MONTEREY COUNTY FIRE CHIEFS ASSOCIATION
FIRE OPERATIONS MANUAL
SECTION 4

Electric Vehicle Response Guidelines

I. INTRODUCTION

This document establishes procedures/guidelines for responding to and mitigation of emergencies involving electric vehicles (EV).

A. Definitions

Battery Electric Vehicles (BEV): Vehicles consisting of a fully electric powertrain powered by an electric motor and rechargeable batteries. Battery cell storage is typically located in the undercarriage of the vehicle.

First Responder Cut Loop: Low voltage wire loops that emergency responders can safely cut to isolate the high-voltage system from the rest of the vehicle. This loop is typically located in the front trunk area or in some models, near the driver's side rear pillar near the 12-volt battery. There may be a hatch that would need to be removed. (Note: Cutting the first responder 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 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 while retaining and discharging high amounts of power.

Stranded Energy: The energy inside of 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 the battery burn itself out without the application of extinguishment agents.

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 produce a
chain reaction resulting in battery fire or explosion. Popping noises, white smoke, and elevated temperatures are common indicators of thermal runaway. (See Figure 6)

II. PROCEDURE

The primary hazards associated with EV's and lithium-ion batteries are electric shock, hazardous smoke, and fire. As such, all high voltage systems are assumed to be energized at all times. The individual mitigation and removal procedures are outlined in Sections A, B, C and D.

A. Vehicle Accidents

The first arriving unit should communicate over Command the involvement of an EV in their initial radio report or in an updated report on conditions.

EV's should be approached by emergency personnel utilizing the "45-degree rule." (See Figure 1) Emergency personnel may attempt to stabilize and/or de-energize the vehicle if the operation can be done quickly and safely. Emergency personnel unfamiliar with the vehicle should not attempt to de-energize.

Because of the potential for fire, electric shock, spontaneous movement and toxic gas production, occupants of EV's involved in a vehicle accident should be removed from the vehicle safely and quickly to a distance exceeding 330 feet. Bystanders should also be removed from the immediate vicinity as well.

There is no likely risk of electric shock from touching the vehicle, whether it is in or out of the water. However, normal safety precautions should be taken including immobilizing the vehicle and isolating the high voltage system using the First Responder Loop.

B. Vehicle Accidents Requiring Extrication

As stated above, EV's involved in accidents have the potential for many different hazards. When patient extrication is involved, emergency personnel must mitigate threats and be prepared for a rapid change in conditions. In all EV accidents involving extrication, the following should be deployed at a minimum:

- Charged 1 ½" hose line
- Extrication tools
- Don SCBA for emergency personnel (fire and toxic gases)
- Staged SCBA/RIC Pack for any victims (fire and toxic gases)
- PPV Fan

DO NOT: Cut, compress or disconnect the High Voltage electric cables (these are primarily orange, but black or blue or sometimes found). (See Figures 3, 4 and 5)

DO NOT: Use the floor pan of an EV for leverage while conducting extrication. Doing so can apply pressure or breach the battery housing which can cause thermal runaway. (See Figure 2)

C. Vehicle Fires

EV's have a potential for fire just as conventional internal combustion vehicles do. Recognition of a component fire vs. thermal runaway will determine whether an offensive fire attack is initiated.

An EV involved in fire is not always in thermal runaway. In the event a fire is determined to be vehicle component based only, a quick and well directed fire attack is appropriate.

An EV in thermal runaway could require thousands of gallons of water for extinguishment. The water used is also considered contaminated and requires a hazardous materials response. For this reason, EV batteries in thermal runaway will be allowed to burn out. Firefighting strategies in this condition should be focused on exposure protection only. Exposure to hazardous smoke shall be avoided. Hazardous smoke impacts to homes, vehicles, and bystanders shall be mitigated through isolation, evacuation, or shelter-in-place. Evacuation distance should be no less than 330' in all directions.

Where an EV fire has taken place in either scenario, proper notifications should be made at officer's discretion.

