**Fire Department Standard Operating Guideline # 000.0**

**Operations Division**

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**EMERGENCY PROCEDURES for**

**HYBRID, PLUG-IN HYBRIDS, & ELECTRIC PLUG-IN VEHICLES**

**I. Overview**

This Operational Guideline identifies recommended practices for Fire Department personnel to address when confronted with an incident such as a crash or vehicle fire involving an xEV (hybrid, plug-in hybrid, electric plug-in vehicle, or extended-range electric plug-in vehicle).

It shall be the goal of \_\_\_\_\_\_\_\_\_\_\_\_\_ Fire Department personnel arriving at the scene of a fire or crash-related incident to complete the recommended seven (7) step xEV “Lock Out – Tag Out” protocol. These essential actions should be accomplished as soon as practical after arrival and after completion of initial scene assessment and hazard control.

All responders should be aware of and fully understand the unique risks that personnel can potentially be exposed to when operating at an xEV incident. Actions taken by responders should be in compliance with applicable manufacturer’s Emergency Response Guide for that specific xEV as well as address the recommended practices in the Interim Guidance document from the National Highway Traffic Safety Administration (NHTSA, 2012).

**II. First-Arriving FD Apparatus**

Tactical Procedures:

Benchmarks are listed, based upon the recommended Lock Out – Tag Out protocol, for the first-arriving fire department units at an xEV emergency incident. Fire suppression actions shall be initiated at a vehicle fire incident following standard operating procedures. During the size-up phase of the incident, the OIC shall complete the following benchmarks;

* Identify vehicle as an xEV (hybrid, plug-in hybrid, electric plug-in , etc)
* Stabilize/chock/block drive wheels to prevent vehicle movement . . .
* Access passenger compartment . . .
* Shift gear selector to Park/ Set Parking Brake lever or button…
* **Turn ignition OFF…**
* Check that the specific xEV dash indicator lights/gauges shut down…
* **Disconnect/shutdown 12v battery . . .**

**III. Incident Command Benchmarks**

The initial-arriving FD officer and/or the Incident Commander should assure that efforts to complete the seven (7) essential “Lock Out – Tag Out” benchmarks are initiated in addition to assigning personnel to accomplish actions necessary to effectively contain and control any additional challenge at the vehicle-related crash or fire incident.

Unless delegated to another responder, the initial company officer and/or Incident Commander shall serve as the Incident Safety Officer.

**IV. xEV CRASH INCIDENT**

It is the intent of this Standard Operating Guideline that actions taken by fire department personnel shall be in conformance with the Interim Guidelines issued by the National Highway Traffic Safety Administration.

• If you detect leaking fluids, sparks, smoke, flames, increased temperature, gurgling or bubbling sounds from the High-Voltage battery compartment, assume there is a battery fire and ventilate the passenger area (i.e., roll down windows, or open doors).

• Request Emergency Medical Services if there are injuries as a result of the crash.

• Request law enforcement to assist with traffic control and/or scene safety.

• In non-fire situations when conditions such as leaking fluids, smoke, gurgling or bubbling sounds are detected, have responder personnel move away from the xEV and evacuate others from the immediate area. Be alert if responders detect any unusual odors or experience eye, nose, or throat irritation. Wear full Personal Protective Equipment (PPE) and Self-Contained Breathing Apparatus (SCBA) if rapid extrication is necessary for injured or trapped occupants.

• Be alert. There is a potential for delayed fire with damaged lithium-ion batteries inside or beneath an xEV.

**V. xEV FIRE INCIDENT**

There are vehicle fires and there are lithium ion battery fires. These are two separate situations or conditions that may take place individually or may be taking place at the same time within the same vehicle. These fires are unique in that the techniques for dealing with each require specific tactics and procedures.

A vehicle fire is considered a condition that involves burning of the combustible materials of the vehicle; seats, instrument panel, etc. A lithium ion HV battery fire is different. It involves a fire within the lithium-ion battery or battery cells/modules that is typically contained within a steel structure; box-like enclosure.

