City of San Marcos/
San Marcos Fire Department

Protection Guidelines for Lithium-Ion BESS Facilities

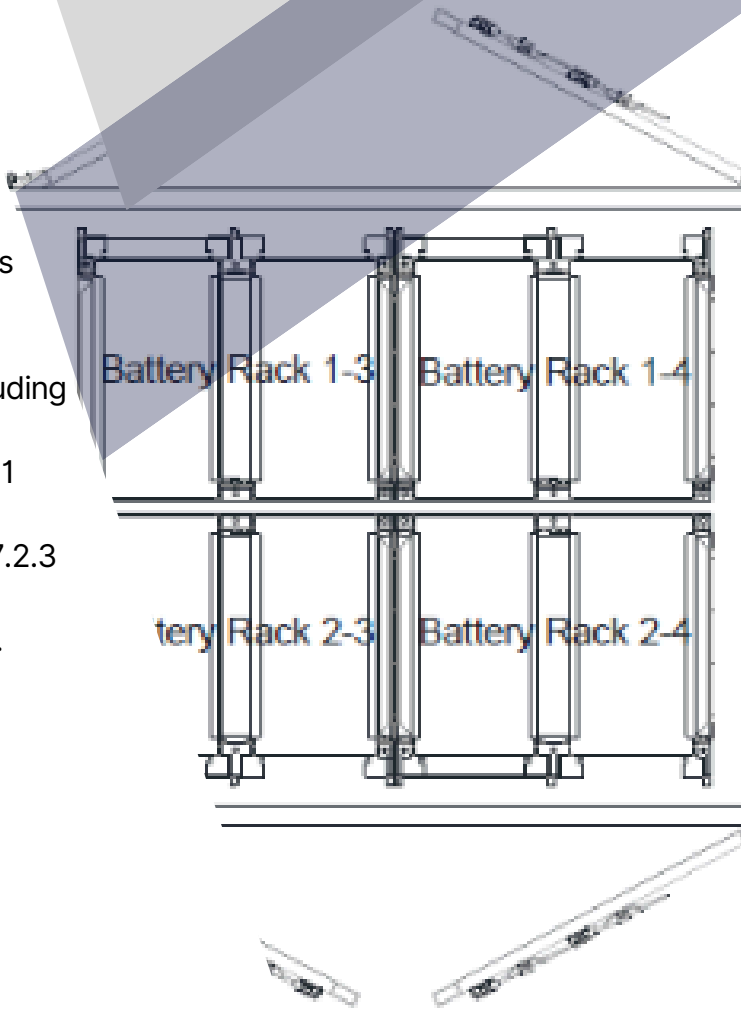
This protection guideline applies to all facilities utilizing lithium-ion batteries in an energy storage system (ESS) where the nominal capacity exceeds 600 kWh. References to NFPA 855 are to the 2023 Edition.

TABLE OF CONTENTS

SUBMITTAL REQUIREMENTS

The following must be submitted for review to the San Marcos Fire Department:

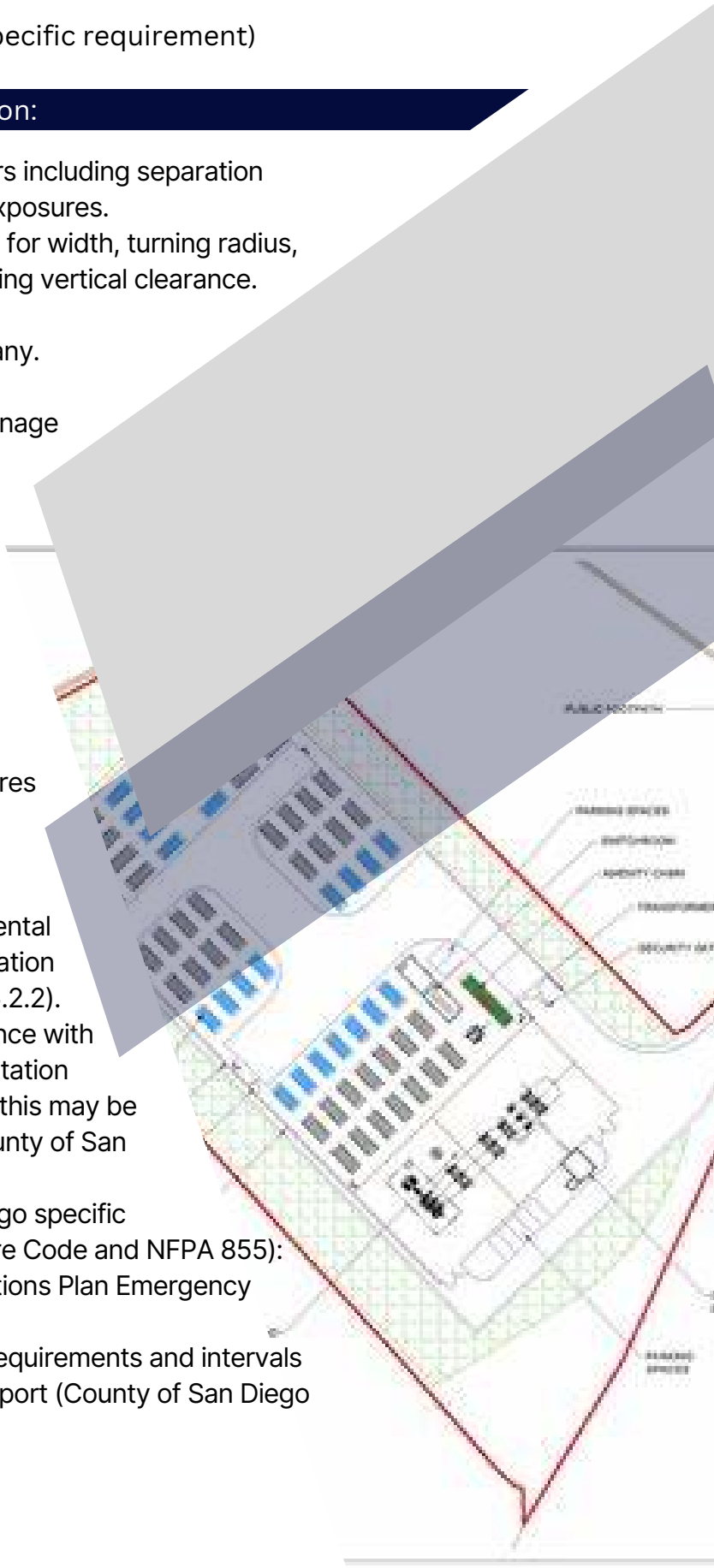
- Location and layout diagram of the room or area in which the ESS is to be installed (CFC Section 1207.1.3).
- Details on the hourly fire-resistance ratings of assemblies enclosing the ESS (CFC Section 1207.1.3).
- The quantities and types of ESS to be installed (CFC 1207.1.3). ESS Capacities must be the total energy capable of being stored (nameplate rating), not the usable energy. (CFC Table 1207.1.1 Footnote a)
- Manufacturer's specifications, ratings, and listings of each ESS.
- Description of energy storage management systems and their operation (CFC Section 1207.1.3)
- Location and content of required signage (CFC Section 1207.1.3)
- Details on fire suppression, smoke or fire detection, thermal management, and **explosion control system** (CFC Section 1207.1.3 – modified text in **BOLD** to clarify explosion control requirement – exhaust ventilation is not required for lithium-ion).
- A report must be provided for all explosion control systems documenting compliance with appropriate standards (see next section).
- Support arrangement associated with the installation, including any required seismic restraint (CFC Section 1207.1.3).
- A commissioning plan complying with CFC Section 1207.2.1 (CFC Section 1207.1.3).
- A decommissioning plan complying with CFC Section 1207.2.3 (CFC Section 1207.1.3).
- Site plan including the information found on the next page. (County of San Diego specific requirement).



