

Workgroup Summary

EV/Energy Transition

Overarching Goal:

Lead and inform the discussion on the fire safety of lithium-ion batteries and other alternative energy sources within our communities, at all levels of government, and with industry partners.

Issue:

The fire service must lead the discussion of safety surrounding lithium-ion (LI) batteries and other alternative energy sources. **As lithium-ion battery powered products** of all scales from e-scooters to electric vehicles to energy storage systems **grow increasingly prevalent**, the fire service's trusted voice and unique insight can engage all stakeholders in **understanding the associated risks** and work to **ensure policy decisions consider the safety of our people and communities**.

While LI batteries are an attractive option to power our many modern needs, fire risk increases when they are damaged or used, stored, or charged incorrectly. These batteries will also be found throughout the supply chain and can be exposed to fire from other sources. Combined with what we know of their **complex fire risk**, their ubiquitous presence **requires the fire service to turn research, data, and response experiences into operational considerations quickly**. LI 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**. The following sections highlight areas where an immediate impact can be made:

Complex Operational Challenges

Firefighters need to consider the presence of LI batteries in all operations, including the risk of faster flashover rates and increased temperatures. The stored energy in a LI battery presents the risk of thermal runaway, which can occur when damaged cells experience uncontrolled increases in temperature and pressure. Current research shows that LI batteries present four hazard scenarios for firefighters: flammable gas release (e.g., an accumulating cloud that could result in a flash fire), flaming (e.g., pressurized jets which extend several feet), vented deflagrations, and explosions. In addition, LI batteries present response challenges that are outside of the norm.

While LI batteries are engineered to be safe, the nature of these devices is that they may continue to hold a charge after being damaged, even if fully submerged in water. This phenomenon is known as stranded energy. Nevertheless, firefighters are often operating around damaged equipment and must always consider the risk that engineered safety systems and elements are no longer functioning as intended. Fires associated with alternative energy sources can require personnel and water resources far exceeding normal expectations to circumvent the robust physical protection intended to prevent abuses which can instigate thermal runaway in the first place. This stresses a department's ability to maintain resources for all emergencies. Additionally, when the cells in a LI battery inside an electric vehicle (EV) fail, they have the potential to release toxic combustion byproducts, and there are concerns that exposures from EV fires may be more harmful than car fires involving a traditional internal combustion engine (ICE) vehicle.

Community Safety

While our communities are generally aware of risks associated with their ordinarily benign devices, it is important for the fire service to adopt fire safety messaging regarding LI batteries and alternative energy sources to share with the public about their unique risks. Messaging on these devices' safe

usage, storage, charging, disposal, and what to do when experiencing a thermal runaway is needed. As policy decisions are made regarding what is allowed to be sold on the U.S. market, the fire service must play a role in discussing the safety of these items, with a specific focus on the components directly affecting the fire safety of U.S. communities.

Need for Research

Research is being conducted to better understand the hazards associated with LI batteries and means for mitigation of those hazards. Nevertheless, more research is needed. To the extent possible, the fire service must continue to mitigate exposure to toxic chemicals released during fires involving LI batteries. Ongoing research is needed to understand the new and complex hazards LI batteries can present, and to provide firefighters with data and information to inform operational procedures. As an emerging technology, there are additional research questions that the fire service can take the lead in addressing with its community partners. For example, how do charging stations fit safely within current zoning and code ordinances? There is an existing roadway infrastructure built for gasoline distribution — how do these two systems work together safely? What challenges exist during the entire lifecycle of lithium-ion powered products, what risks exist, and how do they evolve? How effective are current exposure reduction efforts (e.g., laundering, preliminary exposure reduction (PER)) at removing LI battery contamination from firefighter turnout gear?

While LI batteries are an emerging technology, the reality is that the industry is already seeking alternatives. New technologies will likely seek to increase energy density, allowing a smaller battery footprint with increased capacity. It is critical for the fire service to understand the risks of these new technologies.