D. Vehicle removal from the scene

a. In progress – awaiting CHP input

III. REFERENCES

Figure 1 - 45 Degree Approach Rule

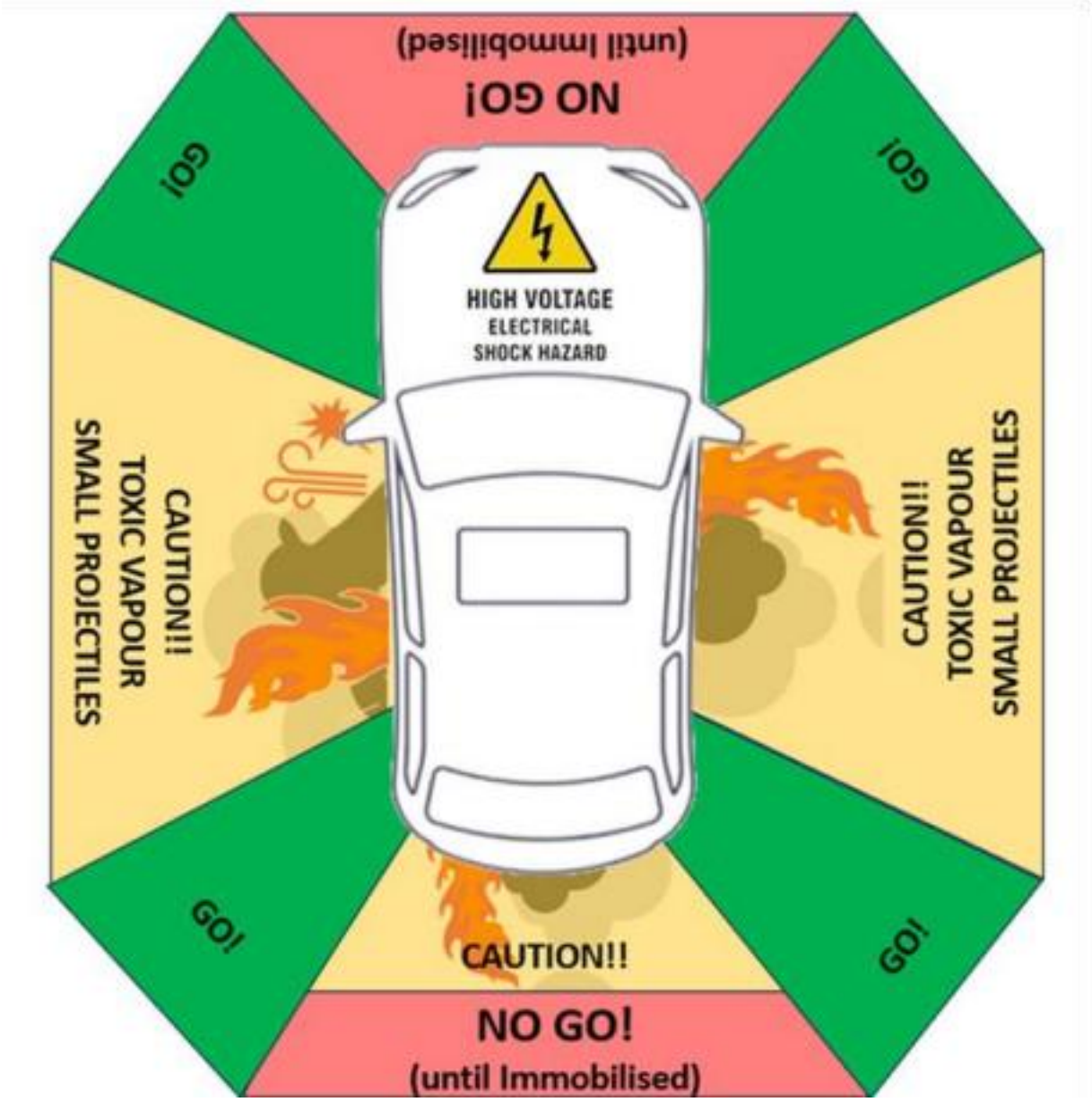

Figure 2 - Battery Storage Location

