

PHOENIX REGIONAL STANDARD OPERATING PROCEDURES	
Policy Name: CAR FIRES	Policy Number: M.P. 202.16
This policy is for internal use only and does not expand an employee's legal duty or civil liability in any way. This policy should not be construed as creating a duty to act or a higher duty of care, with respect to third party civil claims against employees or the Phoenix Fire Department (PFD). Remedies for violations of this policy, if proven, are limited to administrative disciplinary action against PFD employees.	
Related Policies: 205.20, 205.20A, 202.19, 202.19A	
Other Reference: NFPA - Emergency Response Guides for Alternative Fuel Vehicles, IAFC's Fire Department Response to Electric Vehicle Fires Bulletin	
Date Implemented: 04/2023-R	Review Date: 04/2028

PURPOSE

The purpose of this procedure is to identify operational tactics and considerations for motor vehicle fires. As sales of electric and hybrid vehicles increase, fire departments must continue to modify our tactics to address evolving safety and tactical considerations.

OVERVIEW

There is no such thing as a standard vehicle fire. The innovation and design of motor vehicles today has created many different hazards for firefighters. Early recognition of the involvement of an Electric Vehicle (EV), Hybrid Vehicle (HV) Vehicle with Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG) and emerging technologies such as Hydrogen powered vehicles. Autonomous Driving vehicles represent special risks associated with this emerging technology. This information is critical to size up and initial decision making on the incident. This information should be gathered by AHQ if possible. Crews must complete a size-up and attempt to identify the type of vehicle they are dealing with. Responding crews should rely on visual signs to include vehicle markings, color of smoke, location of smoke and/or fire, and any other signs that signal a crew to be aware of the products involved. Remember to consider the following important steps for all vehicle fires:

1. Identify the vehicle type and address life safety.
2. Address scene safety, apparatus placement and tactical positioning, immobilize the vehicle, when possible, chock wheels, etc.
3. Disable the vehicle, turnoff ignition, operate emergency shutoff if equipped, remove key or fab, consider addressing the factory labeled cable cut points.

The minimum level of protection for firefighters is full protective clothing breathing air from their SCBA. Captains must wear full protective clothing to directly supervise crews.

APPARATUS PLACEMENT

Apparatus should be placed upwind and uphill of the incident if possible. This is to afford protection from hazardous liquids and vapors and reduces smoke in the work area. Position the apparatus to protect the scene from on-coming traffic, using the apparatus as a barrier, to shield the incident scene from traffic hazards. Warning lights should be left operating, in conjunction with the use of traffic cones where needed. The use of flares by fire and police should be used with caution; consider the potential for flammable liquids and vapors. Additional consideration should be given to positioning the apparatus at an angle to better allow the removal of any hose from the preconnected cross-lay compartments.

WATER SUPPLY/EXTINGUISHMENT

Except in the case of a large fuel fire, water is the best for extinguishment of motor vehicle fires, however if not immediately available dry chemicals, CO₂, foam, or another typical extinguishing agent should be considered. If an EV/HV has been identified and is on fire, large amounts of water will be required to cool the batteries if the batteries catch fire, are exposed to high heat, or is generating heat or gases. It can take 3,000 gallons or more of water applied to the battery to fully extinguish AND cool down the batteries. This will require an uninterrupted water supply.

FIRE ATTACK

The minimum size of hose line to initiate an attack on a vehicle fire is the 1 ¾ inch handline. Approach the vehicle with full PPE and SCBA with facepiece, initiate the fire attack from a 45-degree angle, utilizing the reach of the fire stream to begin to extinguish the fire. First water should be applied to extinguish or protect the passenger compartment and an all clear should be obtained. Wheel chocks should be applied to prevent the vehicle from rolling. Hand tools can assist in providing access into vehicle spaces.