SITE PLAN (County of San Diego specific requirement)

Site plan must include the following information:

- Layout of buildings containing ESS or ESS containers including separation distances between buildings/containers and from exposures.
- Fire department access roads including dimensions for width, turning radius, dead ends, and information on any objects obstructing vertical clearance.
- Fire hydrant locations.
- Locations of fire department connections (FDC), if any.
- Emergency stop locations.
- Site signage locations (does not need to include signage that is required on containers)
- Water supply and quantity (not required for sites on municipal water).
- Plume Modeling Report (County of San Diego specific requirement). See following section for requirements.
- Hazard mitigation analysis (CFC Section 1207.1.4). Required for all facility locations, including remote outdoor facilities and dedicated use buildings.
- Documentation for any additional protection measures that are required by the hazard mitigation analysis (CFC Section 1207.1.4.3).
- Large-scale fire test report (CFC Section 1207.1.5). The test report must be accompanied by a supplemental report that provides interpretation of test data in relation to installation requirements (NFPA 855 Section 9.1.5.2.2).
- Report outlining Fire Code compliance and compliance with these interim 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). (County of San Diego specific requirement)
- Emergency preparedness plans (County of San Diego specific requirement, also required by 2024 International Fire Code and NFPA 855):
- Fire Safety and Evacuation Plan Emergency Operations Plan Emergency Response Plan
- Maintenance plan outlining testing and inspection requirements and intervals for all safety systems that are referenced in HMA report (County of San Diego specific requirement).



REPORTS REQUIRED

The following documents must be prepared by a qualified Fire Protection Engineer or by a consultant on the City of San Marcos California Environment Quality Act Consultant List. Reports may be combined as desired by the applicant:

- Plume modeling report
- Site specific hazard mitigation analysis
- Explosion control system calculation report*
- Emergency preparedness plans
- Fire alarm design documents for parts of system that are not included in a pre-engineered system's listing documents*
- Fire protection design documents for parts of system that are not included in a pre-engineered system's listing documents*
- 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.

* These items are not required to be prepared by the qualified Fire Protection Engineer on the City of San Marcos California 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" or review letter documenting acceptance.

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 all-inclusive, and all requirements of CFC Section 1207 must be met:

1. ESS and Major components must be appropriately listed:

- 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

- UL 9540 listing must be Edition 2 or more recent. (CFC Section 1207.3.1 and Chapter 80 "Referenced Standards")

- 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 9.6.5.5

- 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).

- Fire alarm, detection, and suppression devices must be provided with appropriate UL listings.

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 all-inclusive, and all requirements of CFC Section 1207 must be met:

2. Large-scale fire testing is required for all installations subject to these interim TESTING guidelines. Testing shall be conducted by an approved testing laboratory (must be a NRTL or approved on case-by-case basis). UL 9540A or equivalent testing reports must be provided at a minimum (CFC Section 1207.1.5).

- 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 was not met.

- Testing that is performed beyond the scope of UL 9540A may be provided in addition to UL 9540A. This may include testing in accordance with CSA TS-800 or testing that involved intentional ignition of battery off-gas to assess the fire propagation hazard. At this time, this is not required to meet a specific test standard and will be evaluated individually for each project as CSA TS-800 is the only test standard currently on the market and was recently released.

- All testing must be provided with a supplemental report that provides interpretation of test data in relation to installation requirements (NFPA 855 Section 9.1.5.2.2). This requirement may be covered by other reports if sufficient detail is provided in the Code Compliance report or the HMA.

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 all-inclusive, and all requirements of CFC Section 1207 must be met:

3. Fire suppression is not required for outdoor containers that are not walk-in units (CFC Section 1207.5.5). Fire suppression is required for buildings, unless permitted to be omitted in accordance with CFC Table 1207.7 Note C. When fire suppression is provided as a required or optional system, the following requirements apply:

- Installation of automatic sprinkler systems shall be in accordance with CFC Section 903.1.1. Sprinkler system density shall be in accordance with NFPA 855 Section 4.9.2.

