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Standard Operating Guideline

Electric Vehicle Response

Scope: Sacramento Regional Fire Departments

Policy Contact: Sacramento Regional Operations Group

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References

- Advanced Extrication: High-Voltage Vehicle Firefighting
- Department of Energy Alternative Fuels Data Center
- IAFC Fire Department Response to Electrical Vehicle Fires
- NFPA Electric and Hybrid Vehicle Quick Reference
- NFPA Emergency Response to Incidents Involving Electric Vehicle Battery Hazards
- NFPA Emergency Response Guides for Alternative Vehicles
- FIRESCOPE ICS-1150 Battery Emergencies Operational Guideline (2025)

01. Guideline

The purpose of this guideline is to establish procedures to ensure safe response to incidents involving electric vehicles (EV) and reduce negative impact to life, property, and the environment.

02. Definitions

2.1 Battery Electric Vehicles (BEV): Vehicles consisting of a fully electric powertrain powered by an electric motor and rechargeable batteries. Battery cells are typically located in the low points of the vehicle, such as floorboard and trunk areas.

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2.2 First Responder Cut Loop: Low voltage wire loops that emergency responders can safely cut to disconnect the high-voltage system from the rest of the vehicle. However, cutting the cut loop will **NOT** remove energy from the high voltage battery.

2.3 Hybrid Electric Vehicles: Vehicles with an electric motor powered by a battery (typically, nickel-metal hybrid or lithium-ion) recharged by an internal combustion engine. Power may also be generated through the turning of the wheels and brake application.

2.4 Lithium-ion Battery: Rechargeable batteries consisting of cells that produce an electric current by converting chemical energy into electrical energy. They are the preferred energy storage source for EV's due to their ability to store large amounts of energy in small sized vessels and retain and discharge high amounts of power.

2.5 Stranded Energy: The energy remaining inside cells of a damaged high voltage battery which may cause the battery to reignite multiple times after extinguishment. In some instances, the best practice may be to let a battery fire burn itself out.

2.6 Thermal Runaway: A rapid uncontrolled release of heat energy from a battery cell that exceeds the rate of heat dissipation. Thermal runaway in a single cell can build to a chain reaction that can result in battery fire or explosion. Popping noises, white smoke, and elevated temperatures are common indicators of battery thermal runaway.

2.7 Toxic and Flammable Gases: Lithium-ion batteries undergoing thermal runaway or failure can release hazardous gases including Hydrogen (H_2), Carbon Monoxide (CO), Carbon Dioxide (CO_2), Hydrogen Fluoride (HF), Oxygen (O_2), Volatile Organic Compounds (VOCs), and nanoparticles of heavy metals including nickel, cobalt, manganese, lithium, aluminum, and copper. These gases create flammable, explosive, and toxic atmospheres. Personnel must wear full PPE with SCBA and recognize that conventional 4-gas monitors may not detect all of these hazards.

03. Resources

3.1 Vehicle Accident

- I Engine or Truck

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3.2 Vehicle Accident with Extrication

- 1 Engine
- 1 Truck
- 1 Medic
- 1 Battalion Chief

3.3 Vehicle Fire

- 1 Engine

3.4 Commercial Vehicle Fire

- 2 Engines
- 1 Battalion Chief

04. Procedure

The primary hazards associated with EV's and lithium-ion batteries are toxic inhalation, electric shock and fire. As such, the best approach is to approach from the uphill and upwind, establish initial isolation distances and assume the high voltage system is energized at all times. For information regarding BEV features, extrication, fire suppression, and other details to a specific make or model electric vehicle, NFPA has compiled a database of Emergency Response Guides for alternative vehicles from 35+ alternative fuel vehicle manufacturers that can be accessed from any computer, tablet, or mobile device.

The minimum level of protection is full structural PPE, for all personnel near an EV involved in a vehicle collision. In addition, SCBA shall be utilized for all EV's involved in a fire.

4.1 All Incidents Involving an EV

4.1.1 First Engine or Truck

- Identify vehicle type, manufacturer, and model
    - If indications are present that the BEV battery pack is involved in thermal runaway:
        - Refer to Section 3.4 below
        - Use a thermal imaging camera (TIC) to monitor the battery compartment.
            - Note: TIC may not reliably detect compromised cells or hidden thermal runaway.

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        - If available, use a gas monitor to check for elevated CO, LEL and hydrogen.
    - If safe to do so:
        - Secure/stabilize the vehicle
            - Ensure the vehicle is in park (P) and turn off the ignition
            - Physically separate the key FOB from the vehicle
            - Chock the wheels
        - Depower the vehicle
            - Operate the high-voltage battery disconnect switch, if equipped
            - Cut the first responder cut loop when there is a visibly compromised battery pack, significant vehicle damage, or an extrication operation.
            - Disable the 12V battery
    - Evaluate the condition of high-voltage battery pack
    - Recommend the vehicle be transported on a flatbed tow
    - Recommend storage of the vehicle in an open area at least 50 feet from exposures and combustibles

4.2 Vehicle Accident

4.2.1 Initial Radio Report/Size-up

- The first arriving resource does not give an initial radio report.

