Research Roadmap: Environmental Impact of Fires in the Built Environment

Concern for the health of the natural environment is growing as human population grows and as new levels of contamination of scarce resources are revealed. Current efforts to improve the sustainability of buildings focus on increasing energy efficiency and reducing the embodied carbon. This overlooks the fact that a fire event could reduce the overall sustainability of a building through the release of pollutants and the subsequent re-build.

Most fires occurring in the built environment contribute to air contamination from the fire plume (whose deposition is likely to subsequently include land and water contamination), contamination from water runoff containing toxic products, and other environmental discharges or releases from burned materials. The environmental impact also has economic consequences for communities and regions and while the direct and indirect costs of fire on a community can be devastating, they are not usually reported at a local scale beyond an account of the human deaths and injuries and the amount of property destroyed or damaged.

To calculate the true cost of fire to society we need to be able to quantify the impact fire has not only on the people or structures involved but also to the environment. Studies have been done to examine the environmental impact of fire but we cannot yet fully quantify this impact and its consequences to the local economy.

Project Goal & Approach

The goal of this project was to develop a research road map identifying needed research to be able to quantify the environmental impact of fire from the built environment and its economic consequences. This was completed through a literature review, analysis of several case studies, and a gap analysis. This project focused on structure fires and excluded wildland and wildland urban interface (WUI) fires.

The final report is available here.

Summary Observations

The findings indicate that most information concerning emissions from fire is available in the field of gaseous emissions from fires. Less information is available concerning emissions from fire to aquatic environments or soil and even less has been found concerning the environmental impact of firefighting choices. Although this final area has received more attention in recent years in light of scares concerning the contamination of soil and waterways.

The case studies indicate that while dispersion models exist, these are most well developed for gaseous emissions and dispersion using atmospheric models. However, despite the broad application of such models, the estimates of gaseous species is often based on the development of source terms using models which are applied beyond their original field of application. Further, models for dispersion of emissions in water and soil are underdeveloped.

The gap analysis identifies the need for significant research to improve our understanding of the environmental impact of fires and their cost. The gap analysis has identified that research needs can be divided into three main thematic areas: Data related research and development, research and development in support of policy development, and the development of modelling tools. These thematic areas are in turn divided into research in support of the development of modern emission factors, receptor characterization, identification of tolerable exposure levels and the development of life-cycle based and cost-based models.

Research by:

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