Lithium ion battery fire suppression efforts will require large, sustained volumes of water for extinguishment; referred to as copious amounts of water. Burning combustibles of a typical vehicle fire incident can generally be completely extinguished with 500 gallons of water or less. Even a portable fire extinguisher may be able to extinguish a vehicle fire.

If the lithium ion HV battery is what is actually burning, copious amounts of water will be required to extinguish. If there is no immediate threat to life or property, consider defensive tactics and allow the xEV battery cell fire to burn out.

• If there is active vehicle or battery fire, follow departmental SOG for vehicle fire suppression. Wear appropriate PPE and SCBA at all times.

• If occupants are still inside the vehicle or are trapped, consider using a fire extinguisher to protect the occupants until a hose line is available or until the occupants are removed.

• Establish a safe perimeter around the vehicle.

• When it is determined that there is a lithium ion battery fire, consider establishing a sustained water supply to support long-term suppression operation that may require approximately 2,000 to 3,000 gallons of water.

• Use a hose line to apply water to extinguish the fire while continuing to cool the HV battery and its casing. It is not recommended that fire department personnel attempt to penetrate the HV lithium ion battery or its casing to apply water due to the shock hazard. There is typically no port provided on the battery enclosure itself where reponders could directly apply water into the battery enclosure and directly onto the burning lithium ion cells.

• During the fire suppression efforts, avoid contact with orange high voltage cabling and areas identified as high voltage risk by warning labels; SAE requirements for orange color on electrical components with >60DC current.

• Be alert. There is a potential for delayed ignition or rekindle/re-ignition of a lithium-ion battery fire even after it is believed to be completely extinguished. This may remain an issue until the electrical energy within the lithium-ion battery is properly discharged by a vehicle service technician. Draining of the stranded energy inside a lithium ion battery is not a realistic or practical activity to requested or completed at an emergency incident scene.

• As with any vehicle fire, the by-products of combustion can be toxic. All individuals not properly trained, properly protected with appropriate PPE, or assigned to combat the xEV fire, should be directed to a location that is a safe distance upwind and uphill from the burning vehicle and out of the way of oncoming traffic.

**VI. POST-INCIDENT**

Post-incident actions by fire department personnel at incidents involving an xEV shall address the following NHTSA recommendations at a minimum;

• Always assume the HV battery and associated components are energized and fully charged.

• Ensure that passenger and cargo compartments remain ventilated, i.e., open window, door or trunk if and when inside an xEV when providing patient care.

• If the lithium ion high-voltage battery is believed to be physically damaged from impact or thermal damage, request that the FD Communications Center (Dispatch) notify an authorized service center or vehicle manufacturer representative (auto dealer) as soon as possible as there may be additional steps they can take at a later time and location to secure and discharge the HV battery.

• Advise the towing/recovery agency removing the xEV from the incident scene to not store a severely damaged xEV with a potentially damaged lithium-ion battery inside any structure or within 50 feet of any structure or vehicle.

• Advise the towing/recovery agency removing the vehicle from the incident scene that the vehicle should be monitored for leaking fluids, sparks, smoke, flames, gurgling or bubbling sounds from the HV battery, and if detected, assume the HV battery is burning and summon the fire department to the location to extinguish the fire.

**Recommended xEV ‘Lock Out-Tag Out’ Protocol**

* **Identify vehicle as an xEV …**

**(Hybrid, Plug-In Hybrid, Electric Plug-In, Extended Range Electric Plug-In)**

* **Stabilize vehicle…**

**(Chock or block front & rear of at least one drive axle wheel/tire)**

* **Access passenger compartment . . .**
* **Shift gear selector to Park/ Set Parking Brake. . .**
* **Turn ignition** **OFF…**
* **Check that any xEV dash indicator shuts down . .**
* **Disconnect/shutdown 12v battery or batteries. . .**