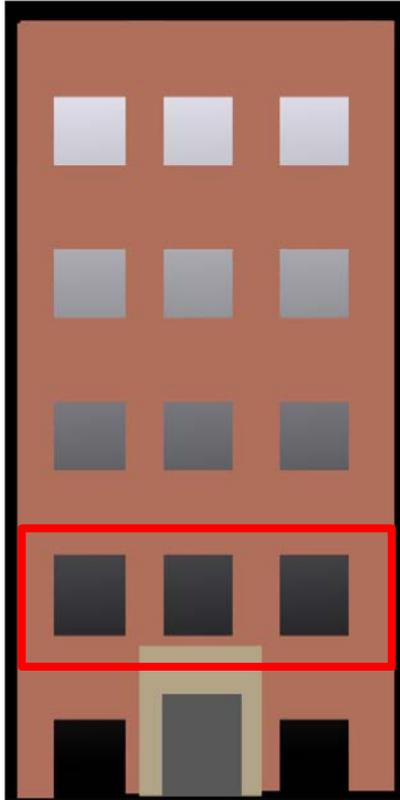




# ESS – Fire Safety Concepts in the 2018 International Fire and Residential Codes

Howard Hopper, FPE  
Regulatory Services Program Manager

# Previous IFC Battery System Requirements



Since 1997 (lead-acid) battery systems allowed in **incidental use areas**

1 or 2 hour fire separations

Hazmat requirements exempted

Spill control, ventilation, smoke detection

Battery quantities unlimited

Location in building not regulated

Standby & emergency power, UPS use

Code did not adequately protect newer battery technologies



# 2018 IFC Concepts

Developed by FCAC working group

Lead acid battery installations – no changes

Appropriate protection for lithium, sodium and other batteries

Conservative criteria for yet to be introduced battery technologies

New capacitor ESS requirements

Prescriptive and performance criteria

Threshold triggers – More conservative and KWh units



# Hazard Mitigation Analysis (HMA)

HMA must be provided for:

- Battery technologies not within the scope
- Multiple battery technologies with potential adverse interactions
- When allowed as a basis for increasing MAQs

Will evaluate the consequences of failure modes

Fire code official must approve the HMA

The HMA is a tool to address unknowns with new technologies



# 2018 IFC General Requirements

Seismic and structural design per IBC Chapter 16

Vehicle impact protection

Combustible storage not allowed in battery rooms, cabinets

Testing, maintenance and repairs per manufacturer's instructions



# 2018 IFC Batteries and Equipment

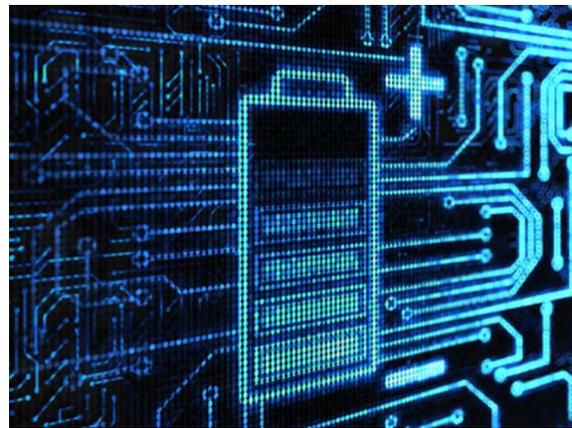
Storage batteries (except lead-acid) must be UL 1973 listed

Prepackaged/pre-engineered systems must be UL 9540 listed

Battery chargers and inverters must be listed

Vented batteries must have flame-arresting safety caps

A battery management system must be provided and send alarms to an approved location if hazardous conditions are detected



