



**NATIONAL FIRE PROTECTION ASSOCIATION**

The leading information and knowledge resource on fire, electrical and related hazards

# NFPA Energy Storage Safety Training

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# Incidents

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Kahuku, Hawaii: August 2011



- 12,000 lead acid batteries
- Fire burned for several days
- Initial extinguishment was attempted with dry chemical with limited success
- Building not designed for hazard level

# Incidents

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Franklin, Wisconsin: August, 2016



- Fire in a battery energy storage system under construction in shipping container
- Facility staff advised against using water due to Lithium
- 20+ departments responded, fire confined to container

# NFPA Energy Storage Systems Research

**2014** - DOE Published a Strategic Plan for Energy Storage Safety.

- Identified gaps in CSR and first responder training.

**2016** – NFPA released Fire Service ESS Online & Classroom Training.

**2018** – NFPA 855, Installation of Stationary Energy Storage Systems Approved.



# Battery ESS Safety Focus: Li-ion Chemistries

Li-ion Projects (2015): 115, Lead Acid: 37, Sodium based: 20 Nickel based: 4

## Li-ion ESS concerns for fire service:

- Corrosive to Eye Tissue
- Can cause Skin Burns
- May be Carcinogenic (if Cobalt compounds present)
- Can cause Tissue Damage

## Thermal Runaway Issues:

- Venting of Toxic and Flammable Gases (CO<sub>2</sub>, CO, H<sub>2</sub>, CH<sub>4</sub>)
- Difficult to Extinguish Fire
- Projection of Battery Materials



# Fire Service Safety Training

- Instructor-led Classroom Course
- Online Training
- Interactive 3D Models
- Educational Videos
- Quick Reference Materials

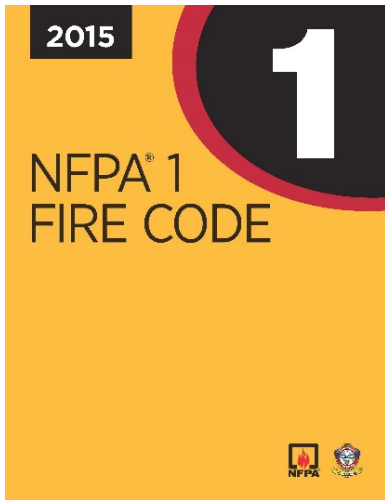
The screenshot displays the user interface for the 'ENERGY STORAGE SYSTEMS SAFETY TRAINING' program. At the top, there are navigation tabs for 'PROGRESS', 'RESOURCES', and 'LOGOUT'. The main header indicates 'CHAPTER 1 Intro to Energy Storage Systems (ESS)'. A left sidebar contains a 'MAIN MENU' with a circular navigation icon and a 'Background Sounds' toggle. Below this is an 'INTRODUCTION VIDEO' section with a list of topics: '01 Intro to Energy Storage Systems', '02 ESS Applications', '03 ESS Types', and '04 Data Review'. Further down, there are links for 'Basic Electrical Theory', 'Battery Energy Storage Systems', 'Battery Chemistry Types', 'Failure Modes and Hazards', 'System Installation and Pre-Incident planning', and 'Mitigation and Emergency Response'. At the bottom of the sidebar is a 'SCENARIO ROOM' button. The main content area features a video player showing a woman in a dark turtleneck speaking, with a 3D model of an ESS facility overlaid on the left. The bottom of the interface includes the text 'ENERGY STORAGE SYSTEM SAFETY TRAINING SAFETY TRAINING', 'A PRODUCT OF THE NATIONAL FIRE PROTECTION ASSOCIATION', and 'FIRE/RESCUE EDITION © 2018 National Fire Protection Association All Rights Reserved'.

# Topics Covered

- ESS applications, types, and terminology
- Basic electrical theory
- Introduction to battery energy storage systems Failure modes and hazards
- Pre-incident planning
- Emergency response procedures



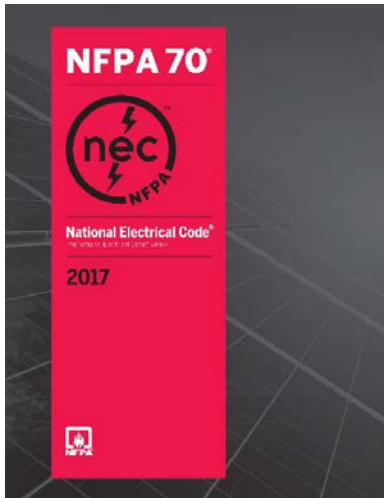
# NFPA 1 – Fire Code



- **Chapter 52, Stationary Storage Battery Systems**
  - Venting
  - Thermal Runaway
  - Location & Separation
  - Spill Control
  - Neutralization
  - Signs
  - Seismic Protection
  - Smoke Detection