GENERAL HAZARDS AND SAFETY CONSIDERATIONS

- Energy absorbing bumpers consist of gas and fluid filled cylinders that when heated during a fire, will develop high pressures which may result in the sudden release of the bumper assembly. This could result in serious injury to anyone in its path. Bumper assemblies have been known to travel 25 feet.
- Batteries have Explosion/Flammability/Toxicity and Electrical shock hazards. Avoid contact with battery components.
- Trunk rear hatch, engine hoods, etc., have hold-open devices that may employ, along or in any combination with any of the following: springs, gas cylinders, extending arms, etc. When gas cylinders are exposed to heat, failure or rupture of these devices should be expected. Excessive pressure may develop in lift assists causing a trunk, hatch, or hood to fly open with explosive force when the latch mechanism is released. To ensure personal safety, be sure to allow sufficient clearance when releasing latches.
- Fires involving the trunk/cargo area should be approached with extreme caution. Contents may include toxic, flammable, or other hazardous materials. Expect the worst!

- Fuel tanks may be constructed of sheet metal or plastic. A rupture or burn-through may occur with these tanks causing a rapid flash fire of the fuel. Do not remove gas cap, as tank may have become pressurized. Do not direct hose stream into tank, as this will cause pressurization of tank, with a possible result of burning fuel spewing from the tank fill opening.
- Well-sealed interiors of modern vehicles present the potential for vent-limited fire on the interior which may grow significantly when fresh air is introduced during suppression. Use caution when opening doors or breaking windows. Appropriate approach, ventilation, and safety concerns must be considered. Have a charged handline ready before making entry. At least one member of the attack team must have forcible entry tools in his/her possession to provide prompt, and safe entry into the vehicle.
- Vehicle stability tires or split rims exposed to fire may explode, causing the vehicle to drop suddenly. Expect exploding rim parts or tire debris to be expelled outward from the sides. Approach from the front or rear of the vehicle for maximum protection from potential flying debris. Some larger vehicles, such as buses, employ an air suspension system. When these systems are exposed to heat or flame, they may fail, causing the vehicle to SUDDENLY drop several inches.

Where patients are trapped in the vehicle, first water should be applied to protect the patients and permit rescue. When rescue is not a factor, first water should be applied for several seconds to extinguish fire or cool down the area around any fuel tanks or fuel systems. This is especially important if the fuel tanks are LPG or CNG.

LPG & CNG

LPG and CNG are used as fuel for vehicles. Pressure release devices can create a lengthy "blow torch" effect, or should the pressure relief device fail, a BLEVE may occur. Vehicles may not be marked to identify this fuel hazard. If there is flame impingement on a visible LPG/CNG storage tank, take action to control the fire and cool the tank. Operate emergency shutoff controls to stop the flow of gas from the storage tank. If vapors escaping from the storage tank relief valve have ignited, allow the LPG/CNG to burn while protecting exposures and cooling the tank. Flow of gas through piping can be controlled by shutting off the valve at the storage tank. Balance to a 2 & 1 hazardous assignment.

ELECTRIC & HYBRID VEHICLES

When arriving on scene, the first step is proper size up. This includes the extent of the fire and if it's a compartment fire or includes the electrical components of the vehicle. Once life safety has been addressed, fire companies should determine if they should suppress the fire or simply allow the vehicle to burn. This can be based on exposures, the extent of the fire, etc. EVs can be viewed as a battery energy storage system on wheels. Batteries are simply a method to store energy and once the batteries have gone into thermal runaway, we understand that the vehicle is most likely

a total loss. Control efforts must consider life safety, property conservation, exposure protection, environmental protection, and **firefighter safety**.

EV fires pose additional hazards to firefighters due to the battery systems. When the decision is made to control the fire, the best method for controlling a battery fire is with water. Battery fires will initially show from under the vehicle where the batteries are located.

1. Protect the working area and position apparatus, accordingly, wear full PPE with SCBA and facepiece, ensure the EV is in park and off when possible.
2. Balance the assignment to a 3-1 Hazardous Materials assignment.
3. Secure a water supply.
4. Chock the wheels. EVs move silently, so never assume the power is off and never assume the EV will not move.
5. Small fires that do not involve the high voltage batteries can be extinguished using typical firefighting methods.
6. For well involved EVs, remember once the interior, contents, etc., are extinguished, sustained suppression on the battery pack may be necessary. Use 1 3/4-inch hand lines to suppress and cool fire and battery. Put water on burning surfaces. The use of AFFF is contraindicated. The use of Class A foam reduces the cooling effect of water in this application.
 - a. Attack an EV fire at a 45-degree angle initiating attack from 40 feet away and move forward. Batteries may vent below the vehicle's rocker panels and exhaust out the sides of vehicles.
7. **Do not cut into or puncture the battery pack.**
8. When necessary, efforts to protect dry-wells and storm drains through diversion and diking should be used. Protect exposures and evacuate the area.
9. EV batteries shall always be considered energized.
10. Recognize off gassing as a sign of continued battery degradation. This visible vapor cloud is toxic and flammable. It may appear as a white smoke even post extinguishment.