# 2018 IFC Location and Separation

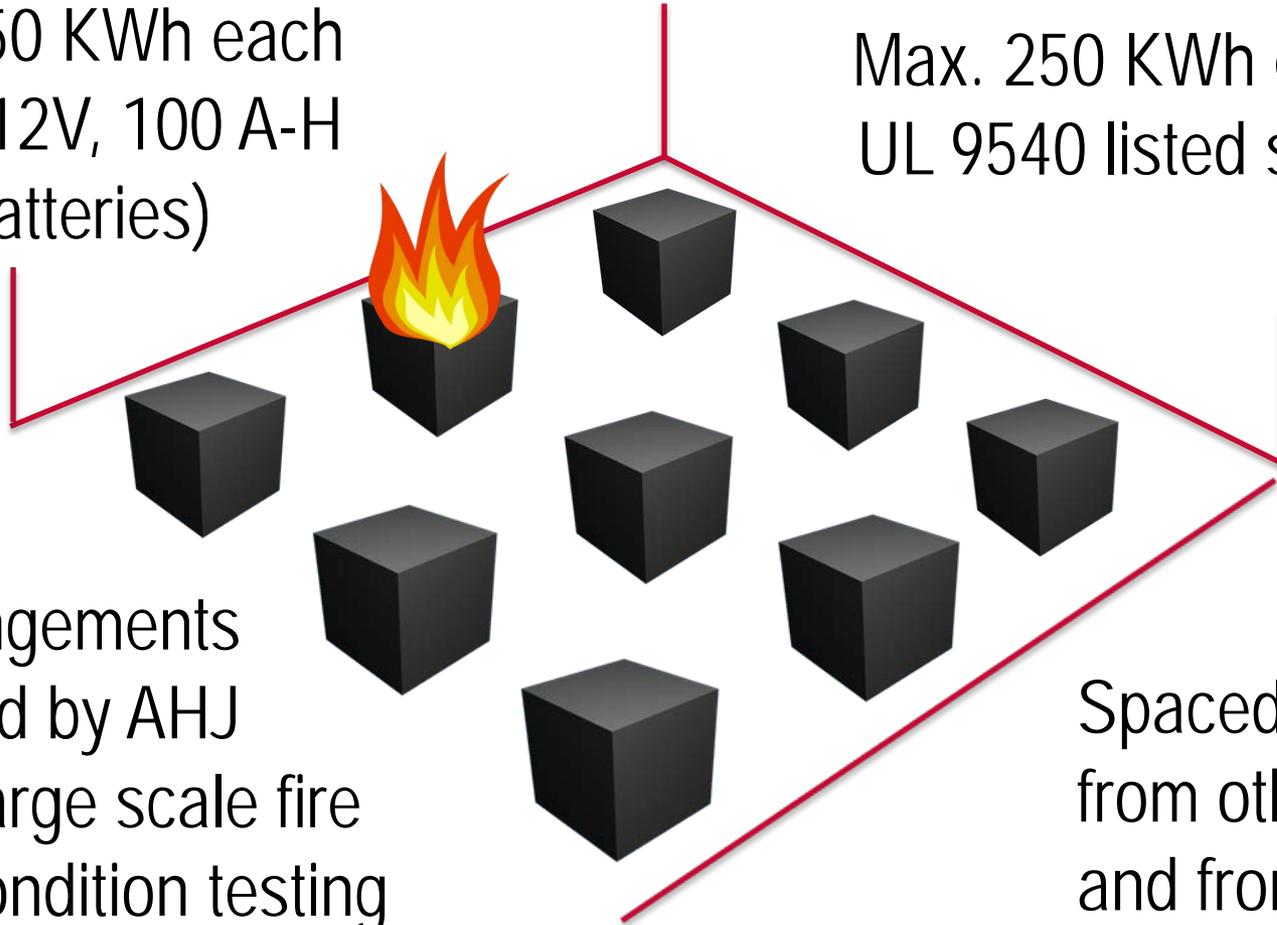
- Battery room floor < 75 feet above and < 30 feet below grade
- When approved by the fire official installations allowed on rooftops > 75 feet
- In mixed use buildings battery rooms must be separated from other areas with 1 or 2 hours fire separations
- Outdoors installations also regulated



