



RESEARCH FOUNDATION

RESEARCH FOR THE NFPA MISSION

PROJECT SUMMARY

Sprinkler Protection of Li-ion Battery Based Energy Storage Systems

29 January 2018

Background: The 2016 Fire Protection Research Foundation (FPRF) project [*Fire Hazard Assessment of Lithium Ion Battery Energy Storage Systems*](#) identified gaps and research needs to further understand the fire hazards of lithium ion battery energy storage systems. There is currently limited data available on the fire hazard of these systems including two full-scale open-air tests from the 2016 FPRF project and a separate project that included intermediate scale fire testing conducted at the module level to evaluate the performance of fire suppressants. The fire protection and fire service communities need guidance on protection requirements for these systems in a building. The Property Insurance Research Group (PIRG) and FM Global have initiated this project to determine sprinkler protection guidance for lithium ion (Li-ion) battery based energy storage systems (ESS) located in commercial occupancies. Through small-scale and large-scale experimental testing this project will inform sprinkler protection guidance and provide recommendations for standards development.

Research Goal: The overall goal of this project is to determine sprinkler protection guidance for grid-connected ESS for commercial occupancies, i.e., 100 to 1,000 kWh capacities. The fire hazard for a range of commercial ESS designs will inform protection requirements.

Project Tasks:

- Establish defining features for Li-ion battery ESS (e.g. energy capacity, battery chemistry, and rack configuration) that will be useful for determining hazard classification and protection requirements.
- Conduct small-scale tests at the ESS module level to determine an appropriate ignition scenario to induce thermal runaway of the lithium ion batteries.
- Conduct free-burn fires to provide a hazard assessment that is representative of the wide range of commercial ESS designs.
- Establish an appropriate sprinkler system design that applies to the ESS locations within a commercial facility and conduct sprinklered fire tests on representative ESS units. The lowest sprinkler density expected to provide adequate protection will be targeted to minimize restrictions on the potential installations of ESS within buildings.
- Provide sprinkler protection guidance and recommendations based on the experimental results.
- Prepare a final report based on previous tasks.

Implementation & Schedule: Testing is tentatively planned for the second quarter of 2018. This research program will be conducted under the auspices of the Fire Protection Research Foundation (FPRF) in accordance with Foundation Policies and will be guided by a Project Technical Panel who will provide input to the project, review periodic reports of progress and research results, and review the final project report.

Reporting and Deliverables: A final written report will be developed for this project which will be published on the Foundation website. Project deliverables will be useful in the development of [NFPA 855, Standard on the Installation of Stationary Energy Storage Systems](#).

About the Fire Protection Research Foundation

The [Fire Protection Research Foundation](#) plans, manages, and communicates research on a broad range of fire safety issues in collaboration with scientists and laboratories around the world. The Foundation is an affiliate of NFPA.



About the National Fire Protection Association (NFPA)

Founded in 1896, NFPA is a global, nonprofit organization devoted to eliminating death, injury, property and economic loss due to fire, electrical and related hazards. The association delivers information and knowledge through more than 300 consensus codes and standards, research, training, education, outreach and advocacy; and by partnering with others who share an interest in furthering the NFPA mission. [All NFPA codes and standards can be viewed online for free.](#) NFPA's [membership](#) totals more than 65,000 individuals around the world.

