



RESEARCH FOUNDATION

RESEARCH FOR THE NFPA MISSION

PROJECT SUMMARY

Impact of Elevated Walkways in Storage on Sprinkler Protection – Phase II

22 September 2020

Background: The Fire Protection Research Foundation (FPRF) “*Impact of Elevated Walkways in Storage on Sprinkler Protection*” Phase II project seeks to address knowledge gaps related to the impact of walkways and mezzanines on sprinkler performance.

The goal of this project is to further the efforts begun in Phase I in which a detailed literature review was performed to document the current sprinkler criteria and the technical substantiation for the currently provided guidance. Based on the gap analysis a research plan was developed to fill the identified gaps in knowledge.

This research was necessary as sprinkler performance may be affected due to the presence of a mezzanine, walkway grating interfering with the spray, delayed activation of the sprinklers as a result of the grate’s influence on the plume, or the impact of pre-wetting of adjacent racks. Ultimately the objective of this effort is to provide guidance to the NFPA 13 technical committee on walkways/sprinkler interface criteria that is well founded in sprinkler performance.

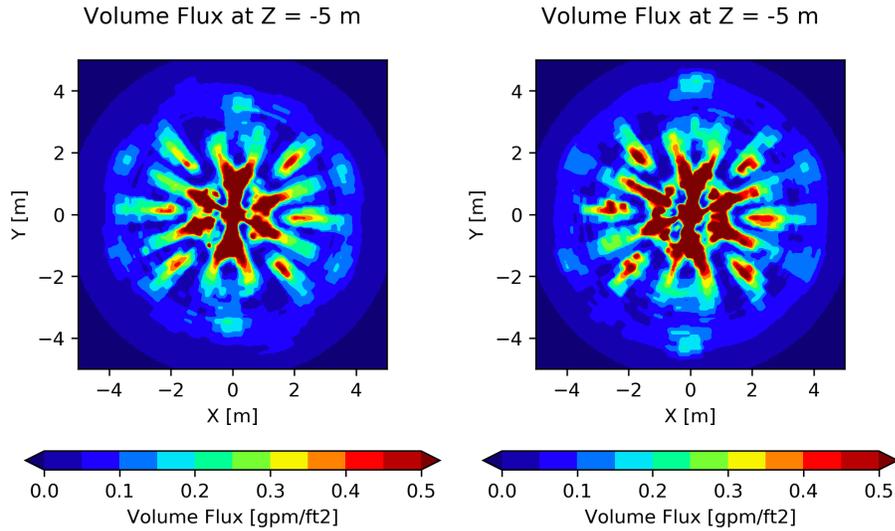
Research Goal: The goal of this research program is to provide technical substantiation and guidance for sprinkler protection in the presence of elevated walkways in storage occupancies. This phase aims to fill the knowledge gaps identified in Phase I and implement the research and testing plan to provide guidance back to the NFPA 13 technical committee.

Project Tasks: The research goal shall be achieved through the following tasks, which will be conducted under the auspices of the Research Foundation in accordance with Foundation Policies and will be guided by a Project Technical Panel of industry stakeholders:

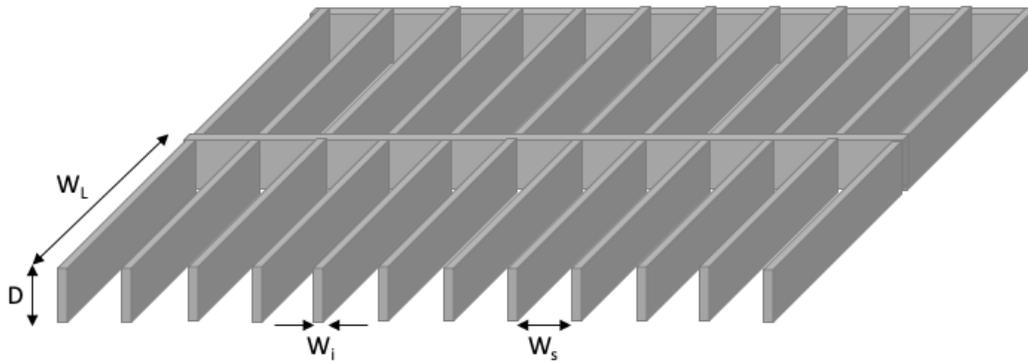
- **Task 1: Survey of existing conditions.** Develop a survey and collect information on current warehouse configurations to gain insight into the status quo and to attempt to ascertain how storage protection may be changing. This will largely be distributed to the fire protection and insurance communities and will focus on the following information: storage configurations; stored commodities, details of mezzanine/walkways, sprinkler system details, loss history (if any), and photographs.
- **Task 2: Sprinkler characterization and modeling of spray/walkways/rack interactions.** This will include baseline scenarios for comparison of the spray pattern development and water delivery and will help determine the range of scenarios to be examined experimentally.

It is proposed to choose three different K-factor sprinklers and to characterize them at three pressures, one pressure towards the lower limit of the operating range, the other at the midpoint of the operating range, and the third at the higher end of expected pressures. As

systems are typically designed based on the minimum operating pressure at the most remote location, the proposed pressures (7, 20, and 50 psi) are intended to cover the widest range of expected normal operating pressures. Thus, the impact of the pressure effects on distribution and obstruction impacts will be addressed, Figure 2. The results of the spray characterization will show the impact of K-factor and pressure on spray characterization and water distribution and plots showing baseline performance will be provided. The data collected from the 4S effort will be used as input into the CFD modeling effort.



- Task 3: CFD modeling** of anticipated fire test scenarios to examine activation and spray distribution. Up to 50 simulations are proposed to be conducted using computational fluid dynamics (CFD) and the reduced order model Sprayviz with varying walkway/storage configurations. Using the schematic shown below, the variables will be altered to change the opening percentage, the spacing between openings, the depth of the grate, the number of levels, and the gaps around the commodity. Bounding conditions will be used to establish a baseline with a single solid mezzanine and will gradually change the other parameters according to Table 1 to attempt to identify trends in activation and blockage. Model configurations will also address a solid mezzanine open rack configuration.



- Task 4: Cold flow experiments** to examine the sprinkler spray characteristics and determination of delivered density to fuel surfaces and storage array faces in a mock storage rack/walkway

environment. Up to 20 tests will be performed, based on the 4S characterization and discussions with the project technical panel.

- Task 5: Development of large-scale fire test plan to fill the identified knowledge gaps in order to complete the development of technical guidance.

Implementation: This research program will be conducted under the auspices of the Research Foundation in accordance with Foundation Policies and will be guided by a Project Technical Panel who will provide input to the project, recommend contractor selection, review periodic reports of progress and research results, and review the final project report.

Schedule:

A final report is expected to be published in March of 2022.

About us:

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.

