SAN DIEGO COUNTY FIRE PROTECTION DISTRICT

FIRE PROTECTION GUIDELINES FOR BESS FACILITIES

PUBLIC SAFETY GROUP

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I. PURPOSE

The San Diego County Fire Protection District (SDCFPD) is committed to ensuring the safety of Battery Energy Storage System (BESS) facilities through the application of a comprehensive framework of local, state, and national codes and standards. These regulations are designed to mitigate the risks associated with fire, explosion, and toxic hazards, thereby safeguarding public health and safety. As BESS technologies evolve, existing codes are being adapted to address the emerging and unique risks posed by these systems. Furthermore, the SDCFPD Fire Chief is vested with the authority to amend or modify the Fire Code, as necessary, to address new safety concerns and technological advancements. The regulations in this document are specific to the SDCFPD but may be adopted by other fire protection and municipal water districts in San Diego County.

II. BACKGROUND

The San Diego County Fire Protection District (SDCFPD) currently employs a mix of local, state, and national codes and standards to review Battery Energy Storage System (BESS) facilities, with the goal of mitigating fire and explosion risks and ensuring public safety. Chapter 1207 of the California Fire Code (CFC) is a set of regulations that addresses the installation, operation, maintenance, repair, retrofitting, testing, commissioning, and decommissioning of energy systems used for generating or storing electricity, including BESS. However, existing regulations, including the (CFC) and the County of San Diego's Consolidated Fire Code, may not fully address the unique hazards posed by modern BESS technologies.

In parallel, the National Fire Protection Association (NFPA) establishes a nationally recognized set of standards for BESS called NFPA 855. NFPA standards, and specifically NFPA 855 are developed by firefighters, fire protection professionals, and safety experts, to provide the most comprehensive requirements and guidance on the design, installation, and operation of energy storage facilities for all site and community contexts. The scope of the standard includes both indoor and outdoor, containerized and non-containerized facilities, including potential hazards associated with lithium-ion batteries. NFPA 855 is updated on a three-year cycle. NFPA 855 is one of a number of standards by which state and municipal fire codes can be updated, usually adopting NFPA 855 in its entirety. The process of adopting NFPA 855 into the CFC and the Consolidated Fire Code can take a year or more. As a result, it is SDCFPD's intention to employ the most recently published NFPA 855 as soon as it is released by NFPA.

In 2024, SDCFPD introduced a requirement as outlined in the Interim Fire Protection Guidelines for BESS Facilities, for a technical study, to be prepared as part of a mandate that BESS facilities conduct comprehensive risk assessments and hazard mitigation plans. These studies are intended to ensure compliance with currently adopted fire codes and address fire and life safety gaps not provided in the currently adopted codes and standards. In accordance with the CFC, the Fire Chief has the authority to authorize changes to existing fire codes when new risks are identified, especially when dealing with emerging technologies like BESS. This gives the Fire Chief the discretion to adapt safety regulations based on evolving industry standards.

The Interim Fire Protection Guidelines for BESS Facilities have been updated to remove the interim status as well as incorporate the latest edition of NFPA 855 and the 2025 Edition of CFC.

III. CODES AND STANDARDS

The following codes and standards were used in preparation of these guidelines.

- 2025 Edition of the California Fire Code (CFC): This edition of the CFC is based on the 2024 Edition of the International Fire Code (IFC) with the state of California amendments and is the prevailing set of regulations for fire safety and fire prevention in California. The CFC is part of the California Code of Regulations, Title 24 which is developed by the State Fire Marshal in partnership with local government, fire officials, building officials and the private sector. The 2025 Edition was released on July 1, 2025, and will be effective on January 1, 2026.
- 2026 Edition of the Consolidated Fire Code for the Fire Protection Districts in San Diego County: The 2026 Consolidated Fire Code contains the county level amendments to the 2025 Edition of the CFC. The Consolidated Code is used by twelve Fire Protection Districts in San Diego County.
- 2025 Edition of the California Electrical Code (CEC): The CEC is based on the 2023 Edition of NFPA 70 and is the prevailing set of regulations for electrical installations in California. BESS installations must comply with the applicable requirements of the CEC but are not covered in detail by these guidelines. Emergency power supplies for BESS safety systems must comply with the requirements of the CEC, as required by CFC Section 1203.1.3.
- National Fire Protection Association (NFPA 13), *Standard for the Installation of Sprinkler Systems,* 2025 Edition: NFPA 13 is the industry benchmark for design and installation of automatic fire sprinkler systems. Although NFPA 13 does not specifically address BESS as a hazard, it still provides the applicable design and installation requirements and is referenced by the CFC and NFPA 855. Fire sprinkler system design criteria for BESS is determined based on large-scale fire testing.
- NFPA 68, *Standard on Explosion Protection by Deflagration Venting,* 2023 Edition: NFPA 68 applies to the design, location, installation, maintenance and use of systems that vent combustible gases resulting from a deflagration so that damage is minimized. NFPA 68 was not specifically written to address the deflagration hazards present in BESS. Deflagration venting is a passive method with minimal maintenance which relies on properly designed vents to relieve pressure.
- NFPA 69, *Standard on Explosion Prevention Systems,* 2024 Edition: NFPA 69 provides requirements for systems designed to prevent and control explosions of flammable gas, vapor, mist, dust or hybrid mixtures. NFPA 69 was also not specifically written to address ESS. The method found in Chapter 8 “Deflagration Prevention by Combustible Concentration Reduction” is commonly used for BESS and relies on the removal of flammable gases to maintain the global concentration of the gas mixture well below the point where an explosion could occur.
- NFPA 72, *National Fire Alarm and Signaling Code,* 2025 Edition: NFPA 72 provides the design and installation requirements for fire detection, signaling, and emergency communications demands. Detection and alarm systems installed as part of BESS facilities are required to comply with NFPA 72.
- NFPA 110, *Standard for Emergency and Standby Power Systems*, 2025 Edition*:* NFPA 110 covers performance requirements for emergency and standby power systems which provide an alternate source of power when the normal power source fails. NFPA 110 is referenced by CFC Section 1203.1.3 as an installation standard.
- NFPA 111, *Standard for Stored Electrical Energy Emergency and Standby Power Systems,* 2025 Edition: NFPA 111 also provides requirements for emergency and standby power systems but specifically focuses on stored energy systems. NFPA 111 is referenced by CFC Section 1203.1.3.

- NFPA 855, *Standard for the Installation of Energy Storage Systems,* 2026 Edition: NFPA 855 is a standard providing the minimum requirements for mitigating the hazards associated with energy storage systems (ESS). This edition was released on August 20, 2025, which is more recent than the 2024 IFC/2025 CFC. The 2026 Edition of NFPA 855 is not currently referenced by the CFC per CFC Section 1201.1, however, as part of these guidelines the latest edition of NFPA 855 will be utilized. NFPA 855 is on a 3-year revision cycle with input from a robust Technical Committee that is formed by engineers, consultants, manufacturers, and fire service members. The standard covers many types of ESS, including electrochemical energy storage systems which include batteries. The body of the standard includes requirements for equipment listings, setbacks, fire suppression, explosion control, and many other topics. The appendices of NFPA 855 also offer a wealth of recommendations beyond those in the body of the standard and provide further understanding of the associated hazards and prevention strategies.
- NFPA 1142, *Standard on Water Supplies for Suburban and Rural Firefighting,* 2022 Edition: NPFA 1142 identifies methods for determining the minimum water supply necessary for structural fire-fighting purposes where there is no or inadequate water for firefighting. The fire code official is authorized but not obligated to utilize NFPA 1142 as stated in CFC Section B103.3.