# New Battery Array Concept

Max. 50 KWh each  
(42 – 12V, 100 A-H  
batteries)

Max. 250 KWh each for  
UL 9540 listed systems



Other arrangements  
as approved by AHJ  
based on large scale fire  
and fault condition testing

Spaced min. 3 ft.  
from other arrays  
and from walls



# 2018 IFC - Maximum Allowable Quantities

MAQ for an incidental use area within buildings is 600 KWh

- 100 KWh for technologies not covered by the code
- No limit for lead acid battery systems

Fire areas containing battery systems above the MAQ shall comply with Group H requirements

Exception: When approved, larger quantities allowed based on HMA and large scale fire and fault condition testing by an approved testing laboratory.



# 2018 IFC - Battery Room Protection

Automatic smoke detection

NFPA 13 sprinkler system. If batteries aren't addressed in NFPA 13, the AHJ can approve the system based on full scale fire and fault condition testing

Signage to identify specific hazards



# 2018 IFC - Battery Specific Protection

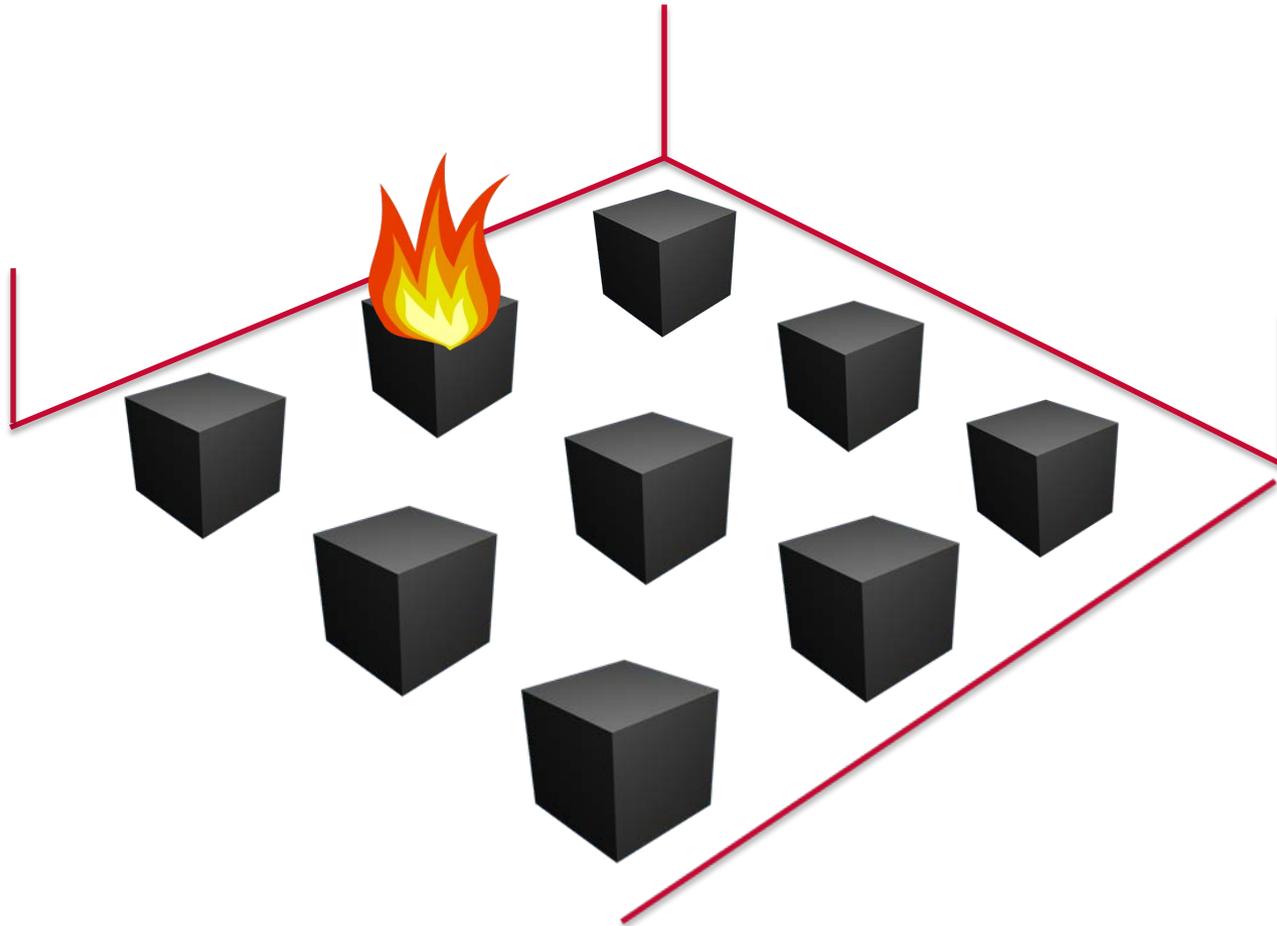
Systems that release toxic/highly toxic gases during charging, discharging and normal use must comply with Chapter 60

