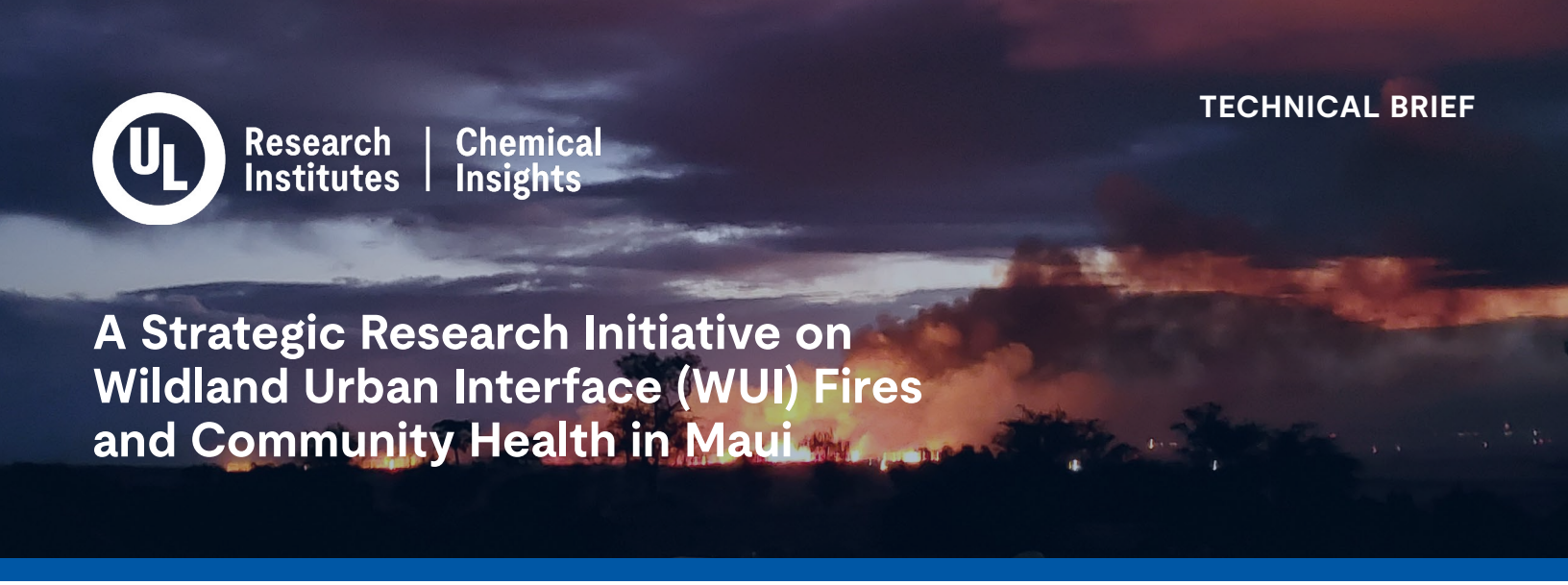

Research Institutes | Chemical Insights

TECHNICAL BRIEF

A Strategic Research Initiative on Wildland Urban Interface (WUI) Fires and Community Health in Maui

Chemical Insights Research Institute (CIRI) of UL Research Institutes is studying burn-impacted and non-impacted areas in Maui, Hawaii to further understand the chemical hazards associated with residual ash, dust, and air samples resulting from wildland urban interface (WUI) fires, and their potential effect on human health.

Introduction

Climate change is contributing to an increase in the frequency and magnitude of natural disasters, such as large wildfires, and the occurrence of extreme weather events, including major hurricanes. As water temperature increases, the traditional hurricane/cyclone season can begin earlier and extend for a longer duration. Similarly, increased risk of wildfires has been typically limited to hot and dry summer months and specific high-risk areas. However, the traditional wildfire season duration is expanding and the rapid growth of communities that meet or intermix with wildland fuels, the WUI, puts more properties and lives at risk of being impacted by wildland/WUI fires every year. By itself, a hurricane or a large fire can cause significant environmental, social, economic, and human health impacts. When these events interact, the consequences may be even more disastrous.

On August 8, 2023, Hurricane Dora passed 500 miles south of Hawaii as a Category 4 storm. While Hurricane Dora did not make landfall in Hawaii, the storm's passing resulted in strong and unpredictable winds on the Hawaiian island of Maui.[1] Around midnight on August 8, fires were ignited among dry vegetation that rapidly intensified and spread to populated areas due to the intense winds. The interaction of the passing major hurricane and dry fire-fuel-rich environmental conditions led to the deadliest wildfire that has occurred in the United States for more than a century.[2]

The WUI fire that occurred in tandem with the passing of Hurricane Dora destroyed the town of Lahaina and impacted other areas on Maui. The event is likely to have extensive short- and long-term effects on environmental and human health. Acute impacts included the confirmed loss of over 100 lives and the destruction of over 2,000 structures. This total included numerous historical dwellings and businesses as well as recently constructed buildings. This structural age range in the affected area indicates that legacy contaminants, such as lead from pre-1970s paint and arsenic from ceilings and wallboard made from sugarcane, are likely intermixed with chemical and metal hazards associated with newer materials. These newer materials may include burned modern vehicles, consumer electronics, and synthetic building and furnishing materials. This complex mixture of hazardous substances may negatively impact overall indoor and outdoor environmental quality. Robust environmental characterization of hazardous WUI fire residues is required to comprehensively evaluate the possibility of fire-related environmental exposures. Specifically, the chemical and elemental composition of the fire residue substances and their potential to infiltrate nearby homes, businesses, and schools both need to be evaluated.

Study Objectives

To further understand the chemical hazards associated with residual ash, dust, and air samples resulting from WUI fires, and their potential effect on human health, CIRI will voluntarily study burn-impacted and non-impacted areas in Maui. Collaborating with scientists from Duke University and the East-West Center, CIRI will integrate data from a combination of real-time and offline analytical chemistry techniques with high-resolution environmental sampling maps to determine the spatial relationships among the locations, types, and levels of volatile organic compounds (VOCs) and metals associated with fire residues with the potential to negatively affects health. This will provide foundational data on the presence of fire-associated pollutants that may adversely affect acute and chronic health outcomes.

KEY OBJECTIVES INCLUDE:

- Application of CIRI's Dust VOC Methodology to measure a wide range of residual VOCs resulting from WUI fires
- Application of high-resolution spatial mapping to correlate trends in environmental sampling data with distance from point-source locations including homes, vehicles, solar panels, kitchens, energy storage units, garages, and agricultural growth sites
- Development of dust- and surface-residue on-site sampling techniques for downstream chemical and metal analyses
- Development of ICP-MS techniques for dust and residue preparation for metal analyses including lead, arsenic, and lithium
- Application of field-deployed FT-IR spectroscopy for real-time air analysis of fire-associated pollutants in WUI dust and fire residues

Scientific Outcomes

1. Generation of a foundational data set of WUI fire pollutants in dust and fire residues

2. Evaluation of analytical tools for sampling and analysis of residual WUI-fire environmental samples
   - Identification and quantification of non-targeted VOCs and metals in fire-related ash and dusts
   - Correlation of pollutant concentration in dust and residues to point sources identified in spatial mapping

3. Generation of parameters for modeling of acute and chronic health risks associated with exposure to post-fire dusts and residues

Research Partners

East-West Center

Duke University

References

1. National Oceanic and Atmospheric Administration https://www.weather.gov/media/hfo/2023_HurricaneSeasonSummary.pdf
2. Honolulu Civil Beat https://www.civilbeat.org/2023/11/maui-fires-your-questions-answered/

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