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DOE OE Energy Storage Systems Safety Roadmap
Focus on Proposed Changes to the ICC Model Codes
Special Briefing Paper March 2018

The goal of the DOE OE ESS Safety Roadmap[1] is to *foster confidence in the safety and reliability of energy storage systems*. There are three interrelated objectives to support the realization of that goal: research, codes and standards and communication/coordination. The objective focused on codes and standards is…..

> *To apply research and development to support efforts that are focused on ensuring that codes and standards are available to enable the safe implementation of energy storage systems in a comprehensive, non-discriminatory and science-based manner.*

The following activities support that objective and realization of the goal:

a. Review and assess codes and standards which affect the design, installation, and operation of ESS systems.
b. Identify gaps in knowledge that require research and analysis that can serve as a basis for criteria in those codes and standards.
c. Identify areas in codes and standards that are potentially in need of revision or enhancement and can benefit from activities conducted under research and development.
d. Develop input for new or revisions to existing codes and standards through individual stakeholders, facilitated task forces, or through laboratory staff supporting these efforts.

The purpose of this special briefing paper is to support the above objective by providing information on current and upcoming efforts being conducted by U.S. standards developing organizations (SDOs), specifically code changes associated with the 2018 Group A International Codes that are relevant to energy storage systems.

Proposed changes to the I-Codes were posted by the ICC on February 28, 2018. Public hearings on those changes will occur from April 15 to 25, 2018 in Columbus, OH (information on the hearings as provided by ICC is shown at the end of this document). PNNL staff undertook a cursory review of those proposed changes (the code change monograph contains over 2500 pages), identified proposed changes that are relevant to energy storage systems and are providing the results of that cursory review in this document.

The intent of this effort is to reduce the need for those interested in energy storage systems (ESS) to review the entire monograph document to find ESS-relevant changes and allow them instead to focus on the assessment of those proposed changes.

The following table identifies those ESS-relevant changes and provides a very brief synopsis of the change *(and where necessary a comment as to why the change has been identified as ESS-relevant).* No attempt to analyze these changes has been made nor have the authors indicated a position on any of the changes – this is simply an identification of specific changes as noted above to assist those who are interested in ESS to review the proposed changes and if desired to participate in the ICC code development process. More in-depth review and analysis of these changes is left to the reader as deemed appropriate.

[1] DOE OE Energy Storage Systems Safety Roadmap, PNNL-SA-126115 I SAND2017-5140 R

Code Change Number	Summary of the Code Change
FS26-18	Adds a new exception to code provisions applicable to exterior walls that serve as part of a required fire-resistance-rated separation for exterior walls required to be fire-resistance rated per Section 1206 of the IFC for enclosing ESS.
G8-18	Adds a new definition of "motor vehicle" to eliminate confusion about what types of vehicles are covered by code sections applying to motor vehicles *(changes related to vehicles MAY be relevant to ESS where the vehicles are electric or have on board systems that can generate power)*.
G13-18	Proposed changes relate to parking garages and having all public garages meet section 406.4 of the IBC as well as 406.5 or 406.6 when open or enclosed respectively and then having private garages meet section 406.3 *(changes related to garages MAY be relevant to ESS where the vehicles are sources of building power).*
G16-18	Adds a new definition of liquid fuel or compressed gas motor vehicle for use in conjunction with parking garage classification as to use group *(classifying motor vehicles in this manner would appear to eliminate application of certain code provisions to electric vehicles – which without this change would continue to be considered motor vehicles).*
G17-18	Adds "ESS in dedicated use buildings" to the list of building types that are considered moderate-hazard factory industrial, Group F-1 buildings.
G24-18	Adds 'electrical room' to the listing of uses included in low-hazard storage Group S-2 occupancies.
G91-18	Adds a new footnote to certain incidental use rooms/areas for the purpose of separation and/or protection requirements. One such room/area is 'electrical installations and transformers' which currently refers to selected sections of NFPA 70. The new footnote points to Chapter 6 of the IFC for additional construction requirements for those rooms/areas. Note that the table does addresses rooms/areas with stationary storage battery systems but the new footnote is not applied to them.
G92-18	Deletes the stationary storage battery system room/area requirement in the table providing required separation and/or protection requirements (the reason is the anticipated revision of Section 1206 of the IFC covering ESS that will include those separation and protection requirements).
G151-18	Adds a new section 3114 to the IBC covering intermodal shipping containers that are repurposed for use as buildings or structures or as a part of a building or structure but includes an exemption for stationary storage battery arrays located in such containers complying with Chapter 12 of the IFC.
S22-18	Adds new provisions to Chapter 17 on Special Inspections that electrical components, appliances, equipment and systems governed by NFPA 70 must be inspected by an approved special inspector with expertise in NFPA 70 and electrical construction.
F3-18	Adds water as a component of certain battery types (lead-acid and Ni-Cd) in the definition of those battery types.
F18-18	Adds a new section to the IFC to address storage of new or off specification Li-ion batteries and also to include such storage areas as high-hazard Group H-2.
F42-18	Adds Group F-1 and S-1 occupancies over 500K s.f. to those required to have a fire command center for fire department operations (see G24-18 that adds ESS dedicated use buildings to those considered Group F-1).
F59-18	Removes Section 601.2 of the IFC related to securing permits for battery systems (because those are in Chapter 12 of the IFC and are therefore a duplication).
F68-18	Requires that electrical equipment, wiring and systems be installed, used and maintained in accordance with NFPA 70 and provisions in Sections 604.2 through 604.11 of the IFC.
F137-18	Would add a new exception for normally unoccupied, stand-alone telecommunications structures less than 1.5k sf. In gross floor area to Section 907.2.22 that requires an automatic smoke detection system in areas containing stationary battery systems.
F168-18	Adds a reference in Section 911.1 to NFPA 68 for deflagration venting and then adds a new special use for ESS to Tables 414.5.1 and 911.1 listing explosion control requirements and a reference to Section 1206 where explosion control is required (for ESS barricade construction is not required by deflagration venting or an explosion prevention system are required).