4.2.2 First Engine or Truck

- Apparatus should be used as a traffic barrier
- Identify obvious safety hazards (powerlines, traffic, fuel leak, etc.), control if possible
- Request additional resources, if necessary

4.3 Vehicle Accident with Extrication

4.3.1 Initial Radio Report/Size-up

- The first arriving resource activates the command process by providing an initial radio report:
    - Unit designation
    - Confirmation of incident location
    - Number of vehicles involved
    - Extrication needs

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- Any obvious safety hazards
- Request additional resources

4.3.2 First Engine Company

Provide initial radio report and communicate initial actions based on incident priorities.

- Apparatus should be used as a traffic barrier
- Designate an area for Truck Company positioning near vehicle(s)
- Designate area in front of apparatus for ambulance positioning
- Identify obvious safety hazards (powerlines, traffic, fuel leak, etc.), control if possible
- Charged minimum 1 ¾" hoseline for protection
- Initiate patient care
- Request additional resources, if necessary

4.3.3 First Truck Company

- Position apparatus in a safe manner and in close proximity to vehicle(s) involved
- Identify vehicle type, manufacturer, and model
- Stabilize the vehicle
- Confirm vehicle has been shutdown/depowered
- Identify energetic hazards (airbags, tensioners, high-voltage components, etc.) using peel-and-peek
- Initiate extrication tactics, avoiding interaction with high-voltage components and the battery
- Request additional resources

4.3.4 First Ambulance

- Position apparatus in a safe manner and in close proximity to vehicle(s) involved
- Assist with patient care
- Prepare for transport

4.3.5 First Chief Officer

- Establish/Assume Command
- Identify command post location
- Request additional resources

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4.4 Vehicle Fire / Commercial Vehicle Fire

Complete extinguishment can take up to several hours and involve the use of thousands of gallons of water with efforts aimed at indirectly cooling the battery by applying water to the compartment exterior.

If water is limited or other factors warrant, consider allowing the fire to burn itself out while protecting exposures.

4.4.1 Initial Radio Report/Size-up

- The first arriving resource activates the command process by providing an initial radio report:
    - Unit designation
    - Confirmation of incident location
    - Number of vehicles involved
    - Extrication needs
    - Any obvious safety hazards
    - Request additional resources

4.4.2 First Engine Company

- Identify the type, manufacturer, and model
    - All Personnel Should:
        - Avoid entering toxic vapor plumes
        - Operate in full PPE and SCBA on-air within 75 feet if smoke, vapor, or fire are present from the Lithium Ion Battery (LiB)
        - Consider establishing a 330- foot initial isolation distance per ERG Guide 123 for Toxic Gases
        - Consider escalating the incident to a Level II Hazmat if appropriate
    - Fire Suppression Tactics:
        - Deploy multiple (2-3) charged 1 ¾” handlines
        - Approach at offset angles from outside the smoke plume
        - Apply water using hydraulic ventilation principles to push products of combustion away from crews
        - Extinguish the vehicle with water (no foam), ensuring adequate water supply.
        - Continuously monitor the battery compartment for rising temperatures

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        - If no existing access to the interior of the battery compartment, apply water indirectly to compartment exterior if monitored temperatures are increasing above 100° F and/or other signs of thermal runaway are present
            - Do not cut, puncture, or open high voltage battery packs during suppression or overhaul.
        - Repeat indirect water application and monitoring until temperatures stabilize and signs of thermal runaway are no longer present
    - Engineer should:
        - Deploy and staff a booster line and have it charged and available
        - Be prepared to perform gross decontamination of personnel who operated in the plume
        - Be prepared to knock down or redirect toxic plumes away from crews or the public
- Post extinguishment
    - Consider escorting the tow truck to its destination to provide fire suppression in the event of re-ignition
    - Provide recommendation to tow truck company to store damaged vehicles at least 50 feet from exposures and near a water supply
    - Perform Decontamination, Documentation, and Disposal (DDD) per AHJ's procedures
    - Plans for storage/transport/disposal are the responsibility of the AHJ and/or the responsible party
        - Coordinate with HazMat and hazardous waste partners as required by AHJ

4.4.3 Second Engine Company

- Establish Command, if not already
- Assist with Fire Attack
- Assist with water supply
- Deploy additional hoseline(s)

4.4.4 First Arriving Chief Officer

- Establish/Assume Command
- Identify command post location
- Request additional resources

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Signatures

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