- 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 a container that did not require installation-level testing), testing is not required but is recommended.

- 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 system). Where fire suppression is required, a water-based suppression system shall also be provided, as recommended by NFPA 855 Appendix G.

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 all-inclusive, and all requirements of CFC Section 1207 must be met:

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

- Fire detection systems must comply with CFC Section 907.2 and NFPA 72.
- Fire detection systems must activate the fire alarm system with occupant notification where ESS are installed in a building with other occupancies.
- 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).

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 all-inclusive, and all requirements of CFC Section 1207 must be met:

5. Explosion control is required to be provided for all rooms, areas, ESS cabinets, or ESS walk-in units (CFC Section 1207.6.3 – ESS cabinets added for clarification based on 2024 International Fire Code and NFPA 855). Explosion control systems must be designed, installed and maintained in accordance with the following:

- NFPA 68 or NFPA 69. ESS cabinets may also meet NFPA 855 Section 9.6.5.6.4 in lieu of providing an NFPA 68 or NFPA 69 system.
- All requirements of NFPA 855 Section 9.6.5.6 as applicable to the selected system.
- A report must be provided documenting the approach and compliance with the entirety of applicable standards.
- All critical components of NFPA 69 systems must be provided with a standby power system meeting the requirements of CFC Section 1203. The standby power must be sized to provide power for 24 hours of standby time for the gas detection system and for the expected single battery enclosure failure event duration in “alarm” for all components. This duration is to be documented in the NFPA 69 report or in the HMA.
- The report provided for an NFPA 68 system must include fireball size which must be incorporated into the site layout and emergency planning.

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 all-inclusive, and all requirements of CFC Section 1207 must be met:

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

- The hazard mitigation analysis must address the fault conditions indicated in CFC Section 1207.1.4.1. 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.

- Other credible failure scenarios must be evaluated as appropriate, including but not limited to the following: Seismic events. Flame impingement due to a wildfire. Thermal runaway conditions beyond the requirements of CFC Section 1207.1.4.1. This includes failure that could result in a partial volume deflagration and a failure of all cells.

- 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.

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

- Analysis approval is as outlined in NFPA 855 Section 4.4.3.

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

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 all-inclusive, and all requirements of CFC Section 1207 must be met:

7. Plume modeling must be provided meeting the following:

- The following software list is pre-approved. Others may be approved on a case-by-case basis:
  i. AERMOD
  ii. Fire Dynamics Simulator (FDS)
  iii. Process Hazard Analysis Software (PHAST)
  iv. SAFER/TRACE
  v. SCICHEM

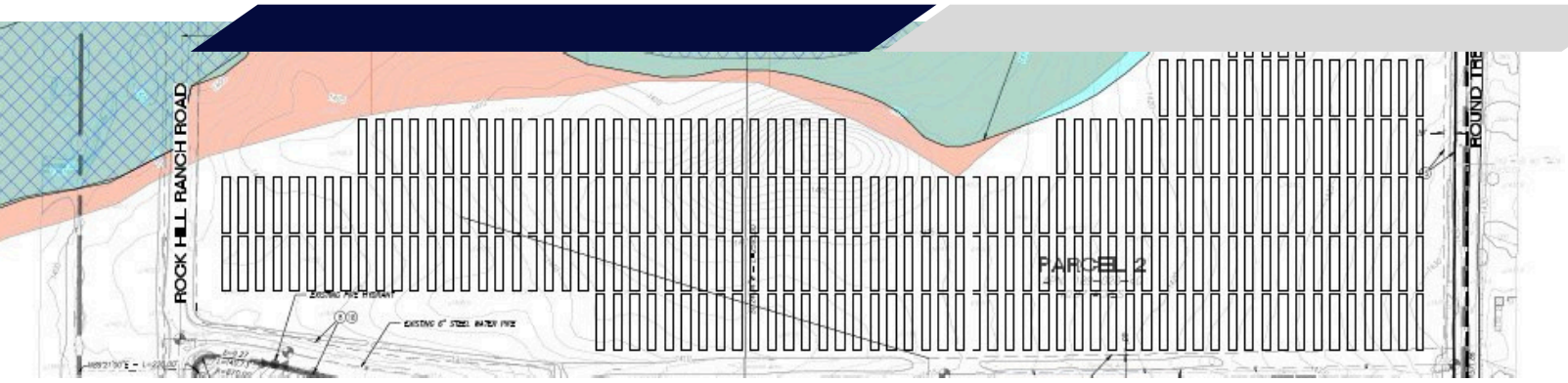
- The following baseline meteorological conditions must be assessed:
  i. Wind speed of 1.5 meters per second (3.4 miles per hour).
  ii. Ambient temperature of 77 °F.
  iii. Atmospheric stability class F.

- A parametric study must also be performed evaluating wind speed sensitivity. Local meteorological conditions found at the site must be modeled.

- Expected toxin(s) to be considered must be documented and justified. Acute Exposure Guideline Level 1 (AEGL-1) must be used. The exposure time must be documented and justified.

- The report must identify additional measures to be taken to protect nearby people if found to be necessary based on modeling efforts.

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 all-inclusive, and all requirements of CFC Section 1207 must be met:



8. 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, and other ESS/utility components that are located within 100 feet of lot lines. Separation distances to other exposures and to lot lines to other occupancies are based on current code required minimums, or as documented in the HMA.

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 all-inclusive, and all requirements of CFC Section 1207 must be met:

9. Separation distances between BESS enclosures are required to be as follows:

- A minimum of 10 feet where no justification for a reduction is provided.
- Distances based on testing which intentionally initiates a fire in an ESS enclosure to evaluate propagation to adjacent enclosures. UL 9540A testing does not include this test procedure and is not considered to meet this requirement. Test procedures and outcomes must be documented in a test report provided by the third-party laboratory that performed the test or in a report prepared by a registered design professional.
- Distances based on other justifications such as fire rating of enclosures or fire exposure analysis may be considered. Justifications must be presented as a report or part of a report prepared by a fire protection engineer.

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 all-inclusive, and all requirements of CFC Section 1207 must be met:

10. Emergency preparedness plans are required for all facilities as follows:

- Fire Safety and Evacuation Plan in accordance with CFC Section 404. May be omitted when approved by AHJ for sites that are not regularly occupied, including by maintenance and operations personnel.

- 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.

- Emergency Response Plan. See NFPA 855 Appendix G.1 for guidance. Emergency response plan must address any expected response from the fire department that is included as a mitigation strategy in the HMA.

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 all-inclusive, and all requirements of CFC Section 1207 must be met:

11. 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:

- Roads must extend within 150 feet of all portions of the facility, which includes BESS units.
- 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).
- The fire code official has the authority to make additional requirements where necessary in accordance with CFC Section 503.2.2.
- Any impacts due to modifications to fire apparatus access roads that are granted must be documented in the HMA and emergency response plan.

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 all-inclusive, and all requirements of CFC Section 1207 must be met:

12. Water supply is required for all facilities in accordance with CFC Section 507.

- For sites with buildings, the requirements of CFC Appendix B or the Insurance Service Office “Guide for Determination of Fire Flow” are applicable.

- For sites without buildings the fire flow shall be calculated as follows:
  i.The fire flow rate shall be 250 gpm.
  ii.The duration is based on expected event duration as determined by required fire testing or a reduced duration approved on a case-by-case basis. The reduced duration is permitted based on spacing of ESS enclosures reducing likelihood of propagation and on fire department ability to provide alternative water supply.

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

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 all-inclusive, and all requirements of CFC Section 1207 must be met:

13. 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:

- 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).

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

Existing facilities must provide the following documentation:

- HMA where the facility utilizes equipment that is not UL 9540 listed.

- 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 AHJ 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.1 for guidance.

City of San Marcos

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