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the FCFPD, the Fresno County Sheriff, and the California Highway Patrol shall be given access to the locked gates via keys or any other means as described in both the construction and operations fire prevention plans described in COCs **WORKER SAFETY-1** and **WORKER SAFETY-2**.

BESS Facility

The project has proposed the use of the Tesla Mega Pack 2 XL (MPXL2) batteries for energy storage. These units are large containers similar in size to large ocean shipping containers and contain modules and battery cells. They are approximately 28.9 ft in length, 5.4 ft deep, 9.2 ft in height, and can weigh up to 84,000 pounds. The cells are the energy-producing units and contain a metal (lithium iron phosphate) as the cathode, graphite as the anode, and an electrolyte (typically a solution of a lithium salt, like lithium hexafluorophosphate (LiPF6) dissolved in an organic solvent). Cells are placed in trays and there are three trays per module. Many modules make up a unit (see **Figure 4.4-1**).

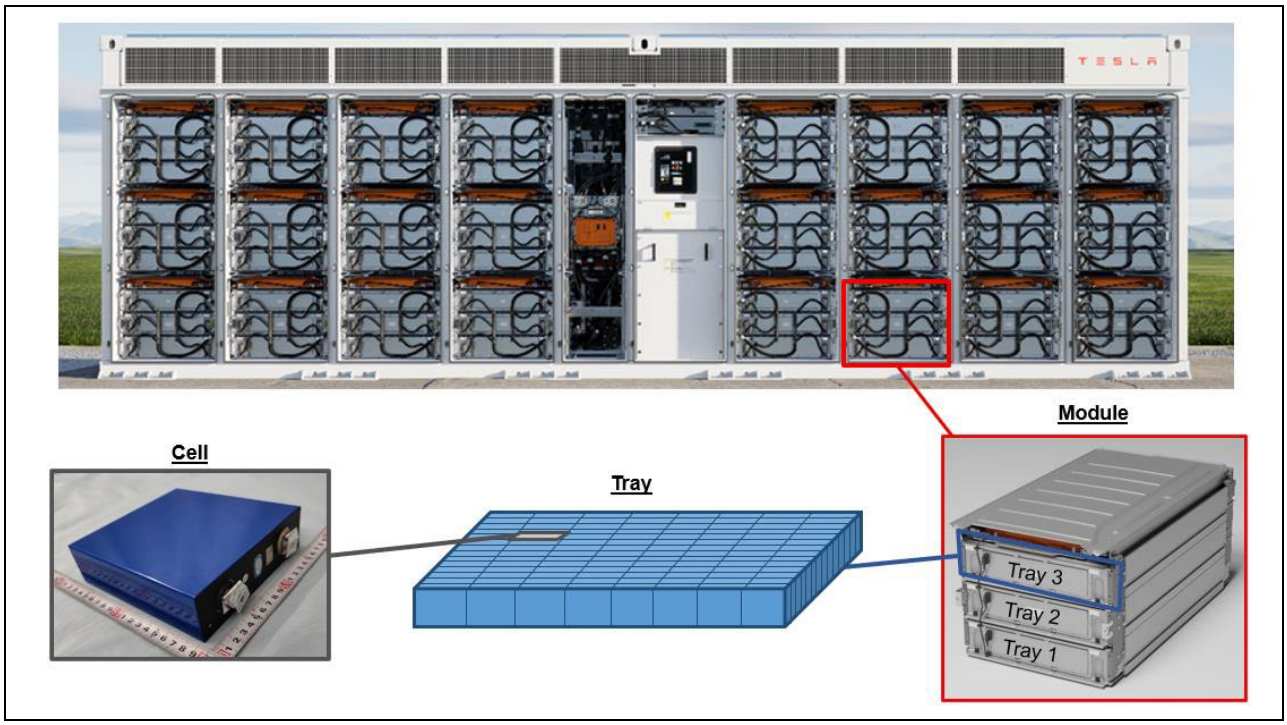

Figure 4.4-1 Tesla MP 2 XL
Source: RCI 2024w, Appendix D

The CEC staff's evaluation of the safety of lithium-ion batteries determined that large lithium-ion BESS installations pose potential hazards. Because they store large amounts of energy, one of the principal hazards associated with lithium-ion BESSs is fire, which could occur if a charged battery cell was somehow damaged, for example by being opened, punctured, or crushed. A fire could also be caused if a battery cell is short-circuited, overheated, or experiences thermal runaway.

