

STATEMENT  
OF  
LORI MOORE-MERRELL, DrPH, MPH  
U.S. FIRE ADMINISTRATOR  
FEDERAL EMERGENCY MANAGEMENT AGENCY  
U.S. DEPARTMENT OF HOMELAND SECURITY  
BEFORE  
THE  
COMMITTEE ON HOMELAND SECURITY  
SUBCOMMITTEE ON EMERGENCY MANAGEMENT & TECHNOLOGY  
U.S. HOUSE OF REPRESENTATIVES  
WASHINGTON, D.C.

“Examining Fire Hazards: Lithium-Ion Batteries and Other Threats to Fire Safety”

Submitted  
By

Federal Emergency Management Agency  
500 C Street SW  
Washington, D.C. 20472  
February 15, 2024

Chairman D’Esposito, Ranking Member Carter, and Members of the Subcommittee: My name is Lori Moore-Merrell and I serve as the Administrator of the United States Fire Administration (USFA) within the Federal Emergency Management Agency (FEMA). Thank you for the opportunity to testify today and to discuss the continuous and evolving fire threats to the nation.

The USFA’s mission is to support and strengthen fire and emergency medical services to prevent, mitigate, prepare for, and respond to all hazards. Since 1974, the USFA has led national efforts to reduce impacts of fire and other disasters in our communities through education, promoting building codes and standards, fire safety advocacy, data collection, research, and grants—yet there is much more to do.

Millions of Americans witness firsthand how fire continues to pose a substantial risk across the United States. Fire is a public health and safety problem of great proportions, and firefighting remains one of the Nation’s most hazardous professions. On average there are more than 1.2 million structure fires, nearly 3,000 deaths, thousands of injuries, and scores of individuals displaced annually from fires. Although disasters such as fires can affect everyone, fires can also exacerbate pre-existing challenges in underserved communities across the country. These impacts are further compounded by poor implementation and enforcement of national building codes and fire risks associated with technology that make fires more common, more intense, and more destructive.

These challenges pose heightened risks to the public and to first responders who safeguard our communities, and the challenge continues to evolve. For example, emerging technologies like Lithium-ion (Li-ion) powered devices and harmful chemicals including polyfluoroalkyl substances (PFAS) introduce new and continued risks to our communities and firefighters.

### **Emerging Technology**

Li-ion batteries are a type of rechargeable battery that contain numerous Li cells. This ordinarily stable electrochemical system provides stored electrical energy, but mechanical, electrical, and thermal abuse and manufacturing defects can destabilize the system and cause thermal runaway. Thermal runaway typically occurs when damaged cells experience uncontrolled increases in temperature and pressure<sup>1</sup>. Thermal runaways can rapidly produce extremely high temperatures in a chain of chemical reactions, and this can induce thermal runaway to propagate to adjacent cells in a battery pack. In addition to heat, Li-ion cells produce flammable gases during thermal runaway that drive Li-ion fires and explosion hazards.

Li-ion batteries are found nearly everywhere. These batteries power everyday items such as cell phones and computers and they are found in e-bikes, e-scooters, and electric vehicles. Li-ion battery energy storage systems are increasingly prevalent at outdoor installations supporting utility operations and installations are expected outside commercial structures and within residences.

While Li-ion batteries are an attractive power option, fire risk increases when they are damaged or used, stored, or charged incorrectly. Combined with what we know of their complex fire risk,

their recurring presence requires the fire service to turn research and data into operational considerations quickly.

Li-ion batteries and emerging alternatives 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.

Li-ion batteries bring complex operational challenges. Firefighters must consider the presence of Li-ion batteries in all operations, including a risk of faster flashover rates and increased temperatures. Current research shows that Li-ion batteries present four hazard scenarios for firefighters: flammable gas release, flaming, vented deflagrations, and explosions.<sup>2</sup>

These batteries are changing the fire risk environment. In a “traditional” fire it typically takes about three minutes or more for a room to be engulfed but now—with the increased prevalence of Li-ion batteries—there is often only 15 seconds from the first sign of smoke to thermal runaway and explosion, with windows being blown out and fire burning in homes, apartments, and businesses. These rapid changes in fire dynamics lead to shorter escape times, shorter time to collapse, and other new and unknown hazards for everyday consumers and for firefighters.

Li-ion batteries also present unusual response challenges. While Li-ion batteries are engineered to be safe, the nature of these devices means they may continue to hold a charge after being damaged, even if fully submerged in water. This phenomenon is known as stranded energy<sup>3</sup>. Therefore, firefighters should always consider whether engineered safety systems are nonfunctional. Li-ion battery fires also can require personnel and water resources far exceeding normal expectations, thereby stressing a department’s ability to maintain resources for other emergencies.

While our communities are generally aware of risks associated with their ordinarily benign devices, it is important for the fire service to develop and deploy fire safety messaging regarding safe usage, storage, and charging of Li-ion batteries and their unique risks. As policy decisions are made regarding what can be sold in U.S. markets, the fire service must play a role in discussing the safety of these items, with a specific focus on components directly affecting the fire safety of U.S. communities.

Although research is being conducted to better understand hazards associated with Li-ion batteries and means for mitigation, more research is needed to understand the new and complex hazards Li-ion batteries can present (including exposure to toxic chemicals these batteries release), and to provide firefighters with data and information to inform operational procedures.

