STATEMENT

OF

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SAN BERNARDINO COUNTY FIRE PROTECTION DISTRICT

BEFORE

THE

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES

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My name is Dan Munsey, I am the Fire Chief and Fire Warden for the San Bernardino County Fire Protection District. This written testimony is in response to the invitation to testify to the Committee on Science, Space, and Technology of the U.S. House of Representatives regarding electrical vehicle fires. I have over 28 years of experience in the fire service, and for the last four years I have served as the fire chief of the largest fire district in our nation. I serve as a director on FIRESCOPE, a board that provides recommendations and technical assistance to the fire service including the FIRESCOPE Incident Command System (ICS) and the Multi-Agency Coordination System. I am also the vice-president of the California Metro Chief Association, an association that includes the largest fire agencies in the nation and for the past-four years I have served as the International Association of Fire Chiefs, Technology Council Chairperson. The International Association of Fire Chief's represents the leadership of 1.1 million firefighters.

I want to thank Chairman Obernolte and the committee members for allowing me to share my testimony on the important and impactful issue of Electric Vehicle (EV) fires. EV fires pose significant and challenging threats to our communities, our residents, and our firefighters. There are a lot of fear, rumors, and some valid concerns over lithium-ion battery fires and how they affect the safety of our communities and firefighters.

San Bernardino is the largest county in the continental United States, with a land mass of over 20,000 square miles, larger than New Jersey, Connecticut, Delaware, and Rhode Island combined together. The County is a diverse geographical region with large coastal valleys, mountainous terrain, and expansive desert areas. San Bernardino County is home to two of the most populated and recreated national forests, the Angeles National Forest, and the San Bernardino National Forest. Almost 80% of the county's land mass is made up of federal land. We serve 2.2 million citizens in sixty-six communities who are often isolated and surrounded by federal land, both mountain and desert areas. This means that San Bernardino County Fire is often impacted by all-hazard emergencies originating on federal lands and, vice-versa, federal lands are often impacted by all-hazard emergencies originating from our local jurisdiction.

The purpose of this written testimony and hearing is to examine emerging EV fire concerns and to discuss the differences between EV fires and internal combustion engine vehicle (ICE) fires and the difficulties these pose in multiple categories including the burden and training of first responders, environmental impacts of the fires themselves, and current methodologies used to extinguish the fires.

On February 15, 2024, our United States Fire Administrator Dr. Lori Moore-Merrell in her written testimony before the Committee of Homeland Security, subcommittee on emergency management and technology indicated that lithium-ion batteries "constitute a significant component of the drive to reduce emissions worldwide. They are part of a complex global ecosystem of multinational agreements and organizations, geopolitical security questions, and finite natural resources. While a daunting task, the fire service has a central and critical role in ensuring policy decisions address fire safety risks". International Fire Chief Association President John Butler in the same hearing provided that "America's fire and emergency service is approximately five years behind the curve in addressing problems relating to lithium-ion batteries and we request federal assistance to catch up". Both are correct, lithium-ion batteries are an important part of our future and we are several

years behind in our fire services ability to educate, regulate, and respond to potential emergencies involving lithium-ion batteries.

With this testimony we must recognize that the fire service first task is to *prevent harm* and minimize hazards placing our communities and first responders at risk. Only upon the failure of this first prevention task should we respond to minimize and mitigate hazards. Prevention, which the fire service views as "Community Risk Reduction" (CRR) relies on several well-established principles, these are: engineering controls, education, economic incentives, and the enforcement of regulations and laws. Each of these, in context of EV fires, are discussed briefly below followed by a discussion on EV fire emergency response.

Engineering Controls

The safety of our responders and public rely on first engineering controls to prevent fires from occurring in lithium-ion batteries. These include Battery Management Systems (BMS), Thermal Management Systems (TMS), Physical Separators, Internal Venting Mechanisms, External Enclosures, Fault Detection, Fire Suppression Systems, and the Structural Design of the batteries.

1. Battery Management Systems: Manages the battery's performance, including temperature, voltage, and state of charge to assist with preventing overcharging, over-discharging, and overheating, thereby reducing the risk of thermal runaway.
2. Thermal Management Systems (TMS): Manage cooling and/or passive thermal management materials that help regulate the temperature of lithium-ion batteries. By dissipating heat efficiently, these systems prevent the batteries from reaching high temperatures, which can trigger thermal runaway.
3. Physical Separators: Physical separators within lithium-ion batteries act as a barrier between the anode and cathode, preventing direct contact and minimizing the risk of short circuits, which can lead to thermal runaway.
4. Internal Venting Mechanisms: Internal venting mechanisms built into lithium-ion battery packs allow the release of gas or pressure in case of overcharging or thermal runaway, reducing the risk of explosion or rupture.
5. External Enclosures: Robust external enclosures or casings provide mechanical protection to lithium-ion battery packs, reducing the likelihood of physical damage that could lead to internal short circuits or thermal events.
6. Fault Detection and Isolation Systems: These systems detect abnormalities or faults within lithium-ion batteries and isolate the affected cells or modules to prevent further propagation of the issue and contain potential risks.
7. Safety Shutdown Mechanisms: Safety shutdown mechanisms automatically disconnect the battery from the load or charging source in case of an anomaly, preventing further energy input/output and mitigating risks.
8. Fire Suppression Systems: Incorporating fire suppression systems within battery enclosures or adjacent to battery installations can help extinguish fires quickly and minimize their spread in the event of thermal runaway.