Accomplishments:

- ▶ Numerous webinars, podcasts and other educational materials have been disseminated to the fire service. Examples include:
 - ▶ <https://www.usfa.fema.gov/a-z/lithium-ion-batteries.html>
 - ▶ <https://www.firescienceshow.com/137-e-mobility-fires-with-adam-barowy/>
 - ▶ <https://www.theforwardfirefighter.com/episodes/episode-19>
 - ▶ <https://www.firerescue1.com/lithium-ion-battery-fires/li-ion-battery-fires-barowy-and-goldfeder-tackle-the-spaghetti-of-tactical-considerations>
- ▶ FSRI, FDNY, USFA, ATF, and Consumer Product Safety Commission (CPSC) launched the Take CHARGE of Battery Safety Campaign. [Battery Safety - Take Charge \(batteryfiresafety.org\)](https://batteryfiresafety.org)
- ▶ FSRI conducted seven full-scale free burn experiments to investigate changes in fire behavior and occupational exposures to firefighters with electrification of passenger vehicles. Research partners include NIOSH, EPA, and Duke University.
- ▶ FSRI conducted one outdoor electric vehicle live fire exercise with the Boston Fire Department and Worcester Polytechnic Institute (WPI).
- ▶ IAFF and UL Solutions issued report: *“Considerations for Fire Service Response to Residential Battery Energy Storage System Incidents”*. https://www.iaff.org/wp-content/uploads/IAFF_DOE_ResidentialESSConsiderations_Final.pdf
- ▶ New York City passed a law requiring e-bikes/scooters be certified to UL standards.
- ▶ HR:1797 and S:1008 - Setting Consumer Standards for Lithium-Ion Batteries Act are moving through Congress.

- ▶ The International Association of Fire Chiefs (IAFF) has continued to develop relationships with National Fire Chiefs Council (United Kingdom) Lithium-Ion Task Force to compare resources for the fire service.
- ▶ Society of Fire Protection Engineers (SFPE) hosted a multi-day and topic conference related to electric vehicles, e-mobility devices, energy storage systems, and bulk storage of batteries, with Dr. Lori Moore-Merrell giving a keynote speech. <https://www.sfpe.org/events-education/liveeducation/in-personeducation/liionsymposium>
- ▶ International Code Council (ICC) Fire Code Action Committee stood up a lithium-ion battery work group. Multiple code changes were submitted for the 2027 International Fire Code as part of the Group A code development process.
- ▶ International Code Council (ICC) has developed an ad-hoc committee on Lithium-Ion Batteries which includes four workgroups covering topics of the built environment.
- ▶ The National Volunteer Fire Council developed and released an EV/Alternative Fuel Vehicle (AFV) Course and held a train-the-trainer event in June 2024 to increase training capacity. <https://www.nvfc.org/nvfc-in-person-training/>
- ▶ The National Institute for Occupational Safety and Health (NIOSH) is in the process of establishing an internal Lithium-ion Battery Workgroup. Additionally, NIOSH has approached other federal agencies like the Environmental Protection Agency (EPA) to gather information on their initiatives regarding the assessment of occupational exposures to LI batteries nationwide.
- ▶ North American Fire Training Directors hosted an Instructor Development Webinar for Response to EV Incidents for state academy instructors.
- ▶ North American Fire Training Directors, in partnership with NFPA, are making the NFPA Fire Incident Response Simulated Training (FIRST) Application and the Energy Storage & Photovoltaic Systems Emergency Response program available at no cost to all state training academies.
- ▶ The World Fire Congress hosted a session on Emerging Technologies, which focused primarily on lithium-ion batteries and has resulted in the establishment of a community of practice to share practices, data, and other information related to incident response involving alternative energy technologies.

Recommendations:

Data & Research

- ▶ Establish a mechanism to monitor industry for incidents and research.
- ▶ Ensure that NERIS includes the ability to track EV/battery product incidents.
- ▶ Conduct research on topics such as: EV suppression, battery fire environmental exposure, firefighter exposure during lithium-ion battery and EV fires, hazards of battery fires in structures (parking garages, homes, energy storage systems, etc.), safe operations around and management of stranded energy, and safe disposal of damaged batteries.

Partnerships

- ▶ Engage/forgo new partnerships to stay abreast/ahead of the evolving issues.

Training

- ▶ Survey state and local training academies and begin culling training programs for best practices.
- ▶ Share Workgroup findings/recommendations with fire service curriculum developers/publishers.

Legislation

- ▶ Continue to support the passage of H.R.1797/S.1008.

Regulation

- ▶ Work with agencies like DOE, CPSC, DOT, HHS, etc. on battery risk mitigation, health effects, etc.

Codes and Standards

- ▶ Encourage fire service representation and participation in future code development committees such as the proposed National Fire Protection Association (NFPA) 800, proposed standard on lithium-ion batteries.
- ▶ Ensure fire service participation in all current codes and standards with lithium-ion batteries such as NFPA 855, UL 9540, UL 9540A.

Firefighting

- ▶ Support research to develop best practices on all forms of lithium-ion battery fires including mobility, EV, and Battery Energy Storage Systems. Based on research support development of Job Performance Requirements and other processes in various NFPA standards on firefighting.