



RESEARCH FOUNDATION

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Fire Fighter Exposure to Wildland Fire Smoke

PROJECT SUMMARY

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Background:

Wildland fires emit gases, particles, and trace metals. The extent inhalation of smoke emitted by wildland fires, with or without different forms of Personal Protective Equipment (PPE), impairs the physiological function of the body remain unknown.

Evidence suggests that occupational wildland fire smoke exposure may have a cumulative effect, specifically because studies focused on chronic exposure to wood smoke have linked it to the development of Chronic Obstructive Pulmonary Diseases (COPD) and stiffening of central arteries in otherwise healthy people. While epidemiological studies can provide evidence of trends and associated risks, they cannot pinpoint which burn scenarios are the most dangerous or recommend feasible protective equipment. Studies under well-characterized and reproducible experimental conditions would help formulate recommendations on shift duration, cost/benefit of aggressive firefighting tactics, and use of PPE's for Wildland Fire Fighters (WLFF) depending on the specifics of the fire.

Implementation and Schedule:

This research project is led by Northeastern University with collaborative support from University of Maryland and the Fire Protection Research Foundation (FPRF). Funding for this project is through a DHS/FEMA AFG Fire Grant with a targeted project completion within 3 years starting from September 2018. The Principal Investigators (PI's) for this project are: Dr. Jessica Oakes and Dr. Chiara Bellini of Northeastern University, email: j.oakes@northeastern.edu, c.bellini@northeastern.edu and the Co-PI is Dr. Michael Gollner of University of California, Berkeley, email: mgollner@berkeley.edu



Project Goal and Aims:

This project aims to quantify the effects of wildland smoke exposure on the pulmonary and cardiovascular systems in fire fighters by using mice as an in vivo model to capture the health repercussions of both short-term and long-term exposure scenarios. The general goal is to have a better understanding of the health consequences and offer imperative guidance on choice of respiratory PPE use on and off the fire line.

Project Methodology:

This study involves the following tasks:

Task 1: Develop Extended Expert Team and Refine Project Strategy. A Project Technical Panel (PTP) will be established to confirm the project plan, identify potential challenges, and guide deployment.

Task 2: Generation and testing of wildland-fire like smoke within the laboratory. Creation of a controlled testing environment, which is able to mimic wildland fires within the laboratory.

Task 3: Correlation of Smoke Dosimetry with Health Consequences. Collect data correlating smoke exposure with inflammatory-driven changes in cardiopulmonary structure and function will provide critical evidence for WLFF occupational exposure.

Task 4: Quantification of Health Benefits of Commonly Used PPE. To provide a scientifically-driven best-case scenario for WLFF protection after understanding the level of smoke-protection provided by existing PPE.

Task 5: Creation of Risk Assessment Framework and Dissemination. Generate a matrix that outlines the recommended exposure times and PPE for each WLFF activity, and the consequences on health if not followed. The PTP will assist the PI's with efforts to share this information to the fire community through outreach methods.

Project Deliverables:

The anticipated outcomes from this three-year effort are to:

- 1) Evaluate the acute and chronic repercussions of wildland smoke exposure on the cardiovascular and pulmonary systems of WLFF's; and
- 2) To create a correlation matrix between exposure levels and lifetime risk to develop cardiovascular and respiratory disease to make recommendations on how to minimize the negative health outcomes and to evaluate the effectiveness of different respiratory PPE.