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ELECTRIC/HYBRID VEHICLE RESPONSE

SCOPE: Western Placer County Fire Chiefs

POLICY CONTACT: Western Placer Regional Operations Group

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.

RESOURCES:

I. **Vehicle Accident**
- 1 Engine or Truck

II. **Vehicle Accident with Extrication**
- 1 Engine
- 1 Truck
- 1 Medic
- 1 Battalion Chief

III. **Vehicle Fire**
- 2 Engines
- 1 Battalion Chief

IV. **Commercial Vehicle Fire**
- 2 Engines
- 1 Battalion Chief

PROCEDURES:

The primary hazards associated with EV's and lithium-ion batteries are toxic inhalation, electric shock and fire. Batteries contain hazardous materials and should be treated accordingly. 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. Smoke and vapors produced by lithium-ion batteries are both toxic and flammable. If an electric vehicle fire blanket has been deployed, ensure the area is well ventilated and air monitoring is performed as there is a risk of explosion from hydrogen build-up. Vehicles can move without sound or notice and should be properly secured. For information regarding BEV features, extrication, fire suppression, and other details to a specific make or model electric vehicle, NHSTA has compiled a database of Emergency Response Guides for alternative vehicles from

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35+ alternative fuel vehicle manufacturers that can be accessed from any computer, tablet, or mobile device. https://www.nhtsa.gov/emergency-response-guides

A thorough risk analysis should be performed prior to engaging in firefighting operations involving lithium-ion batteries. When conditions permit, allowing the battery to consume itself may be the safest way to mitigate the incident.

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.

ALL INCIDENTS INVOLVING AN EV

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

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- Recommend the vehicle be transported on a flatbed tow. Wheel-lift towing may send unwanted power to the lithium-ion batteries
- Recommend storage of the vehicle in an open area at least 50 feet from exposures and combustibles

Vehicle Accident

- Initial Radio Report/Size-up
  - The first due apparatus should give an initial radio report.
- 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

Vehicle Accident with Extrication

- 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

- 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

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- Charged minimum 1 ¾" hoseline for protection
- Initiate patient care
- Request additional resources, if necessary

- 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 shut down/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

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

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

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

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exposures.

- 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

- 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 High-Level 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.

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- Continuously monitor the battery compartment for rising temperatures
- 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 below 300 F 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, while on SCBA, for personnel who operated in the plume
  - Be prepared to knock down or redirect toxic plumes away from crews or the public

- Post extinguishment
  - Allow the vehicle to sit 45 minutes to 1hour prior to tow to ensure the thermal runaway process has stopped. Areas of high heat, visible off-gassing, hissing, and popping are indicators of thermal runaway
  - 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

- Second Engine Company
  - Establish Command, if not already

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- Assist with Fire Attack
- Assist with water supply
- Deploy additional hoseline (s)

- **First Chief Officer**
  - Establish/Assume Command
  - Identify command post location
  - Request additional resources

POST INCIDENT DECONTAMINATION

Following extinguishment of the fire, ensure that all hose and equipment is decontaminated with water and mild detergent prior to leaving the scene.

- Structural Firefighting Turnouts
  - If exposed to products of combustion, turnouts should be properly decontaminated per department procedures.
  - Procedures For Gross Contamination
    - Gross contamination can be determined by several factors including a fire in an enclosed space, heavy exposure to vapors/gas, or the IC's discretion.
    - Initial decontamination should be performed while the firefighter is still on air to prevent exposure from off-gassing
    - Turnouts should be collected and bagged
    - Bagged turnouts should be labeled
    - Normal products of combustion
    - Lithium-ion battery byproducts
    - Specialized hazardous materials exposure

MEDICAL SCREENING

- Symptomatic Personnel
  - Any member that is experiencing symptoms of chemical exposure should be treated and

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transported to the appropriate hospital

- Post Incident Medical Screening Recommendations
  - Heavy Metal /Lithium-Ion Screening
  - Antimony, Arsenic, Bismuth, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Mercury, Molybdenum, Nickle, Selenium, Tellurium, Zinc, etc.

DEFINITIONS:

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. Last

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.

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.

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.

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.

Thermal Runaway: A rapid uncontrolled release of heat energy from a battery cell that exceeds the

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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.

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.

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)

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