Thermal runaway is a process in which the lithium-ion cell enters an uncontrollable, self-heating state and can emit toxic gases such as hydrogen chloride, hydrogen fluoride, hydrogen cyanide, and benzene along with flammable/explosive gases including hydrogen, methane, propane, ethylene, and others. These flammable gases could potentially lead to an explosion within the BESS container. Due to the potential for fire and explosion, staff concludes that the project's BESS would present a significant risk that should be mitigated.

Confirmation of potential hazards posed by BESS installations has been provided through field experience. A notable event that led to a shift in the industry in terms of hazard mitigation at BESS installations occurred on April 19, 2019, at a BESS unit in Surprise, Arizona (a suburb northwest of Phoenix). The facility experienced a thermal runaway event, and the BESS was equipped with a suppression system but was not provided with deflagration venting or explosion prevention systems. The proposed Darden BESS modules for this project would use both deflagration venting and explosion prevention systems. The failure report issued by Arizona Public Services (McMicken Report 2020) indicated that the suspected fire was an "*extensive cascading thermal runaway event initiated by an internal failure within one battery cell of the BESS. The BESS's internal fire suppression discharged a clean agent preventing the fire from spreading to surrounding battery racks. However, the compromised batteries emitted a mixture of combustible gases, which accumulated in the BESS enclosure. The fire department responded and took no immediate action due to a lack of information concerning the system and the event. When a HAZMAT team attempted to enter the BESS area to survey the scale of the event, an explosion occurred, seriously injuring four firefighters.*" This event catalyzed further review and evaluation of the risks and hazards to workers, first responders, and the public posed by Li-ion grid-sized batteries. It spurred additional guidelines, recommendations, and additions to fire codes and industry standards including one important industry practice: placing the modules inside a container, which is the case for this project.

More recently, staff inspected the site of the Tesla Megapack fire that occurred on September 20, 2022, at the Elkhorn Battery Energy Storage Facility near Moss Landing, CA, where one out of a total of 256 Megapacks caught fire. The North County Fire Protection District (NCFPD) responded to the incident and proceeded to let the fire burn itself out per Tesla's emergency action plan for first responders. The fire department used onsite fire water monitors (water cannons) to cool adjacent modules to prevent them from overheating. The NCFPD also had access to a Command-and-Control (CNC) center outside of the BESS facility. The CNC gave firefighters access to the BESS telemetry that was relayed to Tesla along with feeds to the thermal infrared cameras that were placed around the site. This information allowed the incident commander to see what BESS enclosure was on fire based on the BESS telemetry and confirmed with the infrared cameras. It also allowed the incident commander to create an action plan to safely battle the fire and to monitor the situation in real time. Staff learned that during project commissioning, the project owner had provided training opportunities to

the NCFPD for practicing how to deal with a fire at the facility. The important takeaway from this incident is that proper training for first responders with the appropriate fire water supply infrastructure and monitoring infrastructure in place were critical for safely limiting the damage and controlling the fire.

On May 15, 2024, there was an incident at the Gateway Energy Storage Facility (GESF) in Otay Mesa, California which is composed of five buildings that house the BESS. There was a thermal runaway event in one battery rack in building three (in the middle of the five-building unit row) which caused a fire at the 240 MW GESF. GESF is a battery-in-a-building project, which staff has found to be rare, with fire barriers, a chemical suppression system, and a pre-action fire protection system. The chemical fire suppression activated but did not put out the fire. The pre-action system then activated allowing the flow of water to help contain the fire. The fire department appears to have made the decision to keep the pre-action sprinkler water flowing to keep the temperature down and to help protect the integrity of the roof to avoid collapsing. Additionally, the firefighters had to cut into the building to allow more water to be sprayed into it to help control the fire. The fire burned itself out by May 22, 2024. Staff visited the site on May 29, 2024, and found that structural integrity of the building was being assessed due to the incident. Staff's conclusion is that the BESS "failed safely." Equipment worked as planned, the fire department knew what it had to do, and there were no injuries to onsite staff, the firefighters, or the public. However, this incident illustrates the challenges of placing grid scale BESS into dedicated buildings when an incident occurs.