F190-18	Adds repair, commissioning and decommissioning to the scope of Chapter 12 (energy systems used for generating or storing energy) and further refines how the 'aggregate kWh of energy' in a fire area is determined by changing it to 'the aggregate nameplate kWh of all ESS' in a fire area for the purpose of determining the threshold quantity of an ESS in determining if and to what degree provisions in the IFC apply to the ESS.
F191-18	Includes compliance with Section 604 of the IFC, which contains relevant provisions, for electrical wiring and equipment used with energy systems.
F202-18	Adds an exception to Section 1205 covering stationary fuel cell power systems that would allow the temporary use of a fuel cell powered electric vehicle to power a Group R-3 or R-4 dwelling while parked in an attached or detached garage when in conformance to the vehicle manufacturer's instructions and NFPA 70.
F203-18	A complete comprehensive revision to the provisions in the IFC that cover ESS (developed by the ICC FCAC's ESS work group).
F204-18	Clarification of when construction and operational permits are required for stationary and mobile ESS. Also exempts lead acid and Ni Cad battery systems less than 50 VAC/60 VDC under the exclusive control of a communications utility.
F205-18	Eliminates the need for a permit to operate stationary storage battery system.
F206-18	Modifies provisions for ESS (eliminates consideration of explosions in battery cabinets in occupied work centers when doing a HMA, when the fire code official is authorized to approve larger capacities and/or smaller array spacing by adding a reference to UL 9540 and adding an exception to required fire-extinguishing systems when the stationary storage battery system is in an unoccupied, non-combustible container located outdoors housing only ESS equipment).
F207-18	Changes the reference standard for listing and labeling battery chargers from UL 1564 to UL 1741.
F208-18	Adds an exemption from required smoke detection systems in rooms containing stationary storage battery systems for lead acid and Ni Cad battery systems less than 50 VAC/60 VDC under the exclusive control of a communications utility.
F209-18	Adds additional detail for spill control and neutralization of electrolyte or other hazardous material spills in areas containing stationary storage battery systems. Specifically for free flowing electrolyte making the provision applicable when individual vessels exceed a 55 g capacity or the aggregate capacity is over 1k g and to neutralize a spill from the largest individual cell or block to between 5.0 and 9.0 pH.
F210-18	Adds a new section 1206.4 that provides criteria for the installation of ESS on outside of exterior walls of a building. Also adds a new section to provide provisions for a full scale fire test of ESS in accordance with UL 9540A and including criteria for how the test is to be conducted, witnessed and reported.
F211-18	Adds a new section to provide provisions for a full scale fire test of ESS in accordance with UL 9540A and including criteria for how the test is to be conducted, witnessed and reported *(appears identical to that proposed in F210-18).* Also provides an exemption for ESS in Group R-3 and R-4 occupancies when they comply with a proposed new section that provides criteria specific to ESS safety in these building types.
F249-18	Batteries are covered in Chapter 31 as related to their use in conjunction with tents, air supported structures and temporary special event structures. The IFC currently requires them to be disconnected in an approved manner and the proposed change would modify the text to require disconnection unless the fire code official requires the batteries to remain connected to maintain safety features.
F251-18	Adds LI-ion batteries as a product in the commodity classifications table (3203.8) and includes a classification of those batteries as high-hazard.

Registration for the International Code Council's 2018 Committee Action Hearings, Apr. 15–25 in Columbus Ohio can be addressed at, register now.

The Hearings are free to attend and offer building and fire code officials, architects, builders, engineers, designers, PMG and Pool & Spa professionals an opportunity to provide input on proposed code changes to the **2018 Group A International Codes®**.

- International Building Code® (IBC®)—IBC-E, IBC-FS, IBC-G
- International Fire Code® (IFC®)
- International Fuel Gas Code® (IFGC®)
- International Mechanical Code® (IMC®)
- International Plumbing Code® (IPC®)
- International Property Maintenance Code® (IPMC®)
- International Private Sewage Disposal Code® (IPSDC®)
- International Residential Code® (IRC®)—IRC-M, IRC-P
- International Swimming Pool and Spa Code® (ISPSC®)
- International Wildland-Urban Interface Code® (IWUIC®)
- International Zoning Code® (IZC®)

See page 2 of the 2018/2019 Code Development Schedule for details on code chapters, notes and committee information for the Group A codes, click here.

Additional Resources
For more information about the code development process, click here.
For more information about cdpACCESS (used for online voting), visit www.iccsafe.org/cdpaccess.

An Important Note to Readers

Every effort is made by PNNL and Sandia[1] staff to ensure the accuracy of the information presented in this report. For more information on the ESS Safety Roadmap efforts visit http://www.sandia.gov/ess/. For questions related to this document please contact david.conover@pnnl.gov.

1. Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia, LLC., a wholly owned subsidiary of Honeywell International, Inc., for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.