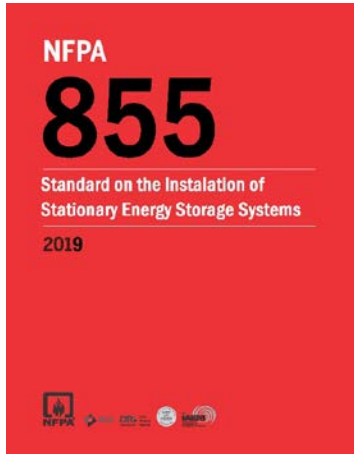


# NFPA 70 – National Electrical Code



- **Article 706, Energy Storage Systems**
  - Classifies ESS into 3 Categories
    - ESS, self-contained
    - ESS, pre-engineered of matched components
    - ESS, other
  - Circuit Requirements
  - Electrochemical Energy Storage Systems
  - Flow Battery Energy Storage Systems

# NFPA 855 – Standard on the Installation of Stationary Energy Storage Systems



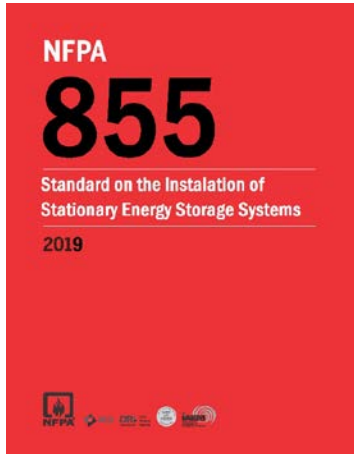
## Standard will address

- Design
- Construction
- Installation
- Fire Protection
- Fire Prevention
- Commissioning
- Operation
- Maintenance
- Decommissioning

### **1.1 Scope.**

This standard establishes criteria for minimizing the hazards associated with Energy Storage Systems.

# NFPA 855 – Standard on the Installation of Stationary Energy Storage Systems



**Energy Storage System** - A device or more than one device, assembled together capable of storing energy for use as electrical energy at a future time.

## **Chemical**

- Hydrogen

## **Electro-chemical**

- Batteries
- Flow Batteries

## **Electrical**

- Capacitors

## **Mechanical**

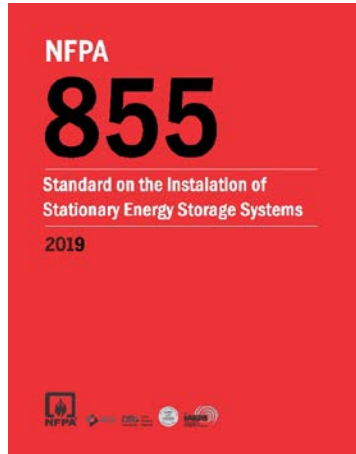
- Flywheel
- Pumped Hydro
- Compressed Air

## **Thermal**

- Thermal Energy Storage

# NFPA 855 – Standard on the Installation of Stationary Energy Storage Systems

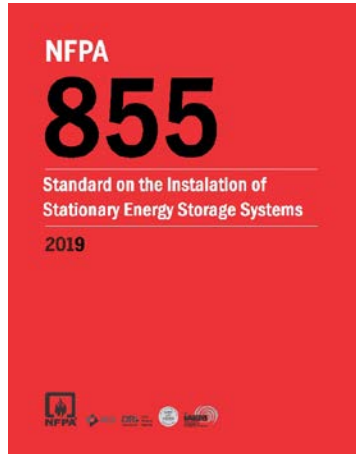
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## Activities to Date

Project Proposal:	Early 2016
Project Approved:	April 2016
Roster Approved:	August 2016
Introductory Meeting:	December, 2016
Drafting Meeting:	January, 2017

# NFPA 855 – Standard on the Installation of Stationary Energy Storage Systems



## Timeline

Drafting Meeting:	April 2017
Standards Council Approves Draft:	August 2017
Open for Public Input	2017
First Draft Meeting	2017
Open for Public Comment,	2018
Second Draft Meeting	2018



# Thank You



**ENERGY STORAGE  
SYSTEMS**

**SAFETY TRAINING PROGRAM**

