

**Property Insurance Research Group Forum on
PV Panel Fire Risk: A Literature Review**

Fire Protection Research Foundation
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THE
FIRE PROTECTION
RESEARCH FOUNDATION

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Acknowledgements

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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)

NFPA is a worldwide leader in fire, electrical, building, and life safety. The mission of the international nonprofit organization founded in 1896 is to reduce the worldwide burden of fire and other hazards on the quality of life by providing and advocating consensus codes and standards, research, training, and education. NFPA develops more than 300 codes and standards to minimize the possibility and effects of fire and other hazards. All NFPA codes and standards can be viewed at no cost at www.nfpa.org/freeaccess.

Keywords: conduits, flame spread, photovoltaic system, plenums, shock hazard,



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Property Insurance Research Group Forum on PV Panel Fire Risk

Sunday June 8, 2014, 3:00 – 5:00 p.m.

Room “Surf E”, Mandalay Bay SOUTH Convention Center
Las Vegas, NV

Meeting Summary

On Sunday, June 8th, property insurers, property owners, fire service representatives and electrical specialists met to discuss concerns and potential strategies related to fire risks associated with roof mounted PV panel installations. The meeting agenda and participants are appended to this summary. In a roundtable discussion, participants shared fire experience and mitigation strategies for installation. The following is a summary of the concerns and issues discussed:

Hazard Concerns

The past ten years has seen a many fold increase in the installation of PV panels on roofs, both in new construction and on existing roofs. For example, it is estimated that there are approximately 8 gigawatts of energy source in existing PV installations in the state of California alone. Many of these installations occurred prior to recent installation codes and standards requirements for best practices (see below).

There are a number of hazards introduced to building roof systems as a result of photovoltaic panel installations. The resulting risk is exacerbated by the size (number of panels) of the installation and the percentage of the roof coverage. These include:

- Creation of combustible concealed spaces (PV racks over combustible roof materials) where fires can develop and spread shielded from and compromising the effectiveness of defensive manual fire extinguishing efforts.
- Increase in potential points of fire ignition on the outside of a building – i.e. electrical faults which may be caused by physical damage, thermal stresses, and corrosion
- Hazards created through panel and roof maintenance activity (dropping tools, stepping on cable conduits or raceways, etc.)
- Delayed detection of fire (exterior ignitions beyond the coverage of indoor fire detection systems) leading to delayed fire service notification and response
- Reduction of fire fighter roof access as a function of coverage of the roof by the panel array
- Elimination of fire fighter roof firefighting due to uncertainty and/or concerns about energization state

Standards

- Panels - Standards exist for PV panels and inverters from both Underwriters Laboratories (UL 1703 and 1741) and FM Approvals. These standards have evolved over the past ten years but there are many installations with panels which do not meet the current version of these standards.
- Panel installation - No current standards exist for PV Panel system installation – an FM Data sheet is schedule for publication in late 2014.

- Flame spread rating - The most recent edition of UL 1703 specifies a test method and criteria to address flame spread rating for PV panel assemblies; there was some concern expressed regarding the severity of the ignition scenario specified in this test method.
- Array and Pathway Access Size - The most recent edition of NFPA 1, section 11.2 and the International Fire Code specify the maximum size of permitted panel array and minimum pathway access areas for the fire service. These standards also specify Panel markings to clarify panel shut down mechanisms.
- Manual shutdown and other electrical safety requirements - The most recent edition of the National Electrical Code Article 690 specifies requirements for ten second manual shut down of panel arrays as well as related marking requirements. Potential further provisions are under discussion for the next edition.
- Maintenance and Inspection – There are no current North American requirements for electrical maintenance or inspection; such requirements exist in the UK. NFPA 70B is a potential location for guidance on this topic.
- Electrical contractor and inspector qualifications – There are currently no specific standards for qualifications related to PV installations.

Awareness and Training

Because of the rapid proliferation of panel installation and the recent and still evolving standards framework, there is uneven knowledge of safe panel installation practices in both the electrical and fire safety enforcement communities at the local level. Further, because of the very recent introduction of code requirements related to rapid shutdown and marking, there is uncertainty in the emergency response community regarding the ability to de-energize a panel array.

Other Issues

- Other Hazards: Certain installation practices designed to mitigate wind uplift hazards may exacerbate fire risk
- Damage Assessment: There is little available information on damage assessment and repair, for example in a post disaster scenario.

Strategies

The following strategies were discussed by the Forum to address these concerns:

- Fire research to explore the impact on flame spread and fire resistance of PV panel installation on roofs with combustible coverings and/or insulation
- Technologies for early detection of panel or panel system faults and fire initiation
- Standards development for system installation to include addressing combustible roof coverings and insulation
- Maintenance and inspection standards development
- Standards requirements for rapid shutdown on a single panel basis
- Further restrictions for panel roof area coverage and pathway areas in standards
- Standards for electrical contractor qualifications
- Consideration of a compilation of installation standards currently in various documents into a single standard to enhance enforcement
- Awareness and training for the electrical and fire safety enforcement communities
- Best practices and training for electrical contractors related to damage assessment and repair
- Training for emergency responders on de-energization of panels.



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Agenda

1. Background and Introductions
2. Review of NFPA and Research Foundation Activities
3. Forum: Perspectives on Current Fire and Electrical Safety Issues/Concerns
 - Insurance Perspectives
 - Property Owner Perspectives
 - Fire Service Perspectives
 - Other Fire and Electrical Safety Concerns
4. Potential Strategies/Solutions
5. Summary/Next Steps

Participants

Ron Hein, Kent O'Donnell, CNA Insurance
Dave Dillon, Tom George, Tokio Marine Insurance
Rich Gallagher, Greg Lanshe, Stuart Lloyd, Zurich Insurance
Chris Wieczorek, Ben Ditch, Gary Keith, Sergey Dorofeev, FM Global
Ralph Tiede, Tom Suehr, Liberty Mutual Insurance
Pete Willse, XL Gaps
Dale Bonn, Travelers Insurance
Nick Tilley, AIG
Chuck Boyte, Sampo
Gilbert Bustos, HSB Professional Loss Control
Tom Pederson, IKEA
Christina Francis, P&G
Mike Snyder, Dow Corning
Karen Rebman and Robert King, Target
Bob Backstrom, Underwriters Laboratories
Steve Quarles, Insurance Institute for Business and Home Safety
Matthew Paiss, San Jose Fire Department
Don Bliss, James Dolan, NFPA Regional Operations
Mark Earley, NFPA Chief Electrical Engineer

Casey Grant, Amanda Kimball, Foundation staff