City of Poquoson
Fire and Rescue

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GENERAL ADMINISTRATION

SOP#: EO 13.00

Title: Motor Vehicle Fires

Effective Date: 11/8/2023

Revised Date:

Fire Chief's Signature

City Manager's Signature

MOTOR VEHICLE FIRES

I. PURPOSE

To establish procedures for operations, tactics, and considerations for motor vehicle fires. With the rapid increase of alternative fuel sources, particularly electric and hybrid vehicles, the traditional approaches for petroleum powered vehicles must be modified to safely and effectively meet this new demand.

This SOP is not all-inclusive and cannot encompass all situations that may be encountered.

II. POLICY/POSITION

New hazards have developed at a rapid rate for firefighters encountering motor vehicle fires. Although diesel and gasoline powered vehicles still dominate the roads, Electric Vehicle (EV) and Hybrid Vehicle (HV) are growing in number as are Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG) and other technologies such as Hydrogen Fuel Cell powered vehicles.

This recent proliferation of different vehicle power sources necessitates the reemphasis on scene size-up and vehicle

identification at any vehicle fire. The following steps are critical at all vehicle fires:

1. Identify the vehicle type and address any life safety concerns.
2. Address scene safety, apparatus placement, tactical priorities, and immobilize the vehicle when possible.
3. Disable the vehicle, turnoff ignition, remove key or fob, address factory labeled cable cut points, operate emergency shutoff if equipped.

Full PPE with SCBA worn and on air is the minimum level of protection for all firefighters engaged in suppressing a vehicle fire. Officers must wear full PPE to directly supervise crews.

IV. PROCEDURES

Apparatus Placement:

Apparatus should be placed upwind and uphill of the incident if possible. Position the apparatus to protect the scene from traffic. Flares should be used with caution considering the potential for flammable liquids or vapors. Additional consideration should be given to position the apparatus to allow better removal of any preconnected hoses.

Water Supply/Extinguishment:

Water is the best for extinguishment of motor vehicle fires other than incidents involving large fuel fires. If an EV/HV has been identified and its batteries are presumed to be on fire, large amounts of water will be needed. 3,000 – 10,000 plus gallons of water may be required to fully extinguish and cool down the batteries.

Fire Attack:

The minimum hose line to initiate an attack is the 1 ¾ handline. Approach with full PPE and SCBA engaged and initiate the fire

attack from a 45-degree angle. Water should first be applied to extinguish or protect the passenger compartment. Wheel chocks should be applied to prevent the vehicle from rolling. Hand tools can assist in providing access into vehicles.

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 sudden violent release of the bumper assembly.
- Batteries have Explosion/Flammability/Toxicity and Electrical shock hazards. Avoid contact with battery components.
- Trunk rear hatch, engine hoods, etc. have devices that may employ any combination of the following: springs, gas cylinders, extending arms, etc. When exposed to heat, failure or rupture of these devices should be expected. When the latch mechanism is released any vehicle access points may open with explosive force.
- Fires involving the trunk/cargo area should be approached with extreme caution. Contents may any type of hazardous materials. Expect the worst!
- Do not remove gas caps, as tanks may have become pressurized. Do not direct hose stream into the tank as pressurization may result of burning fuel spewing from the opening.
- Well-sealed interior of vehicles presents the potential for a vent-limited fire. Use caution when opening doors or opening windows. Have a charged handline ready before making entry. At least one member of the attack team must have forcible entry tools to provide prompt and safe entry into the vehicle.
- Some larger vehicles, such as buses, employ air suspension, when exposed to heat or flame, they may fail, causing the vehicle to SUDDENLY drop several inches.

Where patients are trapped in the vehicle water should be applied first to protect 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:

When LPG or CNG is used as fuel for vehicles pressure release devices can create a "blow torch" effect, or if they fail, a BLEVE may occur. If there is flame impingement on a visible LPG/CNG tank, take action to control the fire and cool the tank. Operate emergency shutoff controls and if vapors from the relief valve have ignited, allow the LPG/CNG to burn while protecting exposures and cooling the tank.

Electric & Hybrid Vehicles:

A proper size up is CRITICAL for addressing EV/HV fires. Identifying a vehicle as an EV/HV can most quickly be done by speaking with a driver or passenger, looking for a charging port, or looking for EV/Hybrid badges. It must be determined if the fire is isolated to the compartment or includes the high voltage electrical components of the vehicle. After addressing any life safety issues, the attacking company should determine if they should suppress the fire or simply allow the vehicle to burn. **Letting the vehicle burn is often the best option** due to the risk of the batteries constantly re-igniting, massive volumes of water required to extinguish lithium-ion batteries once they go into thermal runaway, and the hazardous nature of the runoff created from flowing water onto the burning batteries. Especially considering that most often the vehicle is a total loss once the batteries have gone into thermal runaway. If allowed to burn, consider exposure protection and roadway protection. Also consider hazmat issues.

Consider an EV incident as not only a potential fire, extrication, and patient care emergency, but also a hazmat response. U.S. DOT

Response Guide #125 indicates that lithium battery fires generate hydrogen fluoride off-gas, which could be fatal. All firefighters need to wear SCBA with full PPE, and that no responder should touch or walk through its debris fields without these protections.

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. Secure a water supply.
3. Chock the wheels. EVs move silently, so never assume the power is off and never assume the EV will not move.
4. Small fires that do not involve the high voltage batteries can be extinguished using typical firefighting methods.
5. 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.
6. **Do not cut into or puncture the battery pack.**
7. When necessary, efforts to protect dry-wells and storm drains through diversion and diking should be used. Protect exposures and evacuate the area.
8. EV batteries shall always be considered energized.
9. 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 and Safety Concerns

The NFPA actively maintains a collection of Emergency Response Guides from vehicle manufactures. Access to these documents will be located on unit MDTs. These guides can provide valuable information such as how to power down the vehicle and where factory cut points are for disabling the electrical system.

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.

If vehicle is extinguished check temperatures of battery locations with TIC, 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. Hissing, popping, or crackling may be signs of imminent reignition. 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 vehicle 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.

Post EV/HV Incident Considerations

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

Perform gross decontamination needs at the scene, with all PPE needs then thoroughly decontaminated in a washer/extractor or per the manufacturer's specifications before re-use.

Acronyms/Abbreviations

EV -Electric Vehicle

HV-Hybrid Vehicle

LPG-Liquid Petroleum Gas

CNG-Compressed Natural Gas

PPE-Personal Protective Equipment

SCBA-Self-contained breathing apparatus

NFPA-National Fire Protections Association

MDT-Mobile Data Terminal

AFFF-Aqueous Film Forming Foam