

The Evolving Landscape of Energy Storage System Safety: A Look at IFC and NFPA 855 in Comparison

This white paper explores the evolving fire and life-safety requirements for Energy Storage Systems (ESS), comparing the 2024 International Fire Code (IFC) and NFPA 855 (2023). It highlights key differences and areas of alignment.

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One is a sweeping fire code adopted across states and cities. The other is a specialized standard written by industry stakeholders for designers and engineers. Together, IFC 2024 and NFPA 855 (2023) shape how the United States of America handles the growing risks of energy storage. While they share the same goals, the details reveal both alignment and divergence in safety within a rapidly evolving industry.

According to the U.S. Energy Storage Monitor report released on March 19, 2025 by the American Clean Power Association (ACP) and Wood Mackenzie, the U.S. energy storage market set a new record in 2024 with 12.3 gigawatts (GW) of installations across all segments (grid-scale, residential, commercial, and industrial). That is a total of 12,314 megawatts (MW) and 37,143 megawatt hours (MWh), representing increases of 33% and 34% respectively over 2023 numbers. [1] The rapid growth of energy storage



systems (ESS) has brought a critical focus to safety regulations, with the International Fire Code (IFC) and NFPA 855 (Standard for the Installation of Stationary Energy Storage Systems) serving as foundational documents. While both aim to ensure the safe deployment of ESS, they approach the challenge with distinct roles and nuances, creating a dynamic regulatory environment for authorities having jurisdiction (AHJs), developers, designers, and facility managers.

Complementary Roles, Shared Goal

At a high level, the IFC acts as a model fire code, adopted and amended by states and cities, setting broad parameters for permits, occupancy risks, and referencing external standards. NFPA 855, on the other hand, functions as a detailed installation standard, providing prescriptive requirements for the placement, separation, protection, labeling, and maintenance of batteries in buildings.

"In many cities, the IFC is the enforceable code, and NFPA 855 provides the technical method to comply." [3]

This means the IFC often dictates what needs to be done, while NFPA 855 outlines how to achieve compliance.

Key Differences of Evolving Standards

This selected content from the attached comparison table highlights several specific areas where the IFC and NFPA 855 diverge or offer different levels of detail:

Hazard Mitigation Analysis: NFPA 855 adds two criteria for determining when a Hazard Mitigation Analysis (HMA) is required and adds explosion control measures to the list of required acceptance criteria for AHJs.

Fire Remediation: The IFC specifies the owner/agent must dispatch trained personnel to assist emergency responders during a fire emergency within 15 minutes, a detail not explicitly defined in NFPA 855.

Working Clearances: NFPA 855 does not include specific working clearance requirements, which are present in the IFC.

Toxic and Highly Toxic Gases: While the IFC mandates hazardous exhaust systems, NFPA 855 Section 4.6.11 states that ESS installations "shall not release toxic gases," with further guidance on monitoring exhaust ventilation in Section 9.6.5.1.

Signage: NFPA 855 offers more detailed guidance on the precise locations for ESS signage.

Occupied Work Centers: NFPA 855 includes specific requirements for occupied work centers in non-dedicated-use buildings (Table 9.5.1), and prohibits them in ESS dedicated-use buildings.

Walk-in Units: NFPA 855 expands on the shared verbiage by providing additional details on maximum walk-in unit size and classification methods.

Elevation: While both codes address elevation, the IFC specifies a 75-foot limit for the highest floor above fire department vehicle access, whereas NFPA 855 permits any height as long as the ESS can be reached by the fire department aerial apparatus.

Fire Detection: NFPA 855 requires a smoke and fire detection system for lithium-ion ESS to have a power supply capable of 24 hours of standby and 2 hours of alarm, while the IFC generally references NFPA 72 criteria, which only required 5 minutes of alarm capacity.

