TOLEDO FIRE & RESCUE DEPARTMENT

C-61 Lithium Ion Battery Emergencies

Emergency Manual

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Policy/Procedure

Purpose

Lithium-ion batteries have become prevalent in many consumer devices including cell phones, laptops, mobility devices (hoverboards, E-bikes, scooters), electric vehicles and wheel chairs. Fires involving lithium-ion batteries are becoming more common across the country and it has been found that even when a battery was not the cause of the fire, it increases the intensity of the fire. Larger lithium-ion batteries such as those found in mobility devices and electric vehicles contain a number of individual cells.

One of the most common types of lithium-ion cells is the “18650” which is slightly larger than a standard AA battery. An e-bike or hoverboard may contain 10-20 individual cells while the battery pack in a Tesla contains more than 7,000 “18650” cells.

In a process known as “Thermal Runaway,” the battery rapidly transitions from a stable state to an unstable condition that leads to the rupture of the cell. Thermal runaway can be caused by thermal insult, physical damage or overcharging and begins a self-sustaining reaction that quickly spreads to adjacent battery cells. This can cause fire to grow exponentially in a matter of seconds.

This procedure is mainly for consumer devices, for Electric Vehicle (EV) fires see C-62 EV Emergencies.

LITHIUM ION BATTERY HAZARDS

1. Flammable and Toxic Gases

- Hydrogen, Hydrogen Fluoride, Carbon Monoxide, etc.
- Jets of flame can extend over a foot from the battery

- Submersion of affected batteries may not stop the production of these gases

2. Rapid Progression

- Lithium-ion batteries can deteriorate extremely quick from a seemingly safe condition to rupturing and catching fire.

3. Reignition

- Even once extinguished or fully submerged, lithium-ion batteries may reignite with little to no warning even days later

4. Explosive Force

- Lithium-ion batteries have been known to rupture and rapidly ignite accumulated gases creating structural damage and fire spread
- Even if visible fire has been extinguished, the accumulation of gases from an exposed or submerged battery may create a flammable or explosive atmosphere, especially if located inside a structure

Operational Considerations

Instruct dispatch to contact a Battalion Chief for all thermal runaways to respond. Upon arrival, the BC should consider contacting HAZMAT for a consultation and possible response.

PPE

Turnout gear SHALL be worn and SCBA SHALL be in service at all times whenever operating near any device containing lithium-ion batteries that has been exposed to or on fire.

- This includes “recon”, “overhaul”, etc.
- Even if the cells appear to have finished off gassing or are no longer burning, these gases may have accumulated to harmful or flammable levels
- Additionally, even cells that appear undamaged can become engulfed in fire within seconds once thermal runaway begins

TACTICS

Use a hoseline to extinguish the fire.

- Dry chemical and foam are specifically NOT to be used on these fires.
- Continue flowing water until there is no more visible flame, smoke, or gas coming from the battery or device
- Water may help cool adjacent cells to reduce spread amongst them

If a lithium-ion device has been involved in fire, but not in thermal runaway, attempt to locate stray battery cells that may have been dislodged during the fire or by the hose stream. It’s important to

account for the cells as best as possible due to their reignition potential.

- Leaving these cells under furniture or covering them up with debris from overhaul or checking for extension makes them harder to find and can lead to reignition
- Consider the importance of scene preservation for FIU…always a balance with extinguishment.

ALWAYS have a charged hoseline in place until final mitigation.

While the TIC can be helpful, it should NOT be relied on to accurately predict the condition of a battery pack or cell.

OVERHAUL CONSIDERATIONS

NEVER place battery cells in the pockets of your gear.

Whenever possible, use a shovel or other tool to move cells rather than using your hands. Also consider putting them outside in a separate pile than the debris pile.

NEVER move lithium-ion cells or devices via an elevator unless it has been properly overpacked.

If HAZMAT is deemed to respond due to thermal runaway, the batteries or device should be moved to one of the following locations awaiting evaluation:

- Bathroom tub, all cells fully submerged in water
- Sink large enough to fully submerge all cells
- Bucket large enough to fully submerge all cells

See Also:
