STANDARD OPERATING PROCEDURE 403:

HOUSEHOLD LITHIUM-ION BATTERY REMOVAL

2025 SOCAL WILDFIRE RESPONSE

January 19, 2025

1. OBJECTIVE

The handling of damaged lithium-ion batteries inherently presents significant hazards to response personnel. These Standard Operating Procedures have been established as a set of guidelines for the proper handling of small lithium-ion batteries, such as e-bike and power tool batteries, to protect all response personnel. The purpose of this procedure is to outline the minimum requirements for safe handling, and transportation for fire damaged lithium-ion batteries.

2. EMERGENCY PROCEDURES:

If there is a suspected lithium-ion fire event, STOP all work, and quickly evacuate all personnel at least 330 feet in all directions (per PHMSA's 2024 Emergency Response Guidebook's Guide 147 for lithium-ion batteries large spills).

Do not attempt to extinguish the fire. Water and other smothering agents will not stop the oxidizing chemical reaction. Once in a safe location, contact the local fire department and then Incident Command. Preservation of surrounding areas and materials from any fire may be performed, if safe to do so at an up-wind location.

3. HEALTH AND SAFETY

Qualified personnel should have completed adequate training to enter a disaster area, including HAZWOPER, OSHA, site-specific safety, and cultural training. Numerous chemical and physical hazards are present during vehicle battery recovery. Chemical hazards include acid gases and occasional lead-acid. Physical hazards include heavy lifting of tools, sharp metal, risk of fire or explosion from thermal runaway of a battery, heat stress, ash and chemical exposure, and dehydration. Level C PPE will be used for this operation: full or half-face respirator utilizing acid gas/P100 dual cartridge, cut resistant or shock resistant gloves (as appropriate), hard hat, protective boots and safety glasses. A Job Hazard Analysis (JHA) has been generated by the Safety Officer for inclusion in the Health and Safety Plan, which is housed on the 2025 Southern California Wildfires Teams page, Section 1.1 Safety Officer, managed by the US Environmental Protection Agency (EPA).

4. SUMMARY OF METHOD

Personnel from the Emergency Response and Removal Services (ERRS) contract will be responsible for the physical removal of the batteries and Superfund Technical Analytical Response Team (START) personnel will be responsible for monitoring as well as the documentation of activities in field logbooks and electronic field collection and mapping software. Additional contractors will be responsible for electrical and temperature checks.

4.1 LITHIUM-ION BATTERY IDENTIFICATION

Lithium-ion batteries can come in different sizes and structures. Technology is constantly evolving the shape, chemistry and power of batteries. The most common lithium-ion batteries that may be encountered include:

1. Cylindrical cells (18650 or 2170): The most common battery in micromobility devices (scooters, e-bikes, etc.) are cylindrical batteries.
2. Prismatic cells: Rectangular in shape and larger than the cylindrical cell. These can be found in electric and some hybrid vehicles and hold more charge than a cylindrical cell.
3. Pouch cells: Commonly used in computers and cell phones, however some vehicle manufactures have started using pouch cells to complement existing power or to fully power the vehicle.

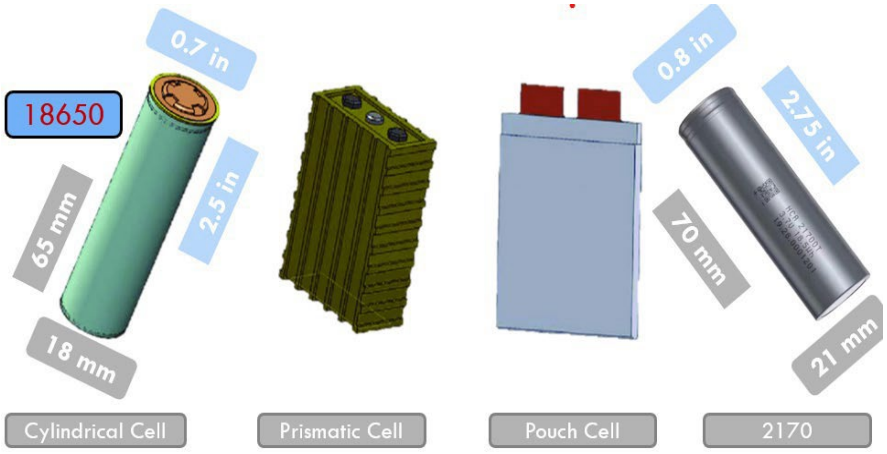

Figure 3: Depiction of lithium-ion battery types.

The different types of lithium-ion batteries depicted in Figure 3 come with pros and cons with regard to stabilization, compartmentalization, and resistance to physical damages. However, these batteries behave similarly during a thermal runaway fire and appropriate precautions should be taken no matter the battery type.

Figure 4: (Left) Lithium metal battery cell (not a lithium-ion battery) depicting a rolled- up strip of lithium metal; (Upper right) burned 18650 cells; (bottom right) fire-damaged cylindrical cells.

4.2 ELECTRIC VEHICLES

If a household hazardous materials (HHM) collection team encounters a suspected damaged electric or hybrid vehicle[1] (EV) no field team member should touch or disturb the vehicle. Suspected EV/HVs should be annotated in the field logbook and the appropriate Task Force Leader (TFL) should be notified. The TFL will notify the EV Task Force of the location of the vehicle. A dedicated EV Reconnaissance Team will be deployed to assess the vehicle. If it is identified as an EV, a blue lightning bolt will be painted on the sides of the vehicle or on the windows with a grease pencil, depending on the condition of the vehicle. Refer to the ***Standard Operating Procedure (SOP) for EV Reconnaissance*** for additional details of recon activities.

4.3 RENDER SAFE PROCEDURE

Support personnel should be performing air monitoring with a multi-gas unit during extraction.

Temperature checks should also be performed throughout the battery recovery process. Using a laser temperature gun or thermal imagery camera, temperature checks should be performed upon initial assessment, during extraction of the batteries and within any container used to store batteries for the transportation process. When taking the temperature readings, attempt to get temperatures from the battery themselves, if possible. If only the outer casing is visible temperature readings may still be valid but will change slower than batteries themselves. Any readings more than 10 degrees above ambient/surrounding material readings may indicate a reaction and should be assessed.

4.4 LOADING AND TRANSPORT OF SMALL LI BATTERIES TO STAGING AREA

Lithium-Ion batteries should not be picked up by hands, tools such as shovels, should be used to pick-up and deposit Lithium-Ion batteries into transport vessels.

Batteries need to be packaged properly for transport to the staging area and handled with care to prevent mechanical damage (such as puncturing or jostling during transport) that would lead to thermal runaway. The following should be considered to help prevent a cascading thermal runaway event during transport to the staging area:

4.4.1 Small lithium-ion batteries should be transported in a packed drum (see Figure 9) to prevent a cascading thermal runaway in transport to the staging area. Note the layers of separation depicted between the batteries.

4.4.2 Battery casings should not be stacked or torn apart during handling or loading. As possible, a few large battery casings should be loaded, without stacking, onto one truck for transportation. A priority should be placed on transporting items to the battery staging area before picking up additional loads.

4.4.3 Avoid simultaneously transport of large quantities of lithium-ion batteries with any other HHW such as lead-acid batteries, flammable compressed gas cylinders or other flammable materials.

4.4.4 Maintain radio communications with all team members and vehicles during transport to the staging area.

4.4.5 If a battery ignites during transport, the transport vehicle will pull over onto the road shoulder, where safe, and exit the vehicle. The situation will be assessed to determine the response and local emergency services will be called immediately. All parties will muster upwind and await arrival of emergency services.

Figure 9: Small lithium-ion batteries can be transported in a regular drum with packing materials.