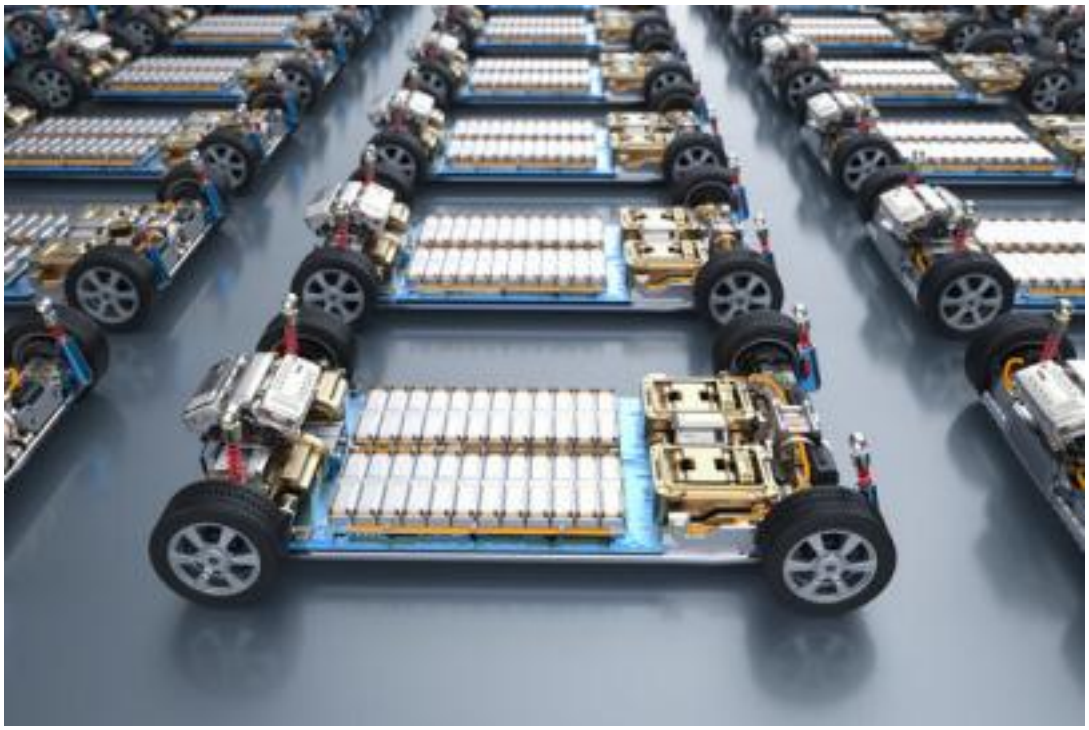

Figure 3 - First Responder Cut Loop

Figure 4 - Tesla Power Distribution

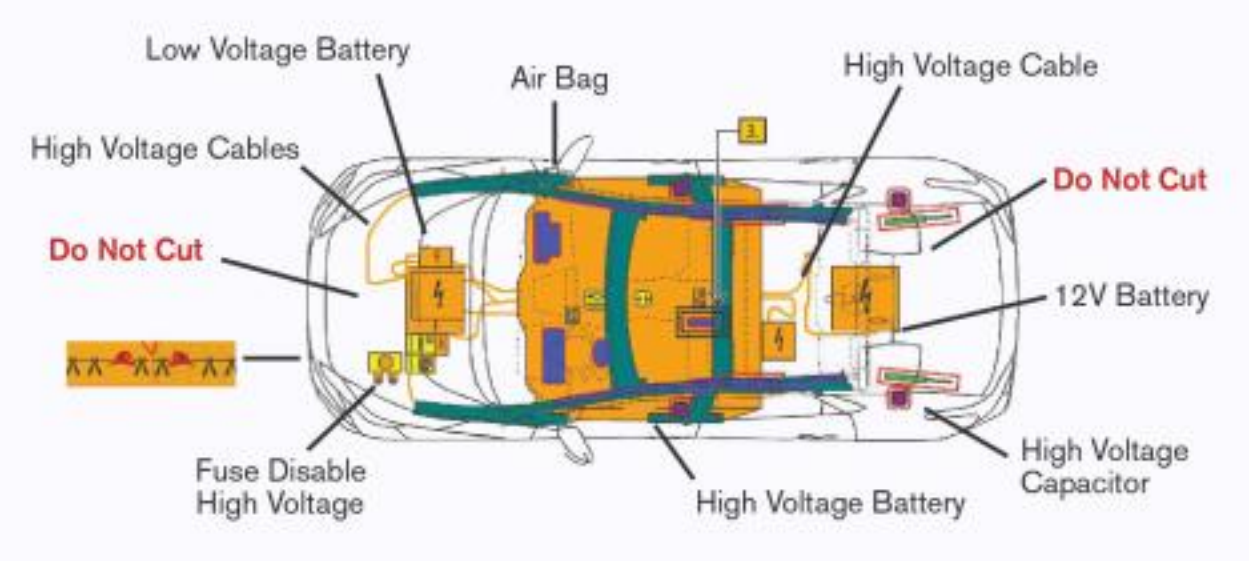

Figure 5 - High Voltage Cables

Figure 6 - EV in Thermal Runaway