Driven by an urgency to meet these risks head-on and save lives, in coordination with the leadership of national fire service organizations, the USFA recently held the second national summit in two years, on fire prevention and control. Together, we assessed the fire problem and challenges faced by firefighters in the United States expanding our 2023 national strategy to address emerging tech. This strategy includes plans to lead and inform discussion on the fire

safety of Li-ion batteries and other alternative energy sources within our communities, at all levels of government, and with industry partners utilizing the following priorities:

- Priority 1: Determine risk to the public and firefighter health from lithium-ion battery incidents.
- Priority 2: Conduct a consumer education campaign.
- Priority 3: Conduct necessary research to inform priorities and fire service response organizations in collaboration with our national labs, research institutes, and state and local partners.

### **PFAS and Firefighter Cancer**

PFAS and other toxicants disrupt an individual’s fundamental physiology, leading to wide-ranging negative health impacts for firefighters, including cancer and heart disease, as well as sleep and reproductive issues.

Certain PFAS are known to be carcinogenic, and degrade very slowly, earning the label “forever chemicals.” PFAS are often found in a firefighter’s blood, their firehouses, some firefighting foams, and bunker gear. Next-generation PFAS-free personal protective equipment, along with science and risk-based mitigation programs, can lessen these risks. Firefighters are also exposed to products of combustion, diesel exhaust, building materials, asbestos, chemicals, and ultraviolet radiation.

### **USFA Actions – Priorities**

The 2022 Fire Prevention and Control Summit was the beginning of a comprehensive and strategic approach to addressing impacts of fire on the nation and PFAS as contributing factors to firefighter cancer. The 2023 Summit added fire risks from emerging technology to the National Fire Service Strategy.

As we look to the future, we need data to inform policy and regulation. We must continue our partnerships across the whole-of-fire services, across local, state, and federal governments, our research partners, our non-profit partners, and the industries in the electric vehicle space to determine appropriate regulations to stop deadly tragic events from occurring. Events like those in New York City since 2021 where e-bikes with damaged batteries were left to charge overnight and placed in hallways and doors – trapping people inside a burning apartment. Or incidents where people buy aftermarket chargers online – because they are less expensive – leaving battery cells to overcharge, which leads to thermal runaway and fire. New York has pushed forward on regulation of aftermarket chargers because of lessons learned from these incidents. It is our hope that the rest of the nation takes heed and follows suit.

USFA is seeking new ways to address evolving challenges by improving how we collect, analyze, and report relevant information in a timely manner. Legacy National Fire Incident Reporting System (NFIRS) data is inadequate; therefore, USFA is working with the Department

of Homeland Security (DHS) Science and Technology Directorate to develop a modern cloud-based data capture system and a streamlined data standard for interoperability and maximum efficiency. The new platform will be known as NERIS (National Emergency Response Information System) and will ensure the USFA and the fire service at-large will have access to secure, interoperable live data that contains outputs from the most authoritative sources. Data scientists and engineers can leverage data from this platform to conduct research and disseminate reports to both the fire service and decision makers at all levels of government.

Additionally, the National Fire Academy (NFA) is increasing its training curriculum to include lithium-ion incident scene safety and fire suppression tactics in existing courses. Major insights were gained from Li-ion batteries found in debris from wildfires in Lahaina on Maui. FEMA and USFA met with the Environmental Protection Agency (EPA) to evaluate a process for de-energizing cells with sustained energy after the fire. Once EPA thoroughly documents the cell de-energization, crushing, and packaging process, the USFA will develop firefighter training curriculum to include this information. NFA curriculum also incorporates training and education for the full spectrum of community risk reduction, and the NFA offers training in multiple mediums to ensure broad access. In Fiscal Year 2023, the NFA delivered training to over 70,000 students.

Regarding PFAS, the “Protecting Firefighters from Adverse Substances Act” (Pub. L. No. 117-248) (PFAS Act) directs the FEMA Administrator (through USFA) to develop guidance for firefighters and other emergency response personnel on best practices to protect them from exposure to PFAS and to limit and prevent release of PFAS into the environment. Section 2 of the PFAS Act, requires DHS in consultation with the EPA, the Centers for Disease Control and Prevention/National Institute for Occupational Safety & Health (NIOSH), and the heads of other relevant agencies, to:

1. Develop and publish guidance for firefighters on training, education programs and best practices;
2. Make available a curriculum designed to reduce and eliminate exposure, prevent release of PFAS into the environment, and educate firefighters and emergency response personnel on PFAS alternatives; and
3. Create a public repository on tools and best practices to reduce, limit, and prevent the release of and exposure to PFAS.

USFA is actively working on these requirements.

As we look to the challenges ahead, such as those posed by the prevalence of structure fires, the increasing risks of emerging technology, and forever chemicals, USFA looks forward to working with both our firefighting partners and the Members of this Committee to build a fire-safe and more resilient nation. Thank you for the opportunity to testify. I look forward to answering your questions.

## Resources

1. Safety Risks to Emergency Responders from Lithium-Ion Battery Fires in Electric Vehicles. National Transportation Safety Board. November 2020.
2. The Science of Fire and Explosion Hazards from Lithium-Ion Batteries. UL/Fire Safety Research Institute (FSRI). <https://fsri.org/lithium-ion-battery-guide>.
3. Safety Risks to Emergency Responders from Lithium-Ion Battery Fires in Electric Vehicles. National Transportation Safety Board. November 2020.