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Large Fire Smoke Risk

Additional submitted attachment is included below.

Ron Cabrera
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March 13, 2025

Mr. Drew Bohan, Director
California Energy Commission
715 P Street Sacramento, CA 95814

Dear Mr. Bohan:

As a retired Fire Chief Officer with 34 years of experience in fire and emergency services, I feel obligated to express my opposition to the proposed Battery Energy Storage System project in San Juan Capistrano, where I currently live. A number of recent fires have indicated a need for additional laws, ordinances, regulations, and standards for increased fire safety, especially in the case where these facilities are located in populated areas. Although the City of San Juan Capistrano opposed the proposed BESS location, under AB 205 Opt-In Certification Program, the California Energy Commission (CEC) has authority to approve renewable energy projects, including battery energy storage systems (BESS). While I understand the need for sustainable energy solutions, the safety concerns associated with BESS installations cannot be overlooked. My opposition is based on the following points:

Beyond the UL 9540A Testing: Battery Energy Storage Systems, particularly those utilizing lithium-ion technology, pose significant fire, smoke, and explosion hazards. Thermal runaway incidents in such systems can lead to uncontrollable fires, presenting a severe risk to nearby residential areas and critical infrastructure. Testing beyond the current UL 9540A should be required to better align with the California Fire Code. Fire and Risk Alliance, LLC performed a Community Risk Assessment to evaluate the plume dynamics from a hypothetical thermal runaway event from a Tesla Megapack 2 XL lithium-ion Battery Energy Storage System, intended for installation at the proposed Compass project site, located in San Juan Capistrano. The Process Hazard Analysis Software Tools and Unified Dispersion Model was used to calculate the downwind dispersion distances, concentration profiles, and widths of flammable and toxic releases of post-combustion gaseous products (e.g., flammable gases, carbon monoxide, and carbon dioxide based on the specific gases released during the UL 9540A testing. The UL 9540A test method provides a way to evaluate thermal runaway and fire propagation of a lithium-ion battery energy storage at the cell level, module level, unit level, and installation level. The unit level test demonstrated that the near simultaneous failure of six cells within the same battery tray did not lead to flaming combustion nor to a propagating thermal runaway event throughout the Tesla MP2XL cabinet containing 8,000 cells. Based on data from the MP2XL UL 9540A test data, the resulting endpoints showed no risks to persons or property extended offsite of the project property boundaries. Consequently, there was no advanced gas analysis performed to measure flammable gases, smoke density, heat release rate, nor toxic exposure levels during an energy storage system fire. Also, only minimal information from the UL 9540A test was utilized for plume modeling and emergency response plans. As the adoption of energy storage systems expands the need for heightened safety measures becomes critical. Past incidents involving lithium-ion and other electrochemical batteries highlight the potential fire risks associated with these systems. To help address these concerns, Authorities Having Jurisdiction are mandating large-scale fire testing, which extends beyond the scope of typical fire testing as per UL 9540A requirements. CSA Group has released the CSA TS-800:24 Large-Scale Fire Test Procedure (https://www.csagroup.org/testing-certification/product-areas/power-generation-energy-storage/battery-energy-storage/large-scale-fire-testing-procedure-csa-ts-80024/). This technical specification fills in a critical gap in the industry by providing a standardized method for evaluating fire hazards associated with energy storage systems. The risks associated with these systems are significant, which can lead to catastrophic fire events. TS-800 provides an extensive testing procedure that verifies fire events from a fully involved energy storage unit do not propagate to adjacent enclosure units or external exposures, helping safeguard lives and the surrounding environment. This specification goes beyond existing tests, such as UL 9540A, which may not result in a fire condition. TS-800 aligns with requirements in codes like the California Fire Code and the International Fire Code, offering a much-needed standardized approach to large-scale fire testing. TS-800 was prepared to serve as interim guidance based on input from industry experts in testing, certification, product development, and Authorities Having Jurisdiction approval. Large-scale fire testing involves intentionally initiating a fire in an energy storage system enclosure to evaluate how fire might spread to nearby enclosure unit systems. This testing is particularly important for ESS installations where multiple enclosure systems are installed close to each other, such as utility sites with numerous energy storage system enclosures. Unlike UL 9540A testing, which may only lead to the release of flammable gases without ignition, large-scale fire testing forces a fire condition in one energy storage system enclosure to assess if thermal runaway and fire propagation will occur in adjacent enclosures. Authorities Having Jurisdiction and regulators are asking for large-scale fire testing in addition to the standard UL 9540A tests because UL 9540A does not always result in a fire condition. Although thermal runaway can occur, it may not ignite, leaving uncertainty about the potential for fire spread. To meet the safety goals outlined in the California Fire Code, International Fire Code, and others, AHJs require testing that verifies a fully involved fire in one energy storage system unit does not spread to nearby units. The International Fire Code Commentary emphasizes the need for large-scale fire tests to document that fire propagation between units will not occur and to gather data for risk assessments in different installation settings. Advanced gas analysis is performed to measure flammable gases, smoke density, heat release rate, and even toxic exposure levels during an energy storage system fire. This large-scale testing provides the most accurate information for plume modeling and emergency response plans.

