Master’s thesis proposal

Compilation of environmental contaminants from contents of burned enclosures

Background
As our society changes and as resources become scarcer, fire safety professionals must consider which strategies are most effective for both fighting fires and reducing the threat of enclosure (building) fires while minimizing the negative consequences on people, property and the environment. Building fires contribute to contamination of air and possibly also surface water, groundwater, sediment, and soil in the natural and built environments. Fire debris and ash often contain many harmful constituents, depending on the fuel and burning conditions of the fire. The impact of responding to enclosure fires, including both tactics and use/choice of suppression media, together with replacement of damaged materials (the structure itself and its contents) can also be an important contributor to negative environmental impacts.

Fire protection engineers and first responders must adapt to fire safety risks that are shifting due to development of new materials, fire protection systems, construction codes and regulations, etc. Improved understanding about whether the environmental damage incurred by an enclosure fire will be reduced, remain unchanged, or be increased by fire protection decisions will help authorities, fire protection engineers and builders make better decisions regarding the environmental impacts of fire safety.

Project description
The primary goal of this project is to further develop a tool that was originally created to estimate the environmental impact of warehouse fires as part of a feasibility study for the National Fire Protection Association (NFPA) and apply it to other types of enclosure fires. The proposed expansion of the tool will take it from the prototype stage to a level that provides useful information to stakeholders about risks to the environment resulting from enclosure fires.

Given a selection of enclosure types, case studies, and scenarios, the proposed master’s thesis will focus on collection and analysis of information about the fuel load, materials and enclosure configurations, as well as firefighting tactics and suppression media used in response to enclosure fires. This information will be used as input for life cycle assessment (LCA) calculations to estimate the environmental impacts of the fire safety design and firefighting response. The steps in the thesis are as follows:

Step 1- Data collection
Certain types of enclosures will be identified by other members of the project and the reference group as high priority with respect to the challenges posed to fire protection engineers and the fire service. Using this guidance, data shall be collected to use as input for the LCA models. The data will be comprised of the quantity and type of materials and processes used in the construction of the selected enclosures and their contents, fire suppression agents, and data related to firefighter response to enclosure fires.

Step 2- Data analysis
The inventory data collected in Step 1 will be analyzed in terms of its contribution to the fire emissions and heat release rate, replacement of enclosure and content materials, and end of life scenarios. Also, sensitivity and uncertainty analyses will be conducted on the improved tool and the data.
**Qualification**

This project is part of a larger project that includes fire safety engineering, fire suppression, and interactions with members of the reference group and first responder community. The student must be a good communicator and be able to work as part of a team. The LCA work will be done under the guidance of an experienced researcher but will require extensive data collection and careful documentation. It is recommended that the student at least be familiar with the concept of LCA and preferably be enrolled in the Environmental Systems Analysis Division at Chalmers University or an equivalent program at a different university.

**Contact**

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