

# Photovoltaic System Fire Risk, an Insurer's Perspective

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# Objectives

- Highlight the NFPA standards addressing PV systems
- Review the current Foundation research project on PVs and fire
- Share possible action on PVs with the NFPA Emerging Issues Team

## **Foundation**

NFPA Research Foundation

## **PV systems**

Photovoltaic systems

# NFPA codes and standards

- NFPA codes and standards addressing PV systems

Number	Title	Latest revision	Specific section(s)
NFPA 1	Fire Code	2015	Section 11.21 Photovoltaic Systems
NFPA 70	National Electrical Code	2014	Article 690 Solar Photovoltaic (PV) Systems
NFPA 780	Standard for the Installation of Lightning Protection Systems	2014	Chapter 12 Protection for Solar Arrays

## Note

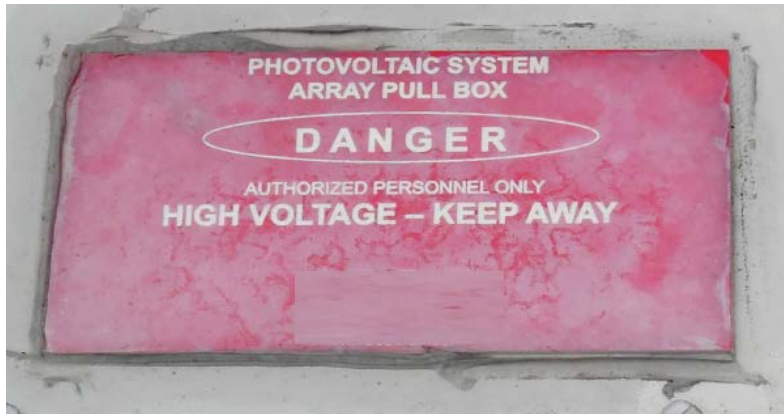
Discussion will be limited to selected topic from NFPA 1 and NFPA 70

# NFPA 1 – Fire Code



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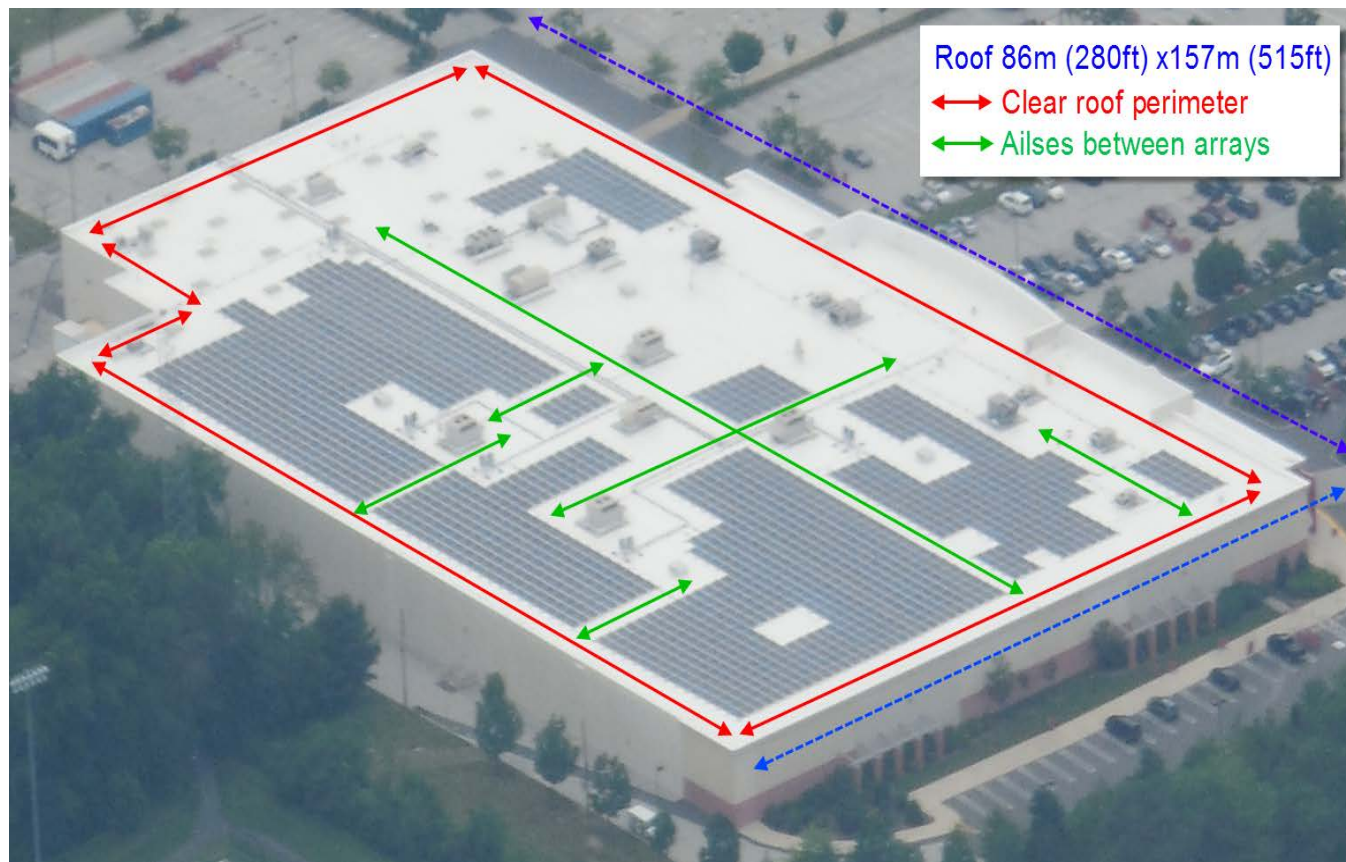
- NFPA 1 intent
  - Provide PV system guidance for firefighter safety
- Requirements for roof mounted PV systems
  - PV system markings to alert firefighters to hazards
  - Access pathways for firefighting operations