IV. LARGE SCALE FIRE TESTING

Fire and explosion testing is a key part of the process of obtaining information to design the safety systems for a battery energy storage system (BESS) installation. UL 9540A has been the main fire and explosion test protocol used for BESS since it was released in 2017. The latest edition referenced by the CFC is the 4th edition (Published in 2019). The latest edition of UL 9540A (6th Edition) was published on March 13, 2026. This section has been modified to incorporate the latest edition of UL 9540A.

One of the key safety strategies used to protect BESS installations is the limitation of fire spread via passive protection such as combustibility of construction and adequate separation distances. While the 4th Edition of the UL 9540A test procedure provides a lot of valuable information, the test procedure does not require that a fire condition is created to validate passive protection during a worst-case fire scenario. Because of this, many professionals, manufacturers, and jurisdictions have argued that the 4th Edition of the UL 9540A is not a large-scale fire test.

Accordingly, the 2026 Edition of NFPA 855 introduced Section 9.2 where an additional fire test procedure is required. This procedure requires that where cell thermal runaway results in the release of flammable gases during a cell- or module-level test, an additional unit-level test shall be conducted involving intentional ignition of the vent gases to address the fire propagation hazard. The procedure must also be conducted or witnessed and reported by an approved testing laboratory to characterize the composition of the gases generated and show that a fire involving one ESS unit will not propagate to an adjacent unit.

NFPA 855, Annex G.11 provides additional discussion around the intent behind a large-scale fire test and its distinction from the 4th Edition of the UL 9540A test procedure. In summary, the intent behind the large-scale fire test is to develop quantitative data to characterize the fire performance hazard of BESS for instances in which a fire condition is developed within the unit of origin and involves the batteries. With this fire condition it is important to observe the effects on surrounding exposed surfaces that can lead to involvement of surrounding combustibles (e.g. adjacent BESS units). Consider, when performing the test, only protection systems installed in accordance with relevant codes and standards are permitted to be included in the large-scale fire test.

For example, performing a large-scale fire test and utilizing water-based suppression as a protection system would be permitted if the ESS maximum stored energy is 50 kWh or less and the water-based suppression system is designed with a minimum density of 0.3 gpm/ft^2 over the area of the room or 2,500 SF per CFC Section 1207.5.5(1). However, if the density is less than that required by CFC Section 1207.5.5(1), then it must be justified via performance in large-scale fire testing.

It is also important to note that active technologies intended to mitigate thermal runaway in the enclosure of origin do not prevent a developed fire condition, irrespective of whether they operate as intended. As such, the large-scale fire test is not intended to evaluate active thermal runaway mitigation devices or strategies in the enclosure of origin. This could include but is not limited to direct injection of water or other agents into the module/cell, battery management systems, etc. Thermal runaway mitigation technologies can be incorporated in all adjacent enclosures but should be deactivated in the enclosure of origin. Fire protection systems installed per applicable codes and standards can be included in all enclosures in the test.

When reviewing unit level large-scale fire test information, the following test objectives must be met:

1. The objective of the test method is to evaluate the thermal exposure from a developed fire within a battery energy storage system unit, including non-battery components, to determine propagation/ignition risk to adjacent units or exposures. The test setup should reflect the final installed configuration of BESS, ancillary equipment, and any immediate surrounding enclosure or buildings.
2. Where accumulation of flammable vent gases might occur, this test method evaluates the developed fire scenario after any potential ignition of the vent gases, including the operation of any mitigation devices, such as deflagration panels.
3. The developed fire condition is assumed to occur after the operation and dissipation of single-use, noncontinuous operation systems designed to protect the enclosure of origin.
4. Only fire protection systems designed and installed in accordance with applicable product and installation standards and meeting applicable code requirements should be used.
5. Tests conducted according to this test method should generate quantitative data to measure thermal exposure to adjacent units or exposures.
6. This test method is not intended to evaluate the effectiveness of systems designed to protect against the accumulation of flammable gas, deflagration mitigation systems, or the reliability of safety systems.
7. This test method is not intended to evaluate active thermal runaway mitigation devices or strategies in the enclosure of origin, but thermal runaway mitigation devices and strategies can be incorporated in all adjacent enclosures.

Lastly, it is important to consider that these objectives do not apply for BESS intended for residential use.

When reviewing the independent large-scale fire test, it is important to confirm that the following items are evaluated:

1. Performance criteria [BESS and BESS equipment (e.g., inverters, combustible wire insulation)], including the following:
    a. Fire and damage impact on critical safety systems.
    b. Survivability of communication pathways.
    c. Proposed spacing between finished product configuration of BESS for outdoor and indoor applications.

    d. Fire impingement, ignition, and damage to exposed surfaces or that lead to thermal runaway propagation, including the following:
        i. Evaluate combustibles – "Involve"
        ii. Evaluate noncombustibles – "Effect"
2. Exposure to adjacent BESS (batteries), including the following:
    a. Adjacent enclosures should all be partially populated (on the sides of the exposure closest to the DUT)
    b. The surface temperature of modules within the BESS units adjacent to the initiating BESS unit should not exceed the temperature at which thermally initiated cell venting occurs according to UL 9540A cell level testing.
    c. Module temperatures measured by the BMS in target enclosures should not be used for this evaluation.
    d. There should be no ignition of combustible materials on or in any adjacent enclosures during testing.
    e. There should be no venting in any cells.
    f. There should be no thermal runaways.

Special considerations to note are as follows:

1. If containers are populated, and the Battery Management System (BMS) monitors the modules during the test, fire impingement or damage might be acceptable as determined by the Registered Design Professional if it doesn't include thermal runaway propagation.
2. In unpopulated containers, if flames penetrate through interconnection paths or fire propagates into adjacent containers, then the assumption is it will lead to thermal runaway in adjacent containers.
3. A Registered Design Professional should review the collected data to verify that the large-scale fire condition of one ESS does not result in thermal runaway propagation to adjacent ESSs for locations with exposures or it should be used to evaluate appropriate risk for remote locations.

In summary, based on the latest revisions in NFPA 855, if the cell and/or module level UL 9540A testing indicates that flammable gases are generated during thermal runaway, then an independent fire test must be conducted to satisfy the intent behind the requirement for a large-scale fire test in addition to the unit level test required by UL 9540A. A technical report must be prepared by a qualified individual (e.g. licensed California fire protection engineer) which summarizes the contents of both the UL 9540A test results and the large-scale fire test.

6th Edition of the UL 9540A Test Procedure

The 6th Edition of UL 9540A has been published as of March 13, 2026, and requires a large-scale fire test which is required during the installation level test. Consider another important change is that in the 6th Edition test, unit level testing is now required for most residential BESS and any BESS with an active thermal runaway propagation prevention system as well. Consider that regardless of BESS type, should the BESS not meet the performance criteria outlined in the module level test, then unit level testing is still required.

Though not formally incorporated by reference to the 2026 Edition of NFPA 855, the prescribed installation level large-scale fire test of the 6th Edition of UL 9540A would meet the intent of NFPA 855's independent fire test. The procedure involves initiating a developed fire condition within the BESS enclosure, involving batteries and surrounding combustibles, and observing the effects on surrounding BESS or structures. The objective of the test is as follows:

1. Evaluate the thermal exposure from a developed fire condition within a BESS stack, enclosure or group, including non-battery components, to determine propagation/ignition risk to an adjacent or nearby BESS stacks, enclosures, or groups;
2. Determine ignition risk to nearby structure(s) of interest;
3. Support proposed separation distances as included in the UL 9540 evaluation and/or manufacturers or integrator's installation instructions; and/or
4. Determine if the prescribed fire protection plan of the building is adequate to control fire spread.

