Table of Contents

O P E R A T I O N S M A N U A L

STANDARD INSTRUCTION 02 SPECIAL RESPONSE GUIDELINES

SECTION 48 ELECTRIC VEHICLE FIRES

I. PURPOSE

To establish operational guidelines for effective response, mitigation, and safe operational procedures for electrical vehicle fires.

II. SCOPE

This policy shall apply to all sworn San Diego Fire-Rescue Department (SDFD) personnel.

III. AUTHORITY

The Fire Chief authorizes the information within this policy.

IV. DEFINITIONS

A. Hybrid Vehicle: Hybrid vehicles are vehicles that use both battery power and some other form of flammable or combustible liquid or gas the most common being gasoline.

B. Fully Electric Vehicle: A fully electric vehicle uses only battery power to operate.

C. Thermal Runaway: Lithium-ion (Li-ion) battery thermal runaway occurs when a cell, or area within the cell, achieves elevated temperatures due to thermal damage, mechanical damage, internal/external short-circuiting, or electrochemical abuse. This elevated temperature releases energy which in turn further increases the temperature. It is a phenomenon known as a positive feedback loop in which the lithium-ion cell enters an uncontrollable, self-heating state.

V. POLICY

A. Hybrid Vehicle Fires

1. Ensure all personnel are wearing full PPE including SCBA
2. If safe, chock the wheels
3. Never assume the vehicle is powered off and won't move
4. Immediately check for trapped victims
5. Avoid the smoke whenever possible
6. Attack the fire as a normal vehicle fire as the batteries may not be involved
7. After confirming this is a hybrid vehicle and the batteries are involved, notify Emergency Command and Data Center (ECDC) for documentation and to notify incoming units of lithium-ion battery fire
    a. If safe to do so, allow the batteries to burn, evacuate the area 330' in all directions, and protect exposures
    b. If extinguishment is required, secure a water supply
    c. Extinguishment may require copious amounts of water likely in the thousands of gallons
8. Locate the main lithium-ion battery

a. Refer to the Emergency Response Guide for the specific make and model of the vehicle for guidance. Guides may be found at www.nfpa.org
b. A thermal imager should be used to check the temperature of the lithium-ion battery and cooling measures should be used if necessary
c. Apply water as directly to the batteries as possible
d. Once extinguished, if it is possible, locate the main disconnect to isolate power to the main lithium-ion battery
e. This can be done by removing the negative terminal from the 12-volt battery and cutting the first responder loop

9. Never cut, crush, puncture, or open a high-voltage battery to extinguish it
    a. If the cells are visible due to damage you can direct a hose stream directly on the cell
    b. Observe the battery and listen for smoke, steam, and popping noises from the battery
    c. If any of these are observed, the lithium-ion battery is in thermal runaway
10. Once the lithium-ion battery has been cooled, stand by for at least one hour and continue monitoring the lithium-ion battery using the thermal imager and observe for any other signs of thermal runaway (e.g., steam, hissing, popping, etc.)
    a. If on a freeway, consider using CHP to move the vehicle out of the way, if feasible and safe
    b. Once determined the vehicle is safe for transport, release the vehicle to the tow company, making sure it's towed on a flatbed. Wheel Lift towing may send unwanted power to the lithium-ion batteries
    c. The tow company is responsible for properly storing the vehicle

B. <u>Fully Electric Vehicles</u>

1. Ensure all personnel are wearing full PPE including SCBA
2. If safe, chock the wheels
3. Never assume the vehicle is powered off and won't move
4. Immediately check for trapped victims
5. Avoid the smoke whenever possible
6. Use 1 ¾ inch hose line to extinguish the fire
    a. Foam is <u>not</u> recommended
7. Attack the fire as you would a normal vehicle fire
8. After confirming this is an electric vehicle (EV) and the batteries are involved, notify ECDC for documentation and to notify incoming units of lithium-ion battery fire
    a. If safe to do so, allow the batteries to burn, evacuate the area 330' in all directions, and protect exposures
    b. If extinguishment is required, secure a water supply

c. Extinguishment may require copious amounts of water likely in the thousands of gallons

9. Consider requesting USAR to assist with tilting the vehicle to gain access to the underside of the vehicle where the floor pan lithium-ion battery is located, if necessary, to gain access to the battery pan
10. Refer to the Emergency Response Guide for the specific make and model of the vehicle for guidance on securing power to the lithium-ion battery. Some battery cooling mechanisms are powered by the 12-volt system. Guides may be found at www.nfpa.org
11. If any lithium-ion cells have come out of the battery and lying on the ground request HazMat
    a. Do not touch any battery that has come out of the battery compartment
12. Use a thermal imager to check the temperature of the lithium-ion battery
    a. Cool with a continuous water stream
13. Never cut, crush, puncture, or open a high-voltage battery to extinguish it
    a. If the cells are visible due to damage you can direct a hose stream directly on the cell
    b. Observe the battery and listen for smoke, steam, and popping noises from the battery
    c. If any of these are observed, the lithium-ion battery is in thermal runaway
14. Once the lithium-ion battery has been cooled, stand by for at least one hour and continue monitoring the lithium-ion battery using the thermal imager and observe for any other signs of thermal runaway (e.g., steam, hissing, popping, etc.)
    a. Once determined the vehicle is safe for transport, you can release the vehicle to the tow company, making sure it's towed on a flatbed. Wheel Lift towing may send unwanted power to the lithium-ion batteries
    b. The tow company is responsible for properly storing the vehicle

C. <u>Post Incident</u>

1. Fire hose and turn-out cleaning should follow current post-fire incident decontamination procedures.