# ELECTRIC VEHICLE FIRES

| | |
|---|---|
| Effective: | July 18, 2025 |
| Scheduled Review: | July 18, 2028 |
| Approved: | Fire Chief Mike Kennedy |

## I. PURPOSE

Compared to internal combustion engine vehicle fires, firefighting tactics need to be modified to reduce the risk associated with emergencies involving hybrid / electric powered vehicles. In order to properly respond to these incidents and protect firefighters mitigating emergencies involving electric or hybrid vehicles, there are additional and separate challenges responding crews must consider.

## II. DEFINITIONS

Battery Ignition and Reignition - Battery cells that have been damaged and then go into thermal runaway are at high risk for catching fire. Once a cell has gone into thermal runaway and catches fire, cooling and suppression could prevent heat from the compromised cell from spreading to other cells and igniting again. Reignition of an EV battery occurs when individual battery cells catch fire at different times.

Cut Loops - Low voltage wire loops that first responders can safely cut to disconnect the high-voltage system from the rest of the vehicle. Severing cut loops will isolate high-voltage power inside of the battery – protecting the rest of the vehicle. The use of cut loops will not reduce the amount of stranded energy within the battery cells, only isolate the energy within the high-voltage power pack.

Stranded Energy - Energy remaining in a cell after efforts to safely strand the stored energy in damaged lithium-ion cells. Stranded energy can impact how batteries can be safely removed, transported, and disposed. NFPA recognizes this as an important (and unresolved) issue as it poses a risk of electric shock and creates the potential for thermal runaway.

Thermal Runaway - This is an exothermic chemical reaction that occurs when the internal Li-Ion battery temperature reaches a point that causes additional chemical reactions that produce even more heat, which drives the temperature higher, causing further chemical reactions. Thermal runaway can spread rapidly if the high-voltage battery is not sufficiently cooled.

## III. PERSONAL PROTECTIVE EQUIPMENT

Full structural fire-fighting personal protective equipment (PPE) and self-contained breathing apparatus (SCBA) shall be utilized for electric vehicle fires.

Reflective traffic safety vests shall not be utilized while actively fighting fire.

## IV. INCIDENT ACTIONS

The first arriving company shall perform a size-up. This shall include the extent of the fire and if it is a compartment fire or includes the electric components of the car. The best method for managing or controlling a battery fire is with water. High voltage battery fires will initially start from under the vehicle, where the battery is located.

If the electric vehicle is well involved in fire and does not pose an exposure issue, allowing the fire to burn out may be the best option.

If the electric vehicle fire is in a parking deck, a potential strategy is to set-up a portable master stream (TFT Blitz Fire or RAM-HD) with a fog tip (2½" fog nozzle in D/O compartment) and let it soak the area on a wide fog. This incident will be long and complex with toxic smoke being a significant issue. This will likely require a first alarm assignment.

Fire attack considerations:

- Ensure the vehicle is in park and off, if possible.
- Consider chocking front and rear wheels.
- Attempt to locate and reference the Emergency Response Guide (ERG) that is available through the vehicle manufacturer. This is available on company officer phones.
- If available, a thermal imaging camera should be used to assist with a 360-degree size up.
- Extinguish small fires that do not involve the high voltage battery by use of standard fire extinguishing procedures.
- If possible, the NTSB recommends disconnecting the 12-volt battery (which will depower the battery management system).
- Evaluate if cut loops are available to isolate the high-voltage system.
- After the knock down of visible flames, re-ignition is to be expected. This is caused by the thermal runaway at the individual cell level internal to the battery packs. While visible flames from the batteries may be clearly extinguished, temperatures within the batteries may be high enough for thermal runaway of internal cells to occur. Subsequent re-ignition is characterized by "whooshing" or "popping" sounds, followed by off gassing of white smoke and/or electrical arcs/sparks that reignited with visible flames/fire. Typically, this will result in visible flames that can be quickly knocked down by a single hose line.
- The continuous application of water on a localized area of the battery for a prolonged period of time before moving onto another area of the battery can provide faster total extinguishment. In addition, once the main battery fire has been controlled, continuous application of water to the battery with the nozzle set on fog could further cool the exterior of the battery, thereby helping to reduce the temperatures of the internal cells. This will reduce the likelihood of additional off-gassing of electrolyte and re-ignition of internal battery cells. Electric vehicle fires have a significant chance for re-ignition hours after extinguishment.
- **Class B foam shall not be used on electric vehicle fires**. Class B foam is not effective and may cause environmental impact.
- Anticipate longer fire-suppression times if the high-voltage battery is involved. Suppression can take an hour or longer.

Sufficient fire personnel and apparatus on scene will be needed to provide for an extended operation, and to monitor the battery's heat or possible secondary ignition. The heat from the fire may have damaged additional cells, which may require additional suppression activities (sometimes referred to as reignition).

## V. INVESTIGATION

The fire prevention bureau shall be notified of electric vehicle fires of suspicious circumstances. Depending on the situation and after consultation with the fire investigator, the vehicle may be towed to a secure yard for investigation later.

## VI. POST INCIDENT ACTIONS

The vehicle should be isolated from other vehicles in junk yards and impound lots. NTSB recommends a 50' clear space around the vehicle once stored (until the battery can be discharged). Do not store inside a building.

An engine company may need to escort the vehicle to the recovery location.

Thermal events, such as thermal runaway, with the high voltage battery system can occur within several hours to a day or more after the initial fire is extinguished.

Preparation for the possibility for secondary fires should be considered and reported to oncoming or relief crews, or departments whose response territory are located where the vehicle is relocated.

Use a thermal imaging camera to aid in determining if battery temperature is maintaining ambient temperature, reducing or increasing.

Companies involved in direct suppression of an electric vehicle fire shall be removed from service until the following occur.

- Personnel shall use medical gloves to remove and handle gear turnout gear. If environmental conditions allow, gear should be placed in garbage bags on the scene. All turnout gear and SCBA involved in suppression efforts must be immediately washed. Personnel shall switch into their back-up turnout gear.
- Personnel shall shower and change into a clean uniform.