Another fire occurred on January 16, 2025, at the 300 MW Moss Landing Battery Energy Storage Facility (MLBESF) owned by Vistra Energy. This facility houses one of the world's largest indoor BESSs. Unlike the GESF though, the building was not purpose-built, but it was placed inside a repurposed turbine hall formerly used by the Moss Landing Power Plant. The blaze prompted the evacuation of approximately 1,200 to 1,700 residents from nearby communities and released plumes of black smoke, raising safety concerns. The cause of the incident is currently under investigation. The MLBESF and the GESF fires demonstrate that the best management practice of siting a BESS facility outdoors in containers and not indoors minimizes the damage caused by thermal runaway fires and reduces the threat of fire propagation.

Like most metal batteries, hydrogen and other flammable gas evolution occurs in lithium-ion batteries due to a parasitic reaction at the anode but the amount varies (even aqueous flow batteries emit small negligible amounts of hydrogen (~ 6 microliters per minute). Some BESS enclosures feature a chimney effect convection cooling design that will automatically dissipate the small amount of hydrogen that could be outgassed. In addition, stacked enclosures can be fitted with a forced-air ventilation system if the natural convection air flow is insufficient for venting purposes. However, given the extreme range of hydrogen flammability, generation of hydrogen remains a safety issue, for any lithium-ion batteries, including the one proposed by the applicant for this project.

In addition to the fire and explosion risks discussed above, there is also the possibility of fire during the transport of the Li-ion containers. The MP2XL would be purchased from Tesla and shipped to the site. There have been several recent transportation accidents on highways involving Li-ion batteries falling off flatbed trucks resulting in fires and highway closures. Staff has reviewed this matter and found that the Pipeline and Hazardous Materials Safety Administration (PHMSA) issued a final rule that became effective on January 20, 2023, that required all Li-ion batteries transported by air to have a state of charge (SOC) of 30% or less. This regulation was issued to enhance the safety of transporting li-ion batteries in aircraft. The SOC limit has been shown to halt or minimize the propagation of thermal runaway within a package, decrease heat release values, and the SOC affects the flammability limits in an apparent parabolic matter, where the widest flammability limits are at or near 100% (PHMSA 2018). Therefore, reducing the SOC during transportation reduces the severity of the thermal runaway, slows or eliminates propagation of the thermal runaway, and reduces the volume of flammable gasses vented during thermal runaway.

Unfortunately, there is not an analogous rule for ground transportation. Though some Li-ion batteries could be shipped via ground transport with a SOC of 30%, there is no guarantee that this would occur. Therefore, staff proposes COC **WORKER SAFETY-7** which would require the project owner to ensure that any Li-ion batteries shipped to the project site could not have a SOC above 30 percent.

Methodology

Staff uses a variety of recent industrial guidelines (UL Solutions and NFPA) and the latest edition of CFC to guide its evaluation of BESS projects that seek a license to construct and operate. The industrial guidelines include NFPA 855: Standard for the Installation of Stationary Energy Storage Systems. Others include UL 9540-2020: Energy Storage Systems and Equipment, which lists requirements for BESSs supporting the local-area electric power systems or the electrical utility power grid, and UL 9540A-2019: Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, which provides the standard test methodology for determining fire and explosion hazards presented by a given BESS design when undergoing an overheating failure, such as thermal runaway. The latest edition of the CFC, particularly chapter 12, also contain fire safety requirements for stationary lithium-ion battery energy storage systems.

Most recently, CPUC has proposed revisions to CPUC GO 167 that would add CPUC oversight over compliance with SB 38 and establish standard maintenance and operational standards for BESS facilities. These revisions would enhance the safety and reliability of BESS facilities by applying industry best practices, lessons learned, and new standards. These are described in the proposed March 13, 2025, CPUC RESOLUTION ESRB-13 (CPUC 2025). Staff believes that this order will enhance the safety and reliability of the proposed BESS facility and has included a requirement in COC