Examples of PV system marking

# NFPA 1 – Fire Code – Access pathways

- Low-slope (flat) roof
  - Pathway guidance includes
    - Clear perimeters
    - Between arrays
  - Objective:  
Provide access to
    - Roof hatches
    - Smoke vents
    - Venting areas
    - Roof hose connections



## Note

Additional guidance is included for pitched roofs

# NFPA 70 – National Electrical Code



# NFPA 70 – National Electrical Code

- NFPA 70 covers a range of electrical requirements including
  - Wiring and connectors
  - Circuit guarding
    - Protection from physical damage
  - Grounding
    - Equipment grounding (protective earthing)
    - System grounding
  - Marking
  - Disconnecting means
  - Overcurrent protection
  - Detecting, interrupting, and indicating
    - Ground-faults
    - Arc-faults
  - Rapid shutdown of PV systems on buildings





# NFPA 70 and grounding



# Equipment grounding (protective earthing )

- Grounding of metal components not normally carrying current

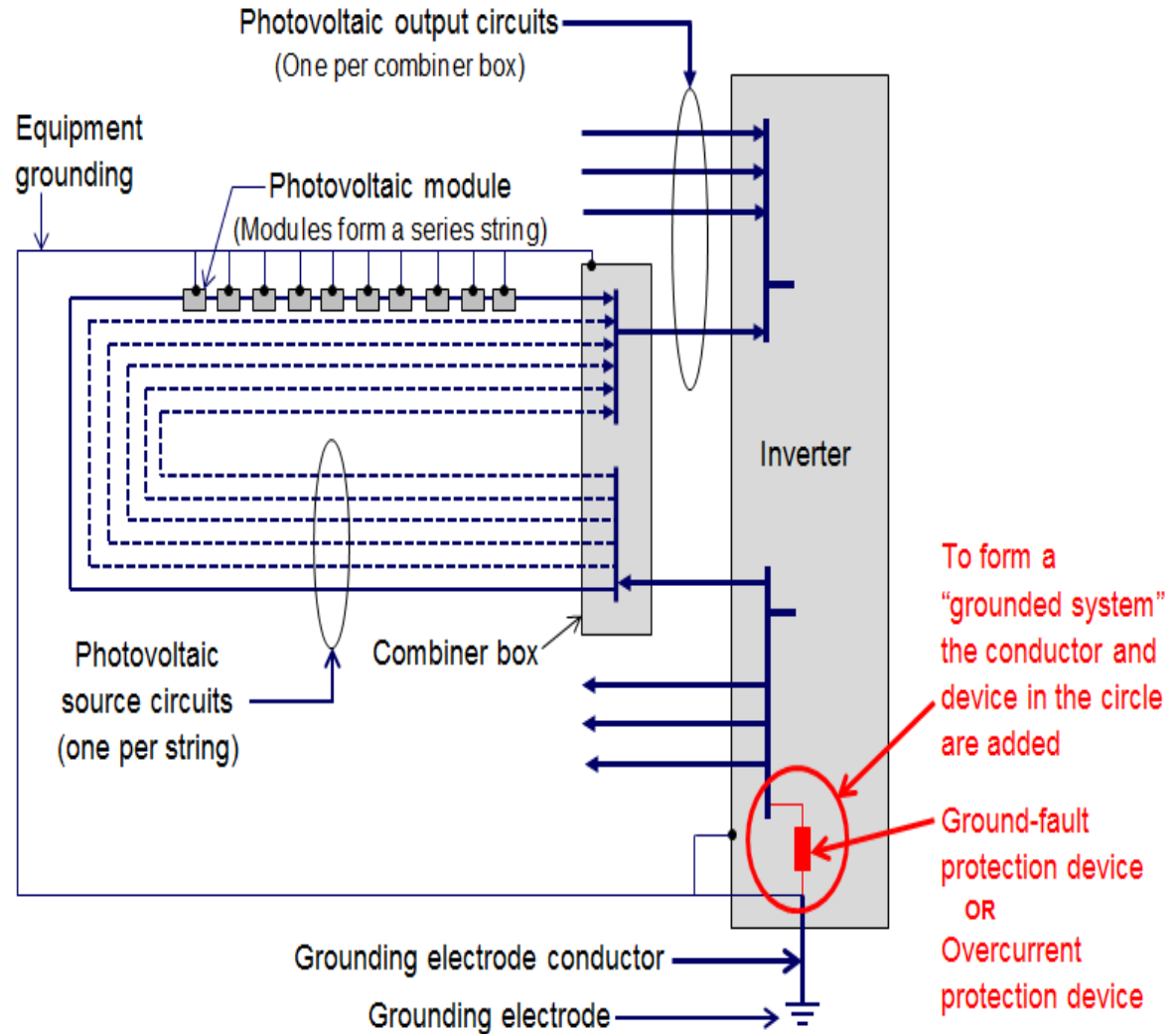


## Note

Global standards typically include equipment grounding (protective earthing)

# System grounding

- System grounding
  - Involves one circuit conductor being connected to ground



**Note 1**  
NFPA 70 allows both grounded and ungrounded systems

**Note 2**  
Ungrounded systems are typically used outside the Americas

# NFPA 70 and rapid shutdown



# Rapid shutdown – new as of the 2014 code

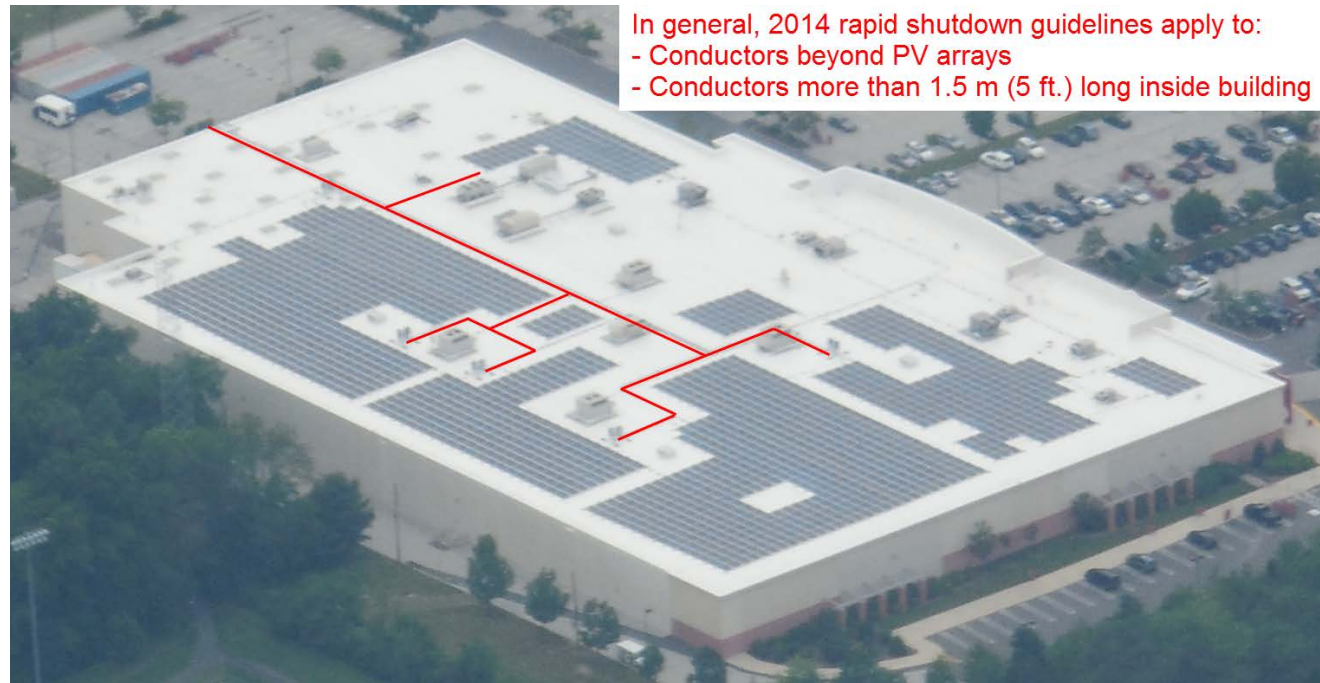
- Rapid shutdown applies to PV system conductors
  - More than 3 m (10 ft.) away from an array located on a building
  - More than 1.5 m (5 ft.) long located inside of a building
- Within 10 seconds of rapid shutdown initiation (a manual action)
  - Voltage is not to exceed 30 V on the controlled conductors

