

2009 BFRL Project Description

Project Title: Performance Metrics for Portable Fire Extinguishers in Fast Growing Nightclub Fires

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BFRL Program: Reduced Risk of Fire Spread in Buildings

Objective: Develop measurement science tools to demonstrate if the current method of rating and locating portable fire extinguishers in areas of assembly is sufficient to enable typically trained nightclub staff to control a plausible worst-case fire.

Problem:

What is the problem? As discussed in NIST NCSTAR 2, “Report of the Technical Investigation of The Station Nightclub Fire,” the potential exists in nightclubs for a fire to start and grow quickly and for the pathway between the location of the fire and a fire extinguisher to be hindered by the assembled occupants. In this scenario, there are two factors that may compromise the effectiveness of a portable fire extinguisher. First, portable extinguishers are rated based on their ability to suppress fires that may not represent the hazard typically found in a nightclub. Wood crib, wood panel, and wood fiber (excelsior) based fires are used to rate Class A extinguishers. A plausible worst-case scenario that produces reproducible fire development and is representative of nightclubs is needed. Second, the locations of class A and B portable extinguishers are based on distance when in fact time may be a more relevant parameter in a rapidly growing fire. The time to cover the distance to reach a portable extinguisher will likely be different in a crowd than in an open space.

Why is it hard to solve? Developing a fire scenario that is widely representative of fire hazards that are typical of nightclub settings presents a challenge. A constraint on the scenario includes the fact that it should produce a plausible worst case, rapidly growing fire that provides reproducible fire development. Materials used should be code compliant, have well characterized properties, and be readily available. Additionally, required overhaul between tests should be minimized. A secondary challenge stems from the fact that fire extinguisher performance is based in part on the expertise of the user.

How is it solved today, and by whom? It has not been demonstrated if the current method of rating and locating Class A and B portable fire extinguishers is sufficient to enable typically trained nightclub staff to control a fire in a plausible worst case, yet code compliant, situation. Ratings for portable fire extinguishers are based on UL 711, “Standard for Fire Extinguishers, Rating and Fire Testing.” Class A and B fire extinguishers are tested against fires

that are relatively large but not growing. These fires do not represent worst case conditions that may be encountered in a nightclub setting. NFPA 10, “Standard for Portable Fire Extinguishers”, specifies placement in occupancies containing Class A and B hazards based on distance. In a situation with a rapidly growing fire, early intervention is critical. The time required to cover the distance dictated by NFPA 10 will be increased significantly in a crowded occupancy such as a nightclub.

Why NIST? This project is consistent with BFRL’s mission and vision by promoting performance-based standards. A primary project outcome will be a measurement science tool to evaluate extinguisher effectiveness against a realistic fire scenario. In this way, the project is aligned with BFRL’s strategic priorities. Potential impact for this project includes adoption of portable extinguisher performance metrics by standards developing organizations. This project leverages BFRL’s core competency on *fire protection and fire spread within buildings and communities*. NIST is uniquely qualified to lead this effort, having both the technical expertise, infrastructure, and experimental facilities to address key topics in fire protection measurement science.

Approach:

What is the new technical idea? Using only materials that are code-compliant and common in nightclubs (distilled spirits and upholstered furniture) and accidental behaviors that are known to occur (dropped bottles and tipped over candles), a scenario will be developed that will ignite a piece of upholstered furniture and lead to a rapidly growing fire that produces a substantial amount of heat and products of combustion if the fire is not extinguished promptly. Tests will be conducted in Bldg. 205 against this fire scenario with different models and ratings of extinguishers to determine if the extinguishers are effective after increasingly longer delay times between ignition and activation. Based upon these results, the maximum delay time for a successful suppression will be translated to a maximum distance of the portable extinguisher spacing (assuming a fully-occupied building). Tests will also be conducted to compare the performance of class A-, B- and ABC-rated portables on the same fire. Testing will focus on baseline performance; extinguisher operation will be conducted by a single individual. The results of these tests will be provided to UL and NFPA to guide future deliberations on possible changes to fire extinguisher ratings and locations in nightclubs.

Why can we succeed now? Current standards related to the rating and placement of portable fire extinguishers lack the measurement science tools needed to evaluate their performance and placement based on realistic fire scenarios. This project is a focused effort to develop these tools and make them available to standards organizations. The project is based on recommendations from a workshop that included participants from government, industry and standards organizations.

What is the research plan? The ultimate outcome of this project will be the development of performance metrics for portable fire extinguishers. These metrics will be presented to UL and NFPA to guide future deliberations on possible changes to fire extinguisher ratings and locations in nightclubs. The research objective is to demonstrate whether the current method of rating and locating portable fire extinguishers in areas of assembly is sufficient to enable nightclub staff or patrons to control a plausible worst-case fire. To accomplish this, a fire

scenario will be developed that is broadly representative of hazards found in nightclub settings. The scenario will be designed to produce rapid, reproducible fire growth using only materials that are code-compliant and common in nightclubs (distilled spirits and upholstered furniture). A wide range of class A-, B-, and ABC-rated portable fire extinguishers will be tested against this scenario using increasingly long delay times between ignition and activation. The results of these tests will be used to assess the effectiveness of current methods for rating and locating portable fire extinguishers. In future years, additional test scenarios will be developed to evaluate portable extinguishers against a range of conditions. Additionally, emphasis will be placed on presenting the developed metrics to NFPA and UL for consideration in standards development.

Recent Results:

Output: NIST IR 7419, “The Use of Portable Fire Extinguishers in Nightclubs: Workshop Summary,” April 2007.

Standards and Codes: This project will provide technical information for NFPA 10, “Standard for Portable Fire Extinguishers,” and UL 711, “Standard for Fire Extinguishers, Rating and Fire Testing.” The PI will join and participate in the NFPA committee on portable fire extinguishers.