INSTRUCTOR GUIDE

TOPIC: RESCUE COMPANY OPERATIONS – HYBRID VEHICLES

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TIME REQUIRED: 1.5 - 2 HOURS

MATERIALS:

- Laptop computer
- Projector
- It would be a benefit to contact a local dealership who sells/services hybrid vehicles and make arrangements for a hybrid vehicle to be brought to the station or allow the class to visit the dealership so that the students could get a hands-on appreciation of the vehicles. If available make arrangements for a vehicle that has a keyless ignition system.

Requisite Knowledge:

- None

Requisite Skills:

- None

Attention: (Call to Order)

Motivation: (State Need to Know): Over the last few years the number of hybrid vehicles operating on our roadways has increased significantly. Given the current fuel costs and the push for more "green" technology, the number of hybrid vehicles and other alternative fuel vehicles will continue to increase. As emergency responders we should be comfortable handling emergencies that we may encounter which involve these vehicles.

Student Performance Objective:
Given information from lecture students should be able to describe and/or discuss the operation of hybrid vehicles and the associated high voltage systems, emergency procedures, how to identify hybrid vehicles and current models of hybrids.

Enabling Objectives:

EO-1 Describe how hybrids operate.

EO-2 Describe the high voltage electrical system.

EO-3 Describe the types of batteries used in hybrid vehicles.

EO-4 Define the "silent" hybrid.

EO-5 Describe hybrid vehicle crash/emergency procedures.

EO-6 Describe other considerations when dealing with hybrid vehicles (i.e. keyless ignition systems)

EO-7 Describe methods for identifying a hybrid vehicle.

EO-8 List at least five makes of hybrid vehicles.

Overview:

- What is a hybrid?
- What type of electrical system do hybrids utilize?
- What types of batteries do hybrids utilize?
- What is the “silent” hybrid?
- Emergency procedures for dealing with hybrid vehicles
- Are there other considerations that you may have to deal with when working with hybrids?
- How can hybrids be identified?
- Who is making hybrids today?

Opener: Call to order, start with a motivator related to the objectives and the lesson; state the objectives and main points.

Lesson Plan **Instructor Notes**

I. Hybrid vehicles

A. Any vehicle which combines two or more sources of power

B. Hybrid structure

1. Parallel – Gasoline motor and batteries which power an electric motor. Both can power the car at the same time.

2. Series – Gasoline motor turns a generator which charges the battery or power an electric motor that drives the transmission.

II. High voltage electrical systems

A. Batteries are nickel-metal hydride

B. Voltage ranges from 144 to 640 volts

C. High voltage wiring may be orange, bright blue, or even yellow

III. Batteries

A. Individual cells contain liquid potassium hydroxide, this is absorbed by the paper membranes inside the cells

B. Batteries are considered to be dry cell

C. Usually located in the rear, under the floor of the trunk

D. The wiring harness from the high voltage batteries usually runs below the floor pan about one foot in from the driver's side

E. Batteries are recharged by a generator or through a process called regenerative braking

IV. The "Silent" Hybrid

A. Gasoline engines usually shut off when not needed

B. Most hybrids have an indicator light to identify the status of the vehicle

C. The vehicle may "awaken" without notice

V. Emergency Procedures

A. Fires

1. Utilize normal vehicle firefighting procedures
2. Virtually all fires involving NI-MH batteries can be controlled with water

B. Battery Pack Physical Damage

1. Do not remove the metal cover from the high voltage battery pack
2. DC current is normally isolated from contact the vehicle; theoretically you would have to contact two separate points within the high voltage systems at the same time
3. Any damage to the high voltage system should cause a short circuit and de-energize the system

C. Crash Procedures (from Ron Moore, Firehouse Magazine, University of Extrication)

1. Hybrid vehicle identification
2. Vehicle stabilization
3. Access to the passenger compartment
4. Shift gear selector to park
5. Turn key off and remove from ignition—keyless ignition systems differ and are addressed later
6. Check that the ready light indicator is out
7. Disconnect the 12 volt battery

VI. Other Considerations

A. Rear-end collisions destroy obvious hybrid logos

B. Significant physical damage to the high voltage battery pack is not a hazmat incident

C. Keyless Ignition Systems

1. Allow for push button start
2. Deter theft and break-ins
3. Utilize key fobs – contain a chip that is vehicle specific
4. Key fob must be in the vehicle for the car to start
5. What to do in an emergency:
    a. Place vehicle in Park
    b. Press start/stop or power button
    c. Remove key fob from the car if possible
    d. Disconnect the low voltage system

VII. Common Means of identification

A. Vehicle logos

B. Large diameter high voltage lines

C. Indicator lights on the dash

VIII. Current and Future Hybrids

A. Current Models

B. Future Models

Summary:

Company Drill: Rescue Company Operations – Hybrid Vehicles

Student Performance Objective:
Given information from lecture students should be able to describe and/or discuss the operation of hybrid vehicles and the associated high voltage systems, emergency procedures, how to identify hybrid vehicles and current models of hybrids.

Review: (Have students draw conclusions about the following key points)

- What is a hybrid and how do they operate?
- Describe the high voltage systems utilized in hybrid vehicles.
- What types of batteries do hybrid vehicles utilize?
- What is the "silent" hybrid?
- Emergency procedures for dealing with hybrid vehicles
- Name one additional consideration you may have to consider when dealing with a hybrid vehicle.
- Name two ways of identifying a hybrid vehicle.
- Name five models of hybrid vehicles.

Sources:
Dalrymple, David; FDIC H.O.T. presentation, Indianapolis, IN, April 2007.

Moore, Ron; *Firehouse.com, University of Extrication*.

Moore, Ron; Firehouse Expo presentation, Baltimore, MD, July, 2005.
www.edmonds.com; Keyless ignition systems.