## Note 1

The 30V limit allows 24V control circuits to combiner boxes

## Note 2

PV arrays may remain fully energized



# Rapid shutdown – proposed 2017 code

- Further guidelines if adopted
  - A new term “array boundary” would be defined
    - It is a boundary located 305 mm (1 ft.) from an array in all directions
    - New guidelines would apply within this array boundary
  - Proposed guideline would include three options
    1. Use a “listed rapid shutdown PV array”
    2. Limit conductors to 80 V within 30 seconds of rapid shutdown
    3. Use PV arrays with “no exposed wiring methods”
  - Proposed effective date 01 January 2019

## Note

Published NFPA committee documents indicate:

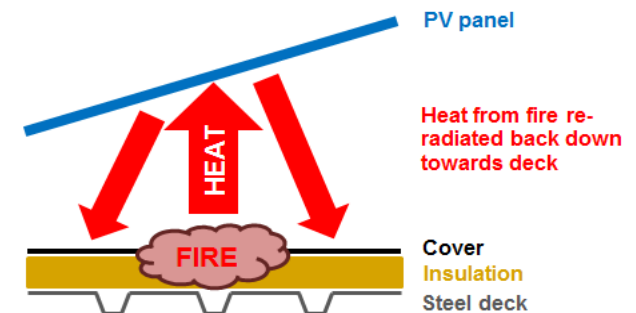
- The fire service supports the rapid shutdown guidelines
  - They recognizes that 80 V is not touch safe
  - But, they considers the reduce voltage as better than full voltage

# NFPA Research Foundation project on PVs and fire



# NFPA Research Foundation project on PVs and fire

- Project title
  - Development of Fire Mitigation Solutions for Photovoltaic (PV) Systems Installed on Building Roofs
- Research Goal
  - Identify features to mitigate fire spread between and within PV arrays
- Phase I objectives
  - Define a test plan to explore this topic on low-slope (flat) roofs
- Phase I tasks
  - Summarize information from any previous fire testing of PV systems
  - Establish parameters for the large-scale test configuration
  - Establish the roof assemblies to be tested
  - Develop a test plan
- Project time line
  - Final report due June 2016





# NFPA Emerging Issues Team and PV systems



# NFPA Emerging Issues Team and PV systems

- A concern has been raised to the NFPA Emerging Issues Team
  - Problem statement
    - Guidance to mitigate PV system fire hazards
      - Is not considered complete, and
      - Is not available from a single source
  - Proposed solution
    - Develop a single NFPA document addressing photovoltaic systems
    - Consider a scope including the full service life of a PV system including
      - Design phase
      - Installation phase
      - Operation phase
      - Fault, emergency response, and recovery phase

## Note

Proposal submitted in March 2016



# References

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# Thank you

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