9. Enhanced Electrolyte Formulations: Researchers are exploring advanced electrolyte formulations that are less prone to thermal decomposition and have improved thermal stability, thereby reducing the likelihood of thermal runaway.
10. Structural Design Considerations: Engineering battery packs with robust structural design features, such as cell-level isolation and reinforced casings, can enhance overall safety by minimizing physical damage and containing thermal events within the battery pack.

The inherent safe design of the battery is the priority to our fire service. Battery designs that minimize or limit thermal runaway and combustion are safer than any extinguishing technique applied once the battery is burning.

Education

A common cause of lithium-ion battery fires is the improper storage, use, care, and charging by consumers. Widespread education campaigns should be clear and concise in their messaging of the harm that can be caused by consumers of lithium-ion batteries. For example, a common cause of lithium-ion fires is the use of charging stations that are not approved by the manufactures or the improper installation of charging equipment. As more widespread use of EV progresses, it is likely that more consumers will contribute to EV fires by not following manufactures recommendations and not meeting electrical code standards.

Economic Incentives

Economic incentives could include many forms. This includes:

1. Insurance discounts for consumers that undertake education to reduce EV fires.
2. Subsidies and tax credits for safety upgrades to older electric vehicles.
3. Research grants and funding for organizations researching safer lithium-ion technology.
4. Manufacture funded incentives for safety upgrades.
5. Infrastructure investments to ensure safe charging.

Enforcement of Laws and Regulations

Likely future laws and regulations will be enacted to ensure electric vehicle safety including fire suppression systems, battery pack design, and recall and reporting requirements. The enforcement of laws should require periodical vehicle safety checks to ensure that electric vehicles maintain reasonable safety precautions.

Emergency Response

Fires involving Electric Vehicles (EVs) and those with Internal Combustion Engine (ICE) vehicles pose distinct challenges to first responders, the environment, and common firefighting methodologies. Here are the key differences and difficulties across various categories:

1. Fire Behavior and Chemical Composition: EV Fires: EV fires involve high-voltage lithium-ion batteries that can reignite even after being extinguished due to thermal

runaway, which occurs when the batteries overheat and enter an uncontrollable chain reaction. Lithium-ion batteries also release toxic gases and pose risks of explosion or chemical exposure. ICE Fires: ICE fires involve flammable liquids such as gasoline or diesel. These fires typically spread quickly and can be difficult to contain due to the volatility of the fuel.

2. First Responder Training and Safety: First responders require specialized training to handle EV fires safely, including knowledge of high-voltage systems, battery chemistry, and the risks of thermal runaway. They also need specialized equipment to safely manage EV fires without risking electric shock or chemical exposure. ICE Fires: While responders are familiar with extinguishing fuel-based fires, they still face risks of explosion, toxic fume exposure, and thermal burns.
3. Environmental Impacts: EV fire involving lithium-ion battery fires release toxic gases and heavy metals into the environment, posing risks to air, soil, and water quality. The disposal of damaged batteries also raises concerns about long-term environmental contamination. ICE fires release harmful emissions into the atmosphere, contributing to air pollution and climate change. Additionally, the runoff from firefighting efforts can contaminate nearby water sources with fuel and chemicals.
4. Extinguishing Methodologies: Traditional firefighting methods may not effectively extinguish EV fires due to the risk of reignition. Specialized firefighting agents such as Class D extinguishers, water mist systems specially designed for lithium-ion battery fires, full water submersion of battery packs, and continuous cooling are often required. In addition, specialized tools may be required to access lithium-ion batteries ICE Fires: Standard firefighting techniques involving water, foam, or dry chemical agents are typically effective for extinguishing ICE fires. However, responders must be cautious of fuel spills and the risk of explosion when applying water to certain types of fuel fires.
5. Burden on Fire Services: Responding to EV fires may require additional resources, including specialized equipment and personnel trained in handling electric vehicle incidents. This can strain emergency services and increase response times. Additional fire engines and access to uninterrupted fire flow may create additional demands on fire systems. Fires in lithium-ion batteries in EV can take up to four hours to extinguish and may reignite hours after fires have been extinguished. Additional training, new specialized equipment, and EV fires requiring a larger effective response force (more fire engines) than ICE fires create financial burdens on fire services.

Conclusion

EV fires present significant challenges to our communities, residents, and firefighters. With the rapid growth of EV technology, it is imperative that we address the unique risks associated with lithium-ion battery fires and implement effective strategies to mitigate these risks.

This testimony has highlighted the importance of prevention through engineering controls, education, economic incentives, and the enforcement of laws and regulations. Engineering controls such as Battery Management Systems and Thermal Management Systems are crucial for preventing fires in lithium-ion batteries. Widespread education campaigns are needed to inform

consumers about the proper use and care of EVs to minimize fire risks. Economic incentives can encourage safety upgrades and research into safer battery technology. Enforcement of laws and regulations will be essential to ensure EV safety standards are met.

Emergency response to EV fires requires specialized training, equipment, and methodologies due to the unique characteristics of lithium-ion batteries. Responders must be prepared to handle high-voltage systems, toxic gases, and the risk of thermal runaway. Additionally, EV fires pose environmental concerns due to the release of toxic materials and the challenges of battery disposal.

Addressing the challenges of EV fires requires collaboration among government agencies, industry stakeholders, and the fire service. By prioritizing safety, investing in research and development, and implementing effective regulations, we can work towards a future where EV fires are minimized, and our communities and firefighters are better protected.

Thank you once again for the opportunity to testify on this critical issue. I look forward to working together to ensure the safety and well-being of our communities as we face the evolving technology.