



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

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

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

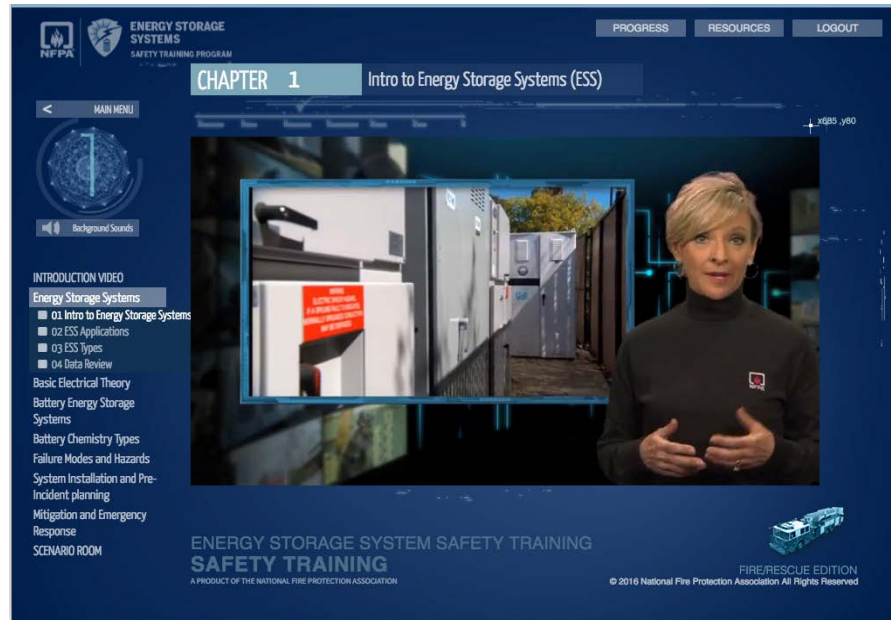
Thermal Runaway Issues:

- Venting of Toxic and Flammable Gases (CO₂, CO, H₂, CH₄)
- 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

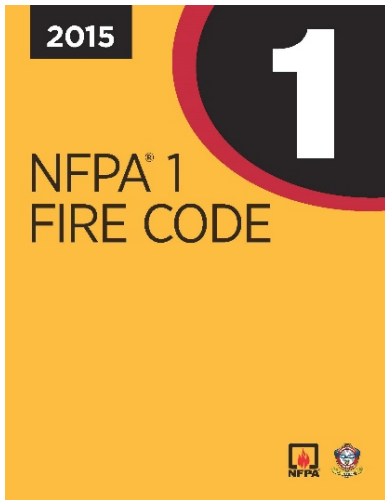


Topics Covered

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

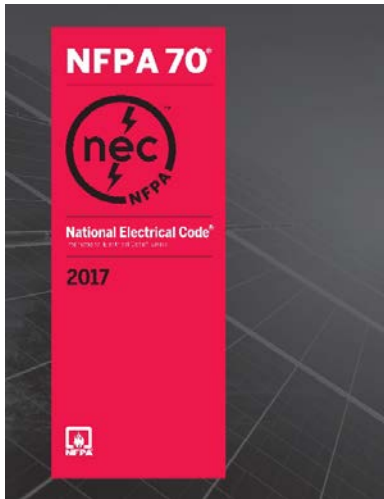


NFPA 1 – Fire Code



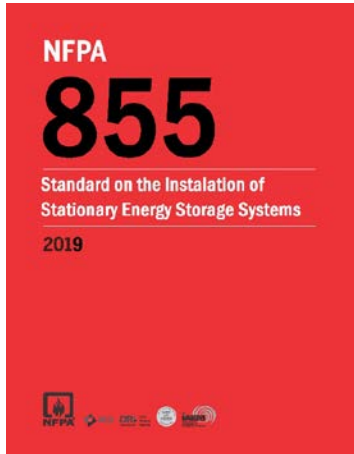
- **Chapter 52, Stationary Storage Battery Systems**
 - Venting
 - Thermal Runaway
 - Location & Separation
 - Spill Control
 - Neutralization
 - Signs
 - Seismic Protection
 - Smoke Detection

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



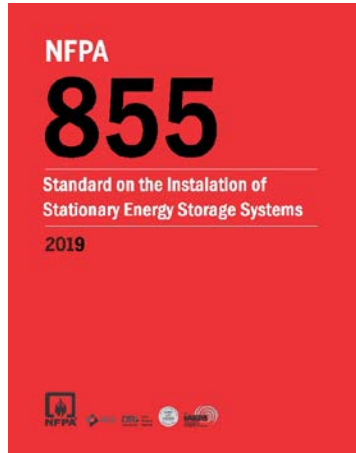
Standard will address

- 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

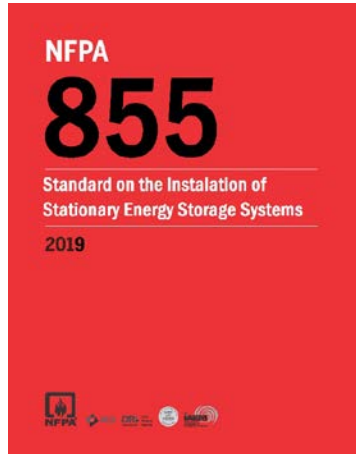
Mechanical

- Flywheel
- Pumped Hydro
- Compressed Air

Thermal

- Thermal Energy Storage

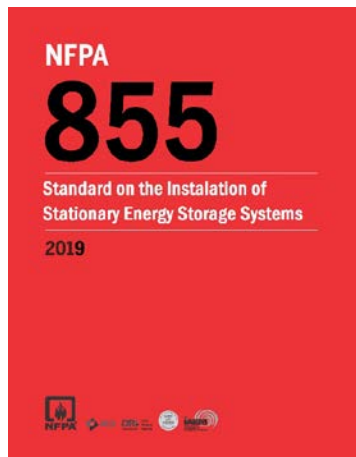
NFPA 855 – Standard on the Installation of Stationary Energy Storage Systems



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