Ventilation is required for system that produce combustible gases during normal operation

Spill control and neutralization required for liquid electrolytes



# Large Scale Fire Testing Needed for Validate Protection Methods



# New 2018 IFC Capacitor ESS

Same protection concept as stationary battery systems

3 KWh threshold triggers requirements

Maximum 600 KWh MAQ per fire area

Requirements developed in advance of actual installations, and are designed to address uncertainties



# New IFC Chapter 12 – Energy Systems

Consolidates new and existing energy related requirements

1201-02 General and definitions

1203 Emergency and standby power systems

1204 Solar photovoltaic power systems

1205 Fuel cell energy systems (New)

1206 Electrical energy storage systems

- 1206.1 Scope
- 1206.2 Stationary storage battery systems (Updated)
- 1206.3 Electrical capacitor energy systems (New)



# 2018 IRC Battery Systems

Applies to battery systems > 1KWh

Battery systems must be listed to UL 9540

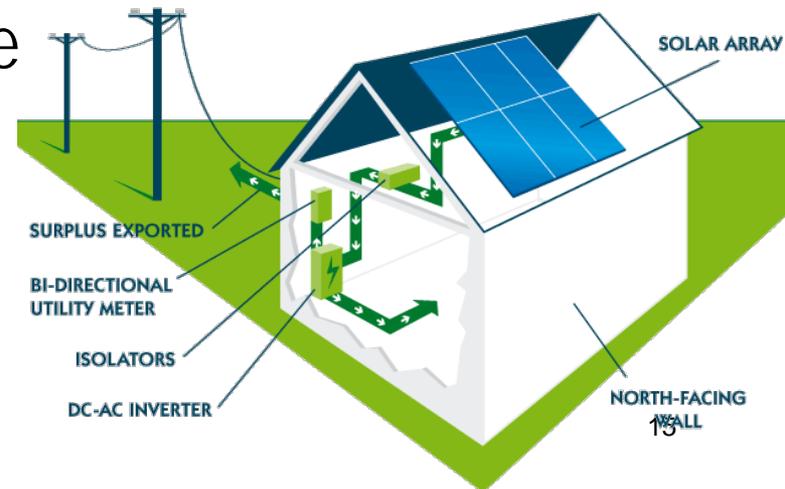
Installed per the manufacturer's instructions

Cannot be installed within habitable space of a dwelling unit

Electrical installation same as residential PV systems

Ventilation required if charging produces hydrogen gas

Vehicle impact protection, if applicable



# 2018 IRC Repurposed Batteries

Repurposed unlisted battery systems from EVs are allowed to be installed outdoors or in detached sheds  $\geq$  five feet from exterior walls, property lines and public ways.

UL 1974 under development – evaluation of batteries for repurposing.





# Discussion