MODULE IV: INITIAL RESPONSE, IDENTIFY, IMMOBILIZE AND DISABLE

TERMINAL OBJECTIVE

Demonstrate knowledge of initial response procedures for an incident involving HEVs and EVs, including how to identify, immobilize and disable the vehicles.

ENABLING OBJECTIVES

The students will:

1. *Identify size up procedures and scene hazards of an incident involving a P/HEV and EV.*
2. *Identify P/HEVs and EVs using formal and informal information and using the Emergency Field Guide.*
3. *Identify immobilization procedures.*
4. *Identify vehicle disabling procedures.*

INTRODUCTION

Proper techniques, standard protocols, and the use of proper PPE are critical in order to stay safe during emergency operations involving any vehicle.

Many of the shut down procedures for HEVs, PHEVs and EVs are similar to the shut down procedures for a conventional vehicle.

Since HEVs, PHEVs and EVs can move with little or no noise, our traditional methods of determining if a vehicle can move under its own power are not effective. Assumptions as to the power status of these vehicles can be dangerous.

By understanding the proper procedures for disabling and immobilizing HEVs, PHEVs and EVs, emergency responders can operate safely at emergencies involving these vehicles.

Upon arrival, conduct your size-up as you would at any other incident.

Common hazards at any incident scene:

- Traffic
- Downed power lines
- Fuel spills or other hazmat
- Environmental Hazards
- Fire
- Unstable vehicles

Initial response actions for an incident involving P/HEV and EV:

1. Identify
2. Immobilize
3. Disable

Electric Vehicle Emergency Guide (EFG)

Consolidated quick reference guide:

- Simple, easy to use format
- Identification
- Shut down
- Danger areas
- System diagrams
- Suppression

Submersion

INITIAL RESPONSE ACTIONS

There are a number of current HEVs, PHEVs and EVs models on the road, including passenger cars, pickup trucks, sport utility vehicles and commercial trucks. Current HEVs, PHEVs and EVs are primarily based on existing vehicle designs and models. This increases the difficulty of identifying a HEV, PHEV or EV during an emergency operation such as a vehicle crash.

Identification

Formal Identification

Formal identification is the identification of badging or labels which visibly indicate a vehicle is a HEV, PHEV, or EV.

One method for identifying a HEV, PHEV or EV is the **exterior emblems** and badging. The most common place for badging is on the front fenders or doors and on the rear. Badging may become hidden or dislodged. Badging often involves manufacture trade names.

Some EVs have badging that indicates they are “Electric” or “Zero Emission” Vehicles. Some model names are specific and are only made as P/HEVs and EVs.

Engine compartment emblems can also be used to identify HEVs, PHEVs and EVs. High-voltage warning labels are located under the hood area and on high voltage components and cabling. Some labels may show the location of the 12v DC and high voltage battery.

Manufacturers use different terms to label their vehicles under the hood including:

1. Hybrid
2. Hybrid synergy drive
3. IMA - Integrated Motor Assist (Honda)

Instrument cluster indicators or emblems may also be used to identify a HEV, PHEV or EV. These emblems include the hybrid or IMA logo. In some cases these labels will not be visible when the vehicle is shut down.

Informal identification

Informal Identification includes any visual clues that do not specifically spell out the words hybrid or electric but indicate that you are dealing with a vehicle of that nature such as battery vents, instrument panels and electric cables. Specific modifications in or on the vehicle are hints that indicate you are dealing with a HEV, PHEV or EV.

Instrument cluster items can also indicate the vehicle is an HEV, PHEV or EV. Charge/Assist indicators are used to indicate to the driver when the battery is being charged and when the battery power is being used to assist in propelling the vehicle on HEVs. Some vehicles have a battery status indictor on the instrument panel.

"Ready" or "Auto Stop" mode lights indicate to the driver that the vehicle is on and that, when placed in gear, the vehicle will move. This also serves as a good indicator to responders that the vehicle has not been shut down. This feature is used on most HEVs and EVs.

Electrical cables, when visible, are also an indicator of a HEV, PHEV, or EV. Intermediate voltage cables are colored blue or yellow. The cables can be found under the hood, on the underside of the vehicle, and in the area of the battery. They are **not** placed in areas typically considered cut points.

There is no requirement that the orange cable be visible. In fact, newer models have often covered up a large portion of the