Critical assumptions behind the large-scale fire test are as follows:

1. Test set up is to be representative of the final installed configuration of the BESS, ancillary equipment, and surrounding enclosure or structures, based on the manufacturers or integrator's installation instruction.
    a. Note that if ancillary equipment (HVAC systems, inverters, chillers, etc.) is included in a separate enclosure from the BESS, it is not required to be included in the installation level test.
2. Where one BESS enclosure or group is capable of being configured with multiple storage capacities configured from the same cells and modules, and where the properties and geometries of all other materials are equivalent based on the construction, the configuration with the highest stored energy capacity shall be representative of all storage configurations.
3. Where accumulation of flammable vent gases may occur, the test evaluates the scenario of a developed fire condition that may occur after any potential ignition of the vent gases including the operation of any overpressure mitigation devices, such as deflagration panels. Ignition of vent gases is required in this test method to evaluate the developed fire condition.
4. The developed fire condition is assumed to occur after the operation and dissipation of single-use, non-continuous operation systems designed to protect the BESS of origin.
5. The BESS in the enclosure of origin and all cells or modules in the targets where provided, are staged to the Maximum Operating State of Charge (MOSOC).
6. All deflagration pressure relief areas in the enclosure shall be open from the beginning of the test. Openings that are not deflagration pressure relief areas shall remain closed.
7. Openings designed to be open during normal operation or thermal runaway conditions on the enclosure of origin shall also be opened for the test. Openings for ventilation (e.g. explosion prevention per NFPA 69) shall be opened.
8. The test is not intended to evaluate the effectiveness of systems designed to protect against the accumulation of flammable gas, deflagration mitigation systems, or the reliability of safety systems.
9. The test is not intended to evaluate active thermal runaway propagation prevention systems.
10. The test does not cover battery energy storage units or stacks evaluated for residential use.
11. The test is not required for aqueous chemistries (e.g. lead-acid, nickel-cadmium, metal-air, nickel-zinc) flow batteries, or other battery chemistries that have been subjected to the Cell level test and which have demonstrated that thermal runaway is not possible.

The acceptance criteria of the large-scale fire test per the 6th Edition of the UL 9540A test procedure is as follows for outdoor installations:

1. There shall be no venting in any cells or modules in the target enclosures.
2. There shall be no thermal runaways in any cells or modules in the target enclosures.

3. If the target enclosures are not populated with cells or modules, there shall be no penetration of flames through existing interconnection paths that result in breaches from the enclosure of origin into the target enclosure.
4. The relevant temperature criteria shall not be exceeded. Temperature criterion is summarized as follows:
    a. Cells within the target enclosures cannot have an average temperature of venting temperature from the Cell level test report.
    b. Modules within the target enclosures cannot have an average temperature of venting temperature from the Cell level test report.
    c. Interior surfaces of the target enclosure cannot have an average temperature which exceeds 110% of the venting temperature from the Cell level test report.
    d. Instrumented walls, if used in place of a target enclosure, cannot have an average temperature which exceeds 110% of the venting temperature from the Cell level test report.
5. Heat flux measurements shall not exceed 12.5 kW/m^2 where used to determine separation distances to combustible structures.
6. For stacked BESS, the enclosure of origin, stacked target enclosures, and any target structures, platforms, or supports shall not collapse after a 24-hour observation period.

For indoor installations (dedicated and non-dedicated use buildings), the acceptance criteria are as follows:

1. Thermal runaway shall be limited to the enclosure of origin or limited to the vertical grouping of modules (e.g. rack) of original and the additional enclosures or vertical groupings of modules immediately on either side and above, if stacked. If enclosures contain three or more vertical groupings of modules side-by-side laterally, then thermal runaway shall be limited to the enclosure of origin only.
2. Fire spread to any combustible materials, and/or thermal runaway or venting in any cells or modules shall not occur in target BESS located across the aisles or beyond the group of origin.
3. The relevant temperature criteria shall not be exceeded. Temperature criterion is summarized as follows:
    a. Cells within the target groups cannot have an average temperature of venting temperature from the Cell level test report.
    b. Modules within the target groups cannot have an average temperature of venting temperature from the Cell level test report.
    c. Interior surfaces of the target groups cannot have an average temperature which exceeds 110% of the venting temperature from the Cell level test report.
    d. Surface temperature measurements along instrumented wall surfaces shall not exceed a temperature rise of 97 °C above ambient to determine clearance to nearby walls.
    e. The maximum 1-minute average temperature measured on the angle steel beam shall not exceed 538 °C.
    f. Heat flux measurements shall not exceed 12.5 kW/m^2 where used to determine separation distances to combustible structures.
    g. There shall be no observations of flaming debris more than 5 feet away from the group of origin or the separation distance between the group of origin and target groups, whichever is greater.
    h. There shall be no observation of re-development of fire or thermal runaway in any portion of the test group not involved in the fire event at the termination of sprinkler protection for 12 hours after the sprinkler operation or other fire protection system operation was discontinued or after external flaming discontinued (if suppression was not used).

In summary, when presented with test results from the 6th Edition of the UL 9540A test procedure, a large-scale fire test which meets the intent of NFPA 855 should have been performed. When reviewing the large-scale fire test data, it is important to confirm that the acceptance criteria detailed above have been met.

V. PROTECTION GUIDELINES FOR LITHIUM-ION BESS FACILITIES

This protection guideline applies to all facilities utilizing lithium-ion batteries in an energy storage system (ESS) where the nominal capacity exceeds 600 kWh. References to NFPA 855 are to the 2026 Edition unless noted otherwise.

Note, the term "safety system" or "critical system" is utilized throughout. The term for the purposes of this document is interchangeable and is defined per NFPA 855 Section 3.3.16.2 as follows:

"Critical Safety Component or System: *A component or system designed to prevent loss of life, serious personal injury, or damage to the natural environment."*

If the failure of an installed component or system could result in loss of life, serious personal injury, and/or damage to the natural environment then the component or system should be considered a safety system. Examples of this may include, but are not limited to the following:

Examples of this include may include but are not limited to the following:

- Fire suppression systems
- Fire alarm systems
- Smoke detectors
- Heat detectors
- Explosion control systems (e.g. deflagration panels)
- Gas detection systems
- Mechanical ventilation systems
- Fuses, circuit breakers, DC contactors, etc.
- Overcurrent protection, ground-fault detection, arc-flash protection
- Emergency stop buttons (BESS mounted or remote)
- Remote monitoring systems
    - *Remote monitoring systems can involve an off-site location that is constantly attending receiving life feedback from various safety systems such as the Battery Management System (BMS), gas detection sampling points, emergency ventilation status, etc. The intent of these constantly attended locations is to ensure an appropriate emergency response is taken in the event of upset conditions being detected by*
- Battery Management Systems
    - *This is a BESS specific component which is tasked with monitoring cell voltage, temperature, and currents to ensure they remain within specification. When these parameters fall out of specification thermal runaway may occur so the BMS will perform mitigative measures and can signal alarms and disconnect the BESS if necessary.*
    - *Consider, an Energy Management System (EMS) is **not** typically considered a safety system. The EMS determines how the BESS will function (charge, discharge, load shed, etc.) but considers safety constraints put in place by the BMS.*

If an HMA and/or an FMEA report are being prepared these safety components should also be identified throughout.