General Awareness & Safety Concerns

The high voltage battery system is controlled through the low voltage battery system. It is important to disable both systems when possible. Locating and cutting the negative terminal on the low voltage side is necessary to potentially disable the system. It is important to note that it may take up to 10 minutes for some electrical capacitors to fully discharge. **The batteries will retain stranded energy and will continue to pose an electrical hazard.**

Hybrid vehicles will have lithium batteries and another fuel source. You will have hazards of high voltage battery systems and the other fuel. If during fire attack with water, the fire does not go out. Consider the use of dry chemical extinguishers for initial suppression.

If vehicle is extinguished check temperatures of battery locations with TIC or temp gun, it is important to understand that you are looking at the casing around the battery with your tool. It is more critical to document trending temperatures to indicate if heat is building or if the heat is decreasing. Reignition potential is indicated by temps increasing. An increase in temperature will indicate the potential for a secondary fire. If the batteries have suffered thermal or mechanical insult the potential for electrocution is present, limit contact to the vehicle. Electric vehicles involved in fire should have a stable or reducing temperature for at least one hour before turning the car over to a tow company. Reignition may occur.

The use of a thermal blanket may be considered to create a fire stop and isolate the burning vehicle's ability to extend. The thermal blanket does not stop the thermal runaway process.

Without a life hazard or an exposure, the IAP may allow us to let the vehicle burn or just battery pack burn and treat the vehicle shell as an exposure. This may limit the total amount of smoke produced.

Hazard mitigation on EV fires is a collaborative process. The NFPA actively maintains a collection of Emergency Response Guides from vehicle manufactures. To access these documents, use the link below:

[NFPA - Emergency Response Guides for Alternative Fuel Vehicles](#)

Post EV/HV Incident Considerations

The general guidance provided to towing companies and storage facilities is to provide a 50-foot clear space around the EV once stored and never inside a building.

Consider briefing towing companies on this and escorting them to the vehicle storage location. Remember, thermal events with the battery system can continue for some time after the initial incident.

FIRES INVOLVING ELECTRIC VEHICLE CHARGING STATIONS

Fires involving EV charging stations should be treated as a fire involving any other electrical equipment:

- Secure Power to the EV Chargers.
- Once power is secured, the fire can be extinguished.

VEHICLES IN PARKING GARAGE

Any vehicle fire in a parking garage poses unique challenges. Upgrade the assignment to a 3 & 1. This will provide additional resources. A thorough size-up of incident factors must be performed. Some example considerations are:

- What level is the vehicle on?

- Is this an above ground or below grade?
- What exposures are attached to the garage?
- Is there a life hazard in the exposed areas?
- Where is the smoke traveling?
- Although non-combustible, the concrete structure can be weakened by extended exposure to the heat of a fire.

Supporting the sprinkler system is a high priority to limit fire spread. Many modern midrise buildings have a combination system that supports the sprinklers and the standpipe from one system. These buildings often have no fire pump, and the system is charged with municipal pressure. Pumping the FDC increases the GPM flow and pressure for both the sprinklers and the attack line.

When the incident has concluded, we should not be leaving the incident with building fire protection systems inoperable, rendering the building unprotected (please see M.P. 202.19 and 202.19A and/or your departments specific policies and adopted fire code regulations).

Controlling the ventilation system will aid in the protection of occupants of the parking garage and the exposures. A size up of the smoke travel/spread must be performed. If the garage is attached to an occupied structure, command must evaluate smoke spread and evacuate occupants from the affected areas. This will limit the exposure to toxic smoke.

Ladder companies may be used as an improvised standpipe at incidents on elevated freeways or parking garages.