fires can result in the resuspension of legacy mine and industrial waste that has settled in river bottoms.

Following a fire, an ecosystem can be dramatically altered. Loss of vegetation promotes erosion and changing soil qualities can impact the type of vegetation that grows. Native species important to ecological recovery and health may have difficulty becoming established as non-native and fast growing species thrive. Ecosystem diversity becomes threatened.

Research is critical to better understand how fires affect water quality and supply and the overall health of an ecosystem. Studies are needed to learn more about the impact of fires on water treatment plant processes, infiltration and the flow of groundwater supplies. This information can be used to protect the safety of drinking water and to assess whether a water supply is vulnerable to the impacts of fires.

Erosion impacts on stream flows and contamination as well as impacts on soil quality are important to understand regrowth and restoration of fire-impacted areas. Research questions include:

- What are best watershed practices for protecting water quality from a wildfire?
- What changes occur in organic carbon mobilization due to wildland fires?
- Can prescribed burns be managed to prevent or reduce reemission of toxic compounds in the soil?

For more information, please visit:

Wildland Fire Research EPA Webpage:
https://www.epa.gov/air-research/wildland-fire-research-protect-health-and-environment

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June 2017