Fire Response Limitations: The complexity of battery energy storage system fires requires the fire departments to respond in a defensive (let it burn) mode. Water is ineffective in extinguishing these types of catastrophic fires. The proposed project's proximity to residential neighborhoods amplifies these concerns, as delayed or inadequate response could have devastating effects. Once an energy storage unit burns with obvious flame, the large volume of toxic smoke will expose thousands of people to dangerous inhalation risks for prolonged periods of time.

Toxic Smoke Impact on Health and Environment: In the event of a large fire, toxic gases and particulate matter released from burning batteries can pose serious health risks to the local community. It is imperative to consider these potential impacts on public health when evaluating the safety and feasibility of such projects. Based on a research paper from the University of Nevada, Reno (Characterization of Lithium-Ion Battery Fire Emissions—Part 2: Particle Size Distributions and Emission Factors), the lithium-ion battery thermal runaway emits a wide size range of particles with diverse chemical compositions. When inhaled, these particles can cause serious adverse health effects.

This study measured the size distributions of particles with diameters less than 10 µm released throughout the thermal runaway-driven combustion of cylindrical lithium iron phosphate and pouch-style lithium cobalt oxide lithium-ion battery cells. A significant amount of organic and elemental carbon, phosphate, and fluoride were released. The emission factor of gaseous hydrogen fluoride was 10–81 mg/watt-hour, posing the most immediate danger to human health. The tested lithium iron phosphate cells had higher emission factors of particles and hydrogen fluoride than the lithium cobalt oxide cells. The emissions documented here have implications for health and safety as well as environmental contamination. Considering that modern lithium-ion battery packs can contain hundreds to millions of watt-hours of energy capacity, the effects of significant emissions of volatile organics, ultrafine and fine particles, hazardous metals, and acidic compounds must be taken into consideration when responding to and cleaning up after lithium-on battery fires. Lithium-ion battery fires are becoming more common as their use expands. The combustion process can occur quickly and without warning, limiting the effectiveness of fire suppression. Therefore, a detailed understanding of the resulting emissions is imperative to allow for effective fire response and cleanup. This research paper has detailed the expected fine particulate emissions in a way that allows extrapolation to any size lithium-ion battery pack if the burned energy capacity is known. This resource will allow first responders, manufacturers, and responsible authorities to plan for and respond to lithium-ion battery fires.

Lithium Iron Phosphate Not Much Safer: Battery energy storage system developers promote the lithium iron phosphate battery as a safer technology with regard to thermal runaway. However, the thermal runaway temperature of lithium nickel manganese cobalt oxide is approximately 410°F and the thermal runaway temperature for lithium iron phosphate is approximately 518°F, about 25% higher threshold providing an insignificant amount of increased resistance to thermal runaway (www.batteryhacker.com). Regarding the flammability of electrolytes, Lithium iron phosphate batteries use the same organic solvents as the nickel manganese cobalt batteries. They simply use a different blend to increase the flashpoint of the mixture, which is an insignificant 20% difference (www.leaptrend.com). Regarding the products of combustion (smoke), although lithium iron batteries typically do not contain heavy metals (nickel, manganese, cobalt) as lithium-ion batteries do, they can produce iron oxide and lithium, an inhalation risk which can cause lung damage, pulmonary edema, seizures, and coma (www.redway-tech.com).

Battery Energy Storage Failure Rate Reality: Although it appears that battery energy storage failure rates dropped 97% from earlier estimates of 2-5 incidents per gigawatt-hour annually during the 2010s, the risks are still concerning. If you use only the data provided by Energy Power Research Institute in their chart and in their database, it provides us with very specific numbers (2020-2023) for the failure rate per gigawatt (each year), which, when converted to gigawatt-hour, shows us how many failures one should expect for a facility of any given size in gigawatt-hour. The industry uses the Energy Power Research Institute chart to show that failure rates have improved over time, but if you do the simple math, they still pose a substantial risk. San Juan Capistrano installation is a proposed 3,961 megawatt-hour facility. Based on incidents/gigawatt-hour per year average of 0.22, the projected fires per year for the San Juan facility would be 0.871 or a probability of fire each year at 87.1%. The projected number of fires would be 4.3 over 5 years and 26.1 over 30 years. (https://storagewiki.epri.com/index.php/BESS_Failure_Incident_Database).

In closing, if safety is a priority for the California Energy Commission (CEC), the reviewing of Opt-In Certification applications, which requires analysis of the proposed project's impacts on the environment;

measures to minimize any significant impacts; reasonable alternatives to the project; and conformance with applicable local, state, and federal laws, ordinances, regulations, and standards, should include fire and health safety risks based on a large-scale test (beyond the UL 9540A), representative of a catastrophic event. The recent Moss Landing fire is a good example of how little we know about the smoke toxins and what toxins to monitor for. Until more accurate data is gathered at real world fire events, our first responders, environmental specialists, and health officials will not be adequately ready to help mitigate future catastrophes. I urge the California Energy Commission to thoroughly evaluate these safety concerns and consider alternative locations or technologies that pose fewer risks to the community. The safety of our residents and first responders must take precedence in all decisions regarding energy storage. Thank you for your consideration of my opposition points based on experience and data.

Sincerely,

Ronald J. Cabrera

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