Submittal Package

The following must be submitted for review:

1. Location and layout diagram of the room or area in which the ESS is to be installed (CFC Section 1207.1.5).
2. Details on the hourly fire-resistance ratings of assemblies enclosing the ESS (CFC Section 1207.1.5).
3. The quantities and types of ESS to be installed (CFC 1207.1.5). ESS Capacities must be the total energy capable of being stored (nameplate rating), not the usable energy. (CFC Table 1207.1.3 Footnote a)
4. Manufacturer's specifications, ratings, and listings of each ESS (CFC Section 1207.1.5).
5. Description of energy storage management systems and their operation (CFC Section 1207.1.5)
6. Location and content of required signage (CFC Section 1207.1.5)
7. Details on fire suppression, smoke or fire detection, thermal management, ventilation, exhaust and deflagration systems, if provided. (CFC Section 1207.1.5).
    a. A report must be provided for all explosion control systems documenting compliance with appropriate standards (see next section).
8. Support arrangement associated with the installation, including any required seismic restraint (CFC Section 1207.1.5).
9. A commissioning plan complying with CFC Section 1207.2.1 (CFC Section 1207.1.5).
10. A decommissioning plan complying with CFC Section 1207.2.3 (CFC Section 1207.1.5).
11. A fire safety plan in accordance with CFC Section 404 (CFC Section 1207.1.5). The fire safety plan must include the following information (CFC Section 404.2.2).
    a. The procedure for reporting a fire or other emergency.
    b. The life safety strategy including the following:
        - Procedure for notifying occupants, including areas with a private mode alarm system.
        - Procedure for occupants under a defend-in-place response.
        - Procedure for evacuating occupants, including those who need evacuation assistance.
    c. Site Plan indicating the following:
        - The occupancy assembly point.
        - The location of fire hydrants.
        - The normal routes of fire department vehicle access.
    d. Floor plans identifying the locations of the following:
        - Exits.
        - Primary evacuation routes.
        - Secondary evacuation routes.
        - Accessible egress routes.
            - Areas of refuge.
            - Exterior areas for assisted rescue.
        - Refuge areas associated with smoke barriers and horizontal exits.
        - Manual fire alarm boxes.
        - Portable fire extinguishers.

- Occupant-use hose stations.
- Fire alarm annunciators and controls.
- A list of major fire hazards associated with the normal use and occupancy of the premises, including maintenance and housekeeping procedures.
- Identification and assignment of personnel responsible for maintenance of systems and equipment installed to prevent or control fires.
- Identification and assignment of personnel responsible for maintenance, housekeeping, and controlling fuel source hazards.
- For Group E Occupancies, Emergency Pre-Fire Planning is required.

12. An evacuation plan in accordance with CFC Section 404 (CFC Section 1207.1.5).
    a. Emergency egress or escape routes and whether evacuation of the building is to be complete by selected floors or areas only with a defend-in-place response.
    b. Procedures for employees who must remain to operate critical equipment before evacuating.
    c. Procedures for the use of elevators to evacuate the building where occupant evacuation elevators comply with Section 3008 of the *California Building Code* are provided.
    d. Procedures for assisted rescue for persons unable to use the general means of egress unassisted.
    e. Procedures for accounting for employees and occupants after evacuation has been completed.
    f. Identification and assignment of personnel responsible for rescue or emergency medical aid.
    g. The preferred and any alternative means of notifying occupants of a fire or emergency.
    h. The preferred and any alternative means of reporting fires and other emergencies to the fire department or designated emergency response organization.
    i. Identification and assignment of personnel who can be contacted for further information or explanation of duties on the plan.
    j. A description of the emergency voice/alarm communication system alert tone and preprogrammed voice messages, where provided.
13. Site plan including the following information (SDCFPD specific requirement). Site plan must include the following information:
    a. Layout of buildings containing ESS or ESS enclosures including separation distances between buildings/enclosures and from exposures.
    b. Fire department access roads including dimensions for width, turning radius, dead ends, and information on any objects obstructing vertical clearance.
    c. Fire hydrant locations.
    d. Locations of fire department connections (FDC), if any.
    e. Emergency stop locations.
    f. Site signage locations (does not need to include signage that is required on enclosures)
    g. Water supply and quantity (not required for sites on municipal water).
14. Plume Modeling Report (SDCFPD specific requirement). See following section for requirements.
15. Hazard mitigation analysis (CFC Section 1207.1.6). Required for all facility locations, including remote outdoor facilities and dedicated use buildings.
16. Documentation for any additional protection measures that are required by the hazard mitigation analysis (CFC Section 1207.1.6.3).
17. Large-scale fire test report (CFC Section 1207.1.7). The test report must be accompanied by a supplemental report that provides interpretation of test data in relation to installation requirements (NFPA 855 Section

9.2.2.2). UL 9540A test results are required for all projects. See the next section for requirements for projects that do not have large-scale fire testing.

18. Report outlining Fire Code compliance and compliance with these guidelines. Any of the above documentation may be included as part of this report. For example, this may be combined with the hazard mitigation analysis. (SDCFPD specific requirement).
19. Emergency preparedness plans (SDCFPD specific requirement, CFC Section 1207.15(11) and NFPA 855 Section 4.3):
    a. Fire Safety and Evacuation Plan prepared in accordance with CFC Section 404 (See Items #11 and #12 of this Section).
    b. Emergency Operations Plan prepared in accordance with NFPA 855 Section 4.3.2.1.
    c. Emergency Response Plan (ERP) in accordance with NFPA 855 Section 4.3.3 and NFPA 855 Annex G.10 for further information.
        - *The attached ERP Template has been created based on NFPA 855 Annex G.10.*
20. Special inspection plan in accordance with CBC Section 1705.1.1. It is critical to ensure that ESS components are installed precisely as required by the manufacturer as to avoid ESS-related emergencies during operation.
    a. The qualified Fire Protection Engineer should provide an opinion on elements that the special inspection plan should cover. Specific consideration towards NFPA 70 Article 706 should be covered which may include but is not limited to:
        - Installation and service performed by qualified individuals who have received safety training to recognize and avoid any hazards that they may be exposed to. Additional training should be provided to ensure the person has the specific skills and knowledge to install and service ESS equipment.
        - Require that installation, commissioning, and service is done strictly in accordance with manufacturer recommendations and detail methods on verifying this is done accordingly.
        - Compliance with circuit and overcurrent provisions per NFPA 70 Articles 706.30 and 706.31 respectively.
21. Maintenance plan outlining testing and inspection requirements and intervals for all safety systems that are referenced in HMA report (SDCFPD specific requirement).
    a. *The Maintenance plan should also outline how maintenance items are documented and how maintenance history is retained (e.g. paper copy, online, etc.).*
22. The following documents that were listed above must be prepared by a qualified Fire Protection Engineer on the San Diego County Fire Protection District California Environment Quality Act Consultant List. Reports may be combined as desired by the applicant:
    a. Report to demonstrate compliance with applicable requirements of the California Fire Code, with these guidelines, and applicable codes and standards. Site specific information may be contained in a separate report from any pre-engineered system documentation if desired by the applicant.
    b. Site specific hazard mitigation analysis.
    c. Plume modeling report.
    d. Emergency preparedness plans.
    e. * Emergency response plan.
    f. * Explosion control system calculation report.

g. * Fire alarm design documents for parts of system that are not included in a pre-engineered system's listing documents.
h. * Fire protection design documents for parts of system that are not included in a pre-engineered system's listing documents.

*** These items are not required to be prepared by the qualified Fire Protection Engineer on the County of San Diego Environment Quality Act Consultant List, however these documents must be reviewed for conformance with the California Fire Code, with these guidelines, applicable codes and standards, and any project specific requirements. A "review by stamp", review letter documenting acceptance, or similar document indicating review and acceptance is required.**

VI. PERFORMANCE CRITERIA

The following requirements must be demonstrated as being met by the documents required above, and any additional documents as needed. This list is not intended to be inclusive, and all requirements of CFC Section 1207 must be met:

1. ESS and major components must be appropriately listed:
    a. Listings must be by an Occupational Health and Safety Administration (OSHA) Nationally Recognized Testing Laboratory (NRTL). The NRTL must be recognized for the specific standard and performed by a laboratory listed on OSHA's website. This list is updated regularly and can be found at: https://www.osha.gov/nationally-recognized-testing-laboratory-program/current-list-of-nrtls
    b. UL 9540 listing must be Edition 3 or more recent. (CFC Section 1207.3.1 and Chapter 80 "Referenced Standards")
    c. Battery management system (BMS) or thermal runaway protection system must be included in UL 1973 or UL 9540 listing. (CFC Section 1207.6.5 and NFPA 855 Section 9.7.6.5.2)
    d. Thermal runaway protection shall be permitted to be provided by the battery management system or capacitor ESS management system that has been evaluated as part of UL 1973 or UL 9540 listing (NFPA 855 Section 9.7.6.5.2).
    e. Power conversion systems (PCS) must be listed in accordance with UL 1741 and compatible with the battery system or included in UL 9540 listing. (CFC Section 1207.3.3).
    f. Fire alarm, detection, and suppression devices must be provided with appropriate UL listings.
2. Large-scale fire testing is required for all installations subject to these guidelines.
    a. CFC currently accepts UL 9540A tests as a "large-scale fire test" (CFC Section 1207.1.7). However, for projects covered by these guidelines, NFPA 855 Section 9.2 requirements will apply. This includes the following:
        i. Testing in accordance with UL 9540A to collect data for gas production at a cell level, thermal runaway propagation potential at a module level, and a thermal runaway propagation potential between adjacent ESSs.
            1. *UL 9540A testing must be a minimum of cell, module, and unit level testing. Installation level testing must be provided when utilizing alternative fire suppression systems (see below) or when performance criteria for unit level test were not met.*

ii. In addition to UL 9540A, an additional unit-level ("large-scale fire test") test shall be conducted involving intentional ignition of the vent gases to assess the fire propagation hazard. This test must demonstrate that a fire involving one ESS unit will not propagate to an adjacent unit at the proposed spacing.
    1. *Consider, the additional large-scale fire test shall only be required where cell and/or module level thermal runaway shows flammable gas generation per NFPA 855 Section 9.2.1.2. CSA TS 800 may be an appropriate test method to satisfy this requirement.*
    2. *Consider, with the recent 6th Edition of UL 9540A test procedure, a large-scale fire test is included and therefore would satisfy the large-scale fire test requirements of NFPA 855.*

b. Testing shall be conducted by an approved testing laboratory (must be a NRTL or others approved on case-by-case basis). The laboratory must provide a report characterizing the composition of the gases generated and show that a fire involving one ESS unit will not propagate to an adjacent unit.

c. All testing must be provided with a supplemental report that provides interpretation of test data in relation to installation requirements (NFPA 855 Section 9.2.2.2). For outdoor ESS enclosures, this report or an additional report must validate that complete combustion of one enclosure will not propagate to an adjacent enclosure. The report must use anticipated wind conditions at the site and information from large-scale fire testing. This requirement may be combined with other reports if sufficient detail is provided.

d. All test reports and supplemental reports shall be submitted for review.

e. Proposed projects utilizing BESS units with only UL 9540A (2019 Ed.) testing will be considered when justified with additional protection measures including but not limited to robust water supply on site, fire modeling, increased separation distances to lot lines and from exposures, and/or additional fire protection measures such as fire barriers. If pursuing this exception, please contact the Fire Protection District early to discuss an acceptable approach to prevent project delays.

NFPA 855 Section 9.2.1.1 does not require UL 9540A and large-scale fire testing if the BESS is listed to UL 1973, used in stationary standby services, and is of the following technologies:

a. Lead acid
b. Aqueous nickel-based
c. Aqueous metal air batteries comprised of vented cells, or cells or batteries

In addition to these criteria, the previously listed battery technologies must also meet one of the following:

a. They are installed with a charging system that is listed to UL 1012, UL 1564, UL 60950-1, UL 62109-1, or UL 62368-1.
b. They are installed with an inverter that is listed to UL 1741.
c. They are part of a UPS that is listed to UL 1778.
d. They are used for control of substations and control or safe shutdown of generating stations under the exclusive control of the electric utility and located outdoors or in building spaces used exclusively for such installations.

e. They are used for control of fixed guideway transit or passenger rail systems under the exclusive control of a transit authority and located outdoors or in building spaces used exclusively for such installations.

f. They are used in telecommunications facilities for installations of communications equipment under the exclusive control of communications utilities and located outdoors or in building spaces used exclusively for such installations.

3. Fire suppression is not required for outdoor enclosures that are not walk-in units (CFC Section 1207.5.5). Fire suppression is required for BESS installations within buildings, unless permitted to be omitted in accordance with CFC Table 1207.7, note C. Additionally, there are three (3) exceptions provided per CFC Section 1207.5.5 which are listed below:

   a. Fire suppression systems for lead-acid and nickel-cadmium battery systems at facilities under the exclusive control of communications utilities that operate at less than 50 VAC and 60 VDC shall be provided where required by NFPA 76.

   b. Lead-acid and nickel-cadmium systems that are used for DC power for control of substations and control or safe shutdown of generating stations under the exclusive control of the electric utility and located outdoors or in building spaces used exclusively for such installations, shall not be required to have a fire suppression system installed.

   c. Lead-acid battery systems in uninterruptable power supplies listed and labeled in accordance with UL 1778, utilized for standby power applications, which is limited to not more than 10% of the floor area on the floor on which the ESS is located, shall not be required to have a fire suppression system.

   When fire suppression is provided as a required or optional system, the following requirements apply:

   a. Installation of automatic sprinkler systems shall be in accordance with CFC Section 903.3.1.1. Sprinkler system density shall be in accordance with NFPA 855 Section 4.9.3. Where ESS groups exceed 50 kWh and testing is not available to determine a sprinkler system density, the sprinkler density shall be based on an engineering analysis provided for review.

   b. Where fire suppression is required (either by UL 9540 listing or by CFC), installation of water spray or water mist suppression systems shall be based on installation-level UL 9540A or equivalent testing. Where an optional fire suppression system is provided (i.e. in an enclosure that did not require installation-level testing), testing is not required but is recommended.

   c. Installation of alternative fire suppression systems that are not water-based is not recommended for the suppression of a fire involving the battery system. Installation of these systems will be approved only on a case-by-case basis as an optional system when shown to not have negative interaction with other safety systems (such as an NFPA 69 explosion control system). Where fire suppression is required, a water-based suppression system shall also be provided, as recommended by NFPA 855 Appendix G.

4. Fire detection systems shall be provided for all facilities and transmit alarm signals in accordance with CFC Section 1207.5.4. For outdoor, non-walk-in unit installations where detection systems are not provided in the enclosures, a fire detection system must be installed outside of the enclosures.

   a. Fire detection systems must comply with CFC Section 907.2 and NFPA 72.

b. Fire detection systems must activate a fire alarm system with occupant notification where ESS are installed in a building with other occupancies.
c. Sites with multiple fire alarm panels must be aggregated to a master panel at an approved location. This location must be included in the emergency response plan and evaluated in the hazard mitigation analysis (NFPA 855 Section 4.8.2.2 and A.4.8.2.2).

5. Explosion control is required to be provided for all rooms, areas, ESS cabinets, or ESS walk-in units (CFC Section 1207.6.3). Explosion control systems must be designed, installed and maintained in accordance with the following:
   a. Explosion control must be in accordance with NFPA 69 (NFPA 855 Section 9.7.6.7.3). ESS enclosures may also meet NFPA 855 Section 9.7.6.7.3.3 in lieu of providing an NFPA 69 system.
   b. NFPA 69 is preferred to NFPA 68 per NFPA 855 Section A.9.7.6.7.3 because NFPA 68 does not address detonation which can be caused by hydrogen accumulation in confined spaces (a reasonable risk for BESS). Proposed projects utilizing BESS units with only NFPA 68 explosion control systems should complete a performance-based design. The performance-based design should consider the type of combustible gases generated during the cell-, module-, and installation-level test under UL 9540A. Where the possibility of detonation exists, alternative solutions, such as an automatic opening system, should be considered.
   c. All requirements of NFPA 855 Section 9.7.6.7 as applicable to the selected system.
   d. A report must be provided documenting the approach and compliance with the entirety of applicable standards.
   e. Gas detection systems that are used to initiate an explosion control system must meet the requirements of NFPA 72. The gas detection equipment shall be listed in accordance with applicable standards such as UL 1484 or UL 2075 for the specific gas or vapor it is intended to detect.

   CFC Section 1207.6.3 lists some instances in which an explosion control system is not required. Exceptions are as follows:

   a. Where approved, explosion control is permitted to be waived by the fire code official based on large-scale fire testing complying with CFC Section 1207.1.7 that demonstrates that flammable gases are not liberated from electrochemical ESS cells or modules.
   b. Where approved, explosion control is permitted to be waived by the fire code official based on documentation provided in accordance with CFC Section 104.2.2 that demonstrates that the electrochemical ESS technology to be used does not have the potential to release flammable gas concentrations in excess of 25% of the LFL anywhere in the room, area, walk-in unit or structure under thermal runaway or other fault conditions.
   c. Where approved, ESS cabinets that have no debris, shrapnel or enclosure pieces ejected during large-scale fire testing complying with CFC Section 1207.1.5 shall be permitted in lieu of providing explosion control complying with CFC Section 911.
   d. Explosion control is not required for lead-acid and nickel-cadmium battery systems less than 50 VAC, 60 VDC in telecommunication facilities under the exclusive control of communications utilities located in building spaces or walk-in units used exclusively for such installations.

e. Explosion control is not required for lead-acid and nickel-cadmium systems used for DC power for control of substation and control or safe shutdown of generating stations under the exclusive control of the electric utility, located in building spaces or walk-in units used exclusively for such installations.

f. Explosion control is not required for lead-acid battery systems in uninterruptable power supplies listed and labeled in accordance with UL 1778, utilized for standby power applications, and housed in a single cabinet in a single fire area in buildings or walk-in units.

6. A hazard mitigation analysis is required for all facilities subject to these guidelines.

a. The hazard mitigation analysis must address the fault conditions indicated in CFC Section 1207.1.6.1 and NFPA 855 Section 4.4.2. The failure of each safety system during a thermal runaway event must be evaluated. The failure of multiple safety systems at the same time is not required to be evaluated per NFPA 855 Section 4.4.2.2. Fault modes required to be evaluated per CFC Section 1207.1.6.1 and NFPA 855 Section 4.4.2.1 are as follows:

i. A thermal runaway condition in a single electrochemical ESS unit.

ii. A mechanical failure of a nonelectrochemical ESS units.

iii. Failure of any battery (energy) management system or fire protection system within the ESS equipment that is not covered by the product listing failure mode effects analysis (FMEA).

iv. Failure of any required protection system external to the ESS, including but not limited to ventilation (HVAC), liquid cooling system, BMS communication system, exhaust ventilation, smoke detection, fire detection, gas detection, fire suppression systems or other critical systems that might impact normal operations.

b. Other credible failure scenarios must be evaluated as appropriate, including but not limited to the following:

i. Seismic events.

ii. Flame impingement due to a wildfire or from other fire hazards on site (such as transformers or liquefied propane tanks).

iii. Thermal runaway conditions beyond the requirements of CFC Section 1207.1.6.1. This includes failure that could result in a partial volume deflagration and a failure of all cells.

c. The HMA shall evaluate the reliability and survivability of the following critical safety components or systems, during a thermal runaway propagation or single failure event:

i. Exhaust ventilation

ii. Smoke detection

iii. Fire detection

iv. Fire suppression

v. Combustible concentration reduction (CCR) system

vi. Gas detection

vii. Explosion control and prevention

d. Mitigation strategies must consider site specific limitations, such as those outlined in NFPA 855 Appendix G.3.3. This may include but is not limited to lack of or minimal water supply, delayed response time due to site location, configuration of site layout impact on fire department response, and presence of personnel on site to assist in early-stage emergency operations.

e. Where 100-foot setback from lot lines is not required, the HMA must address the appropriate minimum distance of enclosures from lot lines needed to achieve the analysis approval criteria or confirm that code required minimums are sufficient.

f. Analysis approval is as outlined in CFC Section 1207.1.6.2 and NFPA 955 Section 4.4.3 which are as follows:

i. Fire will be contained within unoccupied ESS rooms for the minimum duration of the fire resistance rating required by code.

ii. Fire and products of combustible will not prevent occupants from evacuating to a safe location.

iii. Deflagration hazards will be addressed by an explosion control and prevention system.

g. Additional mitigation measures must be clearly identified in the HMA and addressed by project documentation.

7. All safety systems that rely on power must be provided with a reliable emergency power supply system (EPSS) in accordance with CFC Section 1203 and NFPA 855 Section 4.10.

a. The EPSS installation must comply with these requirements, CFC Section 1203, NFPA 110, NFPA 111, and the California Electrical Code (CEC).

b. Transfer must occur within 10 seconds after primary power is lost. The transfer time is permitted to be increased if evaluated as part of the HMA and a safe critical infrastructure load transfer. Transfer time may also be met by the combination of multiple systems (such as a UPS and a generator).

c. The load requirements shall be determined by a registered design professional with an EPSS design background. The duration shall include a 48-hour period of standby time (prior to a failure) and an active duration of at least 48-hours (SDCFPD specific requirement) for new facilities located within Fire Threat Area Tier 3 (Extreme) as indicated on the CPUC Fire Threat Map in Section XI of this document. The 48-hour active duration is to address internal failures of the BESS during a Public Safety Power Shutoff. Existing facilities shall have an active duration based on the expected event duration of one BESS in failure and an additional BESS unit as a safety margin per NFPA 855 Section A.4.10.2.1.

It is important to also note that pre-emptive transfer to an emergency power supply prior to grid de-energization by the BESS operator is acceptable.

d. All BESS protection systems (e.g. ventilation, suppression, management systems) will need to be provided with an EPSS sized for an active duration of 48-hours for new facilities, and an active duration sized based on the HMA for an existing facility (SDCFPD specific requirement).

e. The EPSS must be located such that a failure event of the BESS does not compromise the operation of the system per NFPA 855 Section 4.10.4.

f. Acceptable means of emergency power supply can be determined based on CEC Section 700.12. Stored energy systems are considered ESS and must also meet the requirements of the CFC/these guidelines as applicable.

g. Systems that are provided with backup power from a fire alarm system are not required to be included in loads for the EPSS when the fire alarm system is sized for the minimum load durations as determined above.

h. The safety systems that may require power from the EPSS include but are not limited to the following:
    i. Smoke detection
    ii. Fire detection
    iii. Fire suppression
    iv. Explosion control
    v. Gas detection

i. The CFC does not provide the following exception however, per NFPA 855 Section 4.10.5, EPSS shall not be required on mechanical ventilation systems for all types of lead-acid, aqueous nickel-based, and aqueous metal-air batteries used in ESS in stationary standby service that complies with any of the following:
    i. Comprised of vented cells in systems 600 V dc or less
    ii. Comprised of cells or batteries listed to UL 1973 in systems 600 V dc or less
    iii. Used for control of substations and control or safe shutdown of generating stations under the exclusive control of the electric utility and located outdoors or inbuilding spaces used exclusively for such installations
    iv. Used for control of fixed guideway transit or passenger rail systems under the exclusive control of a transit authority and located outdoors or in building spaces used exclusively for such installations.
    v. Are less than 60 V dc in telecommunications facilities for installations of communications equipment under the exclusive control of communications utilities and located outdoors or in building spaces used exclusively for such installations
    vi. Utilized in uninterruptible power supplies listed to UL 1778, which occupy no more than 10 percent of the floor area on the floor on which they are located

8. Plume modeling must be provided and shall meet the following requirements:
    a. Failure scenarios:
        i. Dispersion modeling shall evaluate flammability and toxicity hazards for all credible battery failure scenarios, including both flaming and non-flaming conditions. Provide technical justification for omitting any scenario.
        ii. Recommended flaming scenarios include full fire propagation within a single BESS enclosure. Multiple BESS enclosures shall also be evaluated where propagation is demonstrated by UL 9540A testing or is otherwise reasonably expected based on test data.
        iii. Recommended non-flaming scenarios include non-flaming propagation with reasonable conservatism to capture a credible bounding scenario.
        iv. Expected flammable and toxic gases and/or particulates shall be identified and justified using available UL 9540A test data or other credible literature. Flaming scenarios shall also consider contributions from enclosure materials, including plastics, insulation, coolants, refrigerants, and flame retardants using available test data, published literature, or a combination of both. Toxic gas species, yields, release rates, fire size, and heat release rate assumptions shall be defined and technically supported based on UL 9540A test data or published literature.

v. Where test data do not adequately characterize heat release rate or expected toxic-gas generation, a technically justified engineering analysis shall be performed using available test observations, system characteristics, and published literature.
vi. Heavier than air gas behavior, including potential separation from the plume and transport toward ground level, shall be evaluated. Separate species transport simulations shall be performed where necessary.

b. Exposure Criteria, and Consequence Distances
i. Dispersion modeling shall distinguish between first responder/on-site worker exposure and community exposure. Toxicity thresholds and exposure durations shall be selected based on the applicable population, failure scenario, and credible exposure duration.
ii. First responders / on-site workers
IDLH criteria may be used for first responder approach, entry, and staging considerations. Consequence distances shall be evaluated at representative breathing height and other relevant elevations, with any additional factor of safety identified and justified.
iii. Community exposure
Community exposure shall be evaluated using the AEGL framework. At a minimum, available AEGL-1 and AEGL-2 consequence distances shall be reported for relevant species at representative breathing height, with any additional factor of safety identified and justified. Where elevated occupied receptors are present, concentrations shall also be evaluated at their representative elevations. AEGL-3 consequence distances shall also be reported where the modeled contour extends beyond the site/property boundary or affects off-site receptors.
iv. Flammable-gas consequence distances shall be reported at 25% LFL and 100% LFL (Lower Flammability Limit), where applicable, to characterize the extent of the potentially flammable vapor cloud.
v. The report shall provide modeled consequence distances and exposure-threshold contours for all applicable scenarios. Plume contours shall be overlaid on the site map showing the BESS location, property boundaries, nearby public receptors, and relevant receptor distances/elevations.

c. Exposure duration
i. The selected AEGL duration shall reflect the credible receptor exposure duration. The analysis shall clearly demonstrate how the expected total event or release duration is translated into receptor exposure duration, considering plume arrival, and emergency-response assumptions. The selected AEGL duration and any conservative adjustment shall be justified and acceptable to the fire official/AHJ.
ii. Where exposure duration falls between published AEGL durations, the next longer duration may be used on a conservative screening basis.

d. Meteorological and Site conditions
i. Where available, site-specific wind roses shall be used to inform the selection of representative wind speeds and directions.
ii. Surface roughness shall represent site land use.
iii. The meteorological data source, period of record, and basis for selecting the modeled conditions shall be documented.

iv. Dispersion modeling shall include 1.5 m/s (3.4 mph) wind speed and Pasquill Stability Class F, consistent with U.S. EPA worst-case meteorological conditions, with ambient temperature and relative humidity selected and justified for the site.

v. Dispersion modeling shall include representative summer and winter conditions based on long-term site-specific meteorological data. Wind-speed sensitivity shall be evaluated over a representative range of site-specific conditions, including wind speeds up to the 99th percentile, with corresponding atmospheric stability, ambient temperature, and relative humidity. The analysis shall identify and report the meteorological condition producing the maximum plume extent for each applicable endpoint. The highest wind speed shall not be assumed to be controlling; lower and intermediate wind-speed conditions shall also be evaluated.

e. Modeling requirements

i. Dispersion modeling shall use an approved or accepted modeling tool appropriate to the release scenario, site conditions, and modeling objective, such as PHAST, FDS, AERMOD, SCICHEM, or other applicable models consistent with recognized guidance and accepted by the fire official/AHJ.

ii. Key model inputs, assumptions, methodologies, and limitations shall be clearly documented and technically justified.

iii. Where available, release area and velocity shall be based on actual enclosure openings/vent sizes, including HVAC/ventilation openings, deflagration vents, and the expected discharge conditions.

iv. Where applicable, the computational domain shall be sufficient to ensure that plume behavior is not influenced by domain boundaries. Release area, temperature, velocity, release rate, duration, height, and other relevant source conditions shall be explicitly defined.

v. The effects of nearby obstructions, including adjacent BESS enclosures, sound walls, and other on-site structures, if any, shall be considered where they may influence local flow or plume behavior.

f. Interpretation of modeled distances

i. IDLH and AEGL consequence distances are intended to support safety, emergency-response, and risk evaluations. They shall not automatically be assumed to represent the final recommended setback for a specific site.

ii. These distances shall be provided to and discussed with the fire official/AHJ, who shall determine appropriate protective actions and setback distances considering the incident scenario, plume conditions, nearby receptors, site configuration, evacuation or shelter-in-place, monitoring capabilities, local conditions, the Emergency Response Plan, and established response protocols.

g. Mitigation: Where dispersion modeling indicates unacceptable risk, as determined by the AHJ, mitigation measures shall be identified. Mitigation measures may include layout modifications, increased setback distances, physical barriers, or operational controls in coordination with fire officials/AHJs.

9. 100-foot setbacks are required from lot lines where residential, educational, or institutional occupancies are located. The 100-foot setback is applicable to battery systems, other ESS/utility components may

be located within 100 feet of lot lines. Separation distances to other exposures and from lot lines to other occupancies are based on current code required minimums, or as documented in the HMA.

10. Separation distances between BESS enclosures are required to be as follows:
    a. Distances based on testing which intentionally initiates a fire in an ESS enclosure to evaluate propagation to adjacent enclosures. UL 9540A (4th ed.) testing does not include this test procedure and is not considered to meet this requirement. Refer to Item 2b for additional information.
11. When an exception is granted to waive large-scale fire testing involving the intentional ignition of vent gases, alternative justifications such as the fire rating of enclosures or a fire exposure analysis may be considered. These justifications must be submitted in the form of a report or as part of a report that is prepared by a fire protection engineer from the County of San Diego's approved BESS consultant qualification list.
12. Emergency preparedness plans are required for all facilities as follows:
    a. Fire Safety and Evacuation Plan in accordance with CFC Section 404. May be omitted when approved by the SDCFPD.
    b. Emergency Operations Plan complying with NFPA 855 Section 4.3.2.1. Emergency operations plan must address any response from on-site personnel that is included as a mitigation strategy in the HMA.
    c. Emergency Response Plan. See NFPA 855 Appendix G.10.9 for guidance and the attached Emergency Response Plan Template. Emergency response plan must address any expected response from the fire department that is included as a mitigation strategy in the HMA.
13. Fire apparatus access roads are required for all facilities and must meet the requirements of CFC Section 503 and the SD County Consolidated Fire Code. The following specific considerations are noted:
    a. Roads must extend within 150 feet of all portions of the facility, which includes BESS units.
    b. Location of the road with respect to BESS enclosures that may make access difficult or impossible during an incident must be considered (for example, a road that is in the direction of a deflagration vent within the calculated fireball distance).
    c. The fire code official has the authority to make additional requirements where necessary in accordance with CFC Section 503.2.2.
    d. Any impacts due to modifications to fire apparatus access roads that are granted must be documented in the HMA and emergency response plan.
14. Water supply is required for all facilities in accordance with CFC Section 507.
    a. Where fire sprinkler systems are provided, fire flow shall be the greater of the fire sprinkler system demand including hose stream allowance or the calculated fire flow.
    b. Where nonmechanical ESSs are installed, they shall be provided with a permanent source of water for fire protection. Where no permanent adequate and reliable water supply exists for firefighting purposes, the requirements of NFPA 1142 shall apply (NFPA 855 Section 4.9.5).
    c. Accessible fire hydrants shall be provided for site ESS installations where a public or private water supply is available (NFPA 855 Section 4.9.5.3).
    d. For sites with ancillary buildings that do not contain ESS, the requirements of CFC Appendix B or the Insurance Service Office "Guide for Determination of Fire Flow" are

applicable. Where located in rural or suburban areas where an adequate and reliable water supply is not available, NFPA 1142 may be used.

e. Fire flow rate for buildings containing ESS shall be calculated as stated in Item 14a, with a duration of 2 hours. SDCFPD will establish a plan to supply additional water utilizing this 2-hour window.

f. The fire flow for ESS enclosures shall be calculated as follows:
   i. The fire flow rate must be a minimum of 250 GPM.
   ii. The duration is 2 hours. SDCFPD will establish a plan to supply additional water utilizing this 2-hour window.

g. Fire flow needed to control spread of fire from other equipment located on site, such as transformers, shall be based on an engineering analysis that is provided for review.

h. The fire flow for the site shall be based on the greatest calculated fire flow from the methods above as applicable. For example, for a site consisting of outdoor ESS enclosures and an ancillary building, the fire flow is the greater of that calculated for the building and that calculated for the ESS enclosures.

i. Fire hydrant systems must meet the requirements of CFC Section 507.5 and CFC Appendix C. Additional fire hydrants may be requested as needed to assist in fire department response efforts.

j. Where an adequate and reliable water supply system for firefighting purposes does not otherwise exist, NFPA 1142 may be used. However, the minimum water supply quantity must still be based on the methods outlined above. NFPA 1142 water supply quantity is based on structural protection and does not contain guidance for special fire protection hazards.

15. Use of any protection technology that is not required or addressed by current codes or standards may be approved on a case-by-case basis. Approval will be based on the following:

a. Testing and/or analysis by a reputable third party demonstrating the effectiveness of the technology when used in lieu of providing a code required protection system (i.e. an emerging suppression system being utilized in lieu of a code required sprinkler system).

b. Testing and/or analysis by a reputable third party demonstrates that the technology will not have negative interactions with other safety systems.

c. Thermal Runaway Propagation Prevention (TRPP) Protection Systems (NFPA 855 Section 9.7.6.6):
   i. Definition: An active means to mitigate thermal runaway propagation. As an example, some TRPP systems sense the venting of gases or elevated cell temperatures and release an agent to absorb sufficient heat such that thermal runaway will not propagate to adjacent cells.
   ii. Fluid based supplemental systems shall be compliant with applicable parts of ASME B31.1 or B31.3. Compliance shall be documented as part of UL 9540 listing.
   iii. The control system shall be a fire alarm control unit specifically listed for releasing service.
   iv. The system must comply with Emergency Power Supply requirements (see Item 7 of these guidelines).
   v. The system effectiveness must be evaluated as part of the required fire testing.
   vi. The system must comply with the commissioning requirements below.

vii. The system must be inspected and tested at least annually.

VII. EXISTING FACILITIES

Existing facilities must provide the following documentation:

1. HMA where the facility utilizes equipment that is not UL 9540 listed.
2. All emergency planning documents that are required for new facilities:
    a. Fire Safety and Evacuation Plan in accordance with CFC Section 404. May be omitted when approved by SDCFPD for sites that are not regularly occupied, including by maintenance and operations personnel.
    b. Emergency Operations Plan complying with NFPA 855 Section 4.3.2.1.
    c. Emergency Response Plan. See NFPA 855 Appendix G.10.9 and the SDCFPD ERP Template for guidance.

VIII. REQUIRED COMMISSIONING, INSPECTION, TESTING & MAINTENANCE

Commissioning and Maintenance plans must address the following, at a minimum:

1. Manufacturer's specified commissioning and maintenance procedures.
2. Periodic inspection and testing intervals and procedures must be noted in the maintenance plans and performed in accordance with manufacturer's recommendations, any deviations noted in the HMA, and in accordance with applicable codes and standards such as NFPA 13, NFPA 25, NPFA 72, and NFPA 69. The maintenance plan must be submitted as part of the permit documents and is subject to approval.
3. Systems that are designed in accordance with NFPA 69 must initially be inspected and tested at 3-month intervals. This duration may be increased or decreased based on a hazard analysis and based on performance after multiple inspection intervals.
4. Where two or more integrated critical safety systems are present, the systems shall be tested in accordance with NFPA 4. Testing shall be conducted prior to certificate of occupancy and at 5-year intervals during the operation of the facility.
5. Records of completed testing are required to be kept on site in hard copy form and be available to San Diego County Fire Protection District upon request.

IX. COST RECOVERY

Facility owners must reimburse emergency services for response costs, ensuring sustainability of public safety operations. This ensures that the financial burden of emergency response services, such as personnel, equipment, logistics, and other resources, is reimbursed by BESS facility owners or responsible parties. This approach promotes financial sustainability for emergency services while prioritizing public safety and environmental protection. Additionally, these requirements will be periodically reviewed and updated to current operational costs.

X. CAUSE AND ORIGIN

As a part of cause and origin for fires in BESS facilities root cause analysis shall be conducted by the Fire Chief, their designee, or the fire chief may direct the owner to hire an approved third party. Any associated costs to conduct the analysis shall be borne by BESS facilities owners or responsible parties.

XI. CPUC FIRE THREAT MAP

Note, the CPUC Fire Threat Map located on the linked website and any updates by CPUC take precedence over the map provided in this document.