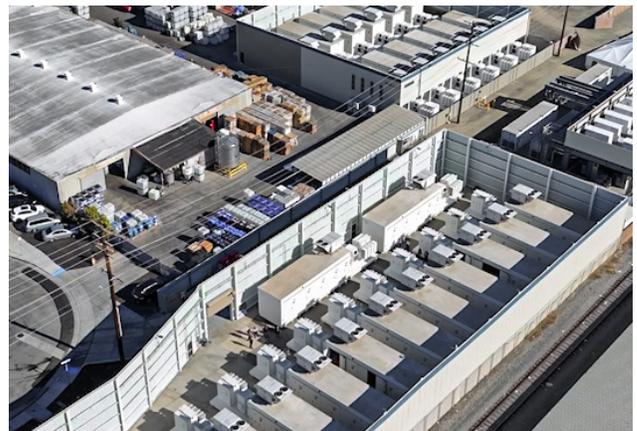
Fire Suppression Systems: NFPA 855 introduces NFPA 770 Hybrid Water and Inert Gas Systems as an

approved standard, allowing alternative automatic fire control and suppression systems.

Maximum Enclosure Size: NFPA 855 increases the maximum width by 6 inches compared to the IFC.

Spill Control and Neutralization: NFPA 855 provides specific thresholds for free-flowing liquid electrolyte (55 gallons for individual vessels, 1,000 gallons total), while the IFC requires spill control regardless of volume.

Explosion Control: Both require explosion control and prevention for most battery technologies. NFPA 855 includes additional exceptions for lead-acid battery systems and systems complying with UL 1973, exceptions for outdoor ESS installations, and specific performance criteria for gas concentration reduction systems and hot/cold aisle arrangements.



Beyond these specific points, industry sources highlight broader distinctions, especially to the 2021 IFC:

Prescriptive vs.

Performance-Based: NFPA 855 often provides more prescriptive requirements for metrics such as maximum energy and spacing between units, as detailed by the American Clean Power Association (ACP) [2].

UL 9540A Testing: NFPA 855 references UL 9540A for large-scale fire testing, which is crucial for justifying spacing and fire features [4,6]. The 2021 IFC may request performance data, but NFPA 855 explicitly points to UL 9540A results for AHJ assessment [2].

Retroactivity: NFPA 855 provides for a measure of retroactivity for existing ESS not listed to UL 9540, requiring a hazard mitigation analysis (HMA) and empowering the AHJ to mandate safety upgrades [2]. This provision was not in the 2021 IFC but was anticipated for the 2024 edition.

Fire Containment Strategy: The 2023 edition of NFPA 855 mandates fire suppression for all ESS, with exceptions at the AHJ's discretion. It also emphasizes explosion prevention combined with fire

containment, allowing ESS fires to gradually extinguish in a controlled fashion while protecting adjacent enclosures [2]. This approach aims to prevent dangerous scenarios like the McMicken ESS incident [7] in Surprise, Arizona, which resulted in several firefighter injuries when they attempted to enter a BESS unit undergoing thermal runaway. [8]

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Historical Context and Future Harmonization

The evolution of these codes reflects a growing understanding of ESS hazards. As noted by Vertiv, both NFPA and IFC regulations underwent major changes in 2016 due to concerns from fire officials and insurance companies regarding lithium-ion battery deployments [4]. Historically, the Uniform Fire Code (UFC) covered stationary energy storage, with the IFC later reducing the regulated electrolyte amount. The introduction of NFPA 855 in 2019, driven by the California Energy Storage Alliance, aimed to address regulatory gaps and became the basis for ESS fire code requirements in the 2021 versions of IFC, IRC, and NFPA 1 [5, 6].

While the 2023 edition of NFPA 855 is a year ahead in its revision cycle, it will inform the 2024 editions of model codes, indicating a continuous effort towards harmonization [2]. However, local adoption paths and amendments remain critical, and AHJs ultimately determine which editions apply [3].



Conclusion

The interplay between the IFC and NFPA 855 creates a comprehensive framework for ESS safety. While the IFC provides the overarching regulatory structure, NFPA 855 offers the detailed technical guidance necessary for safe installation and operation. As ESS technology continues to advance, the ongoing collaboration and evolution of these standards will be crucial in ensuring the safety and widespread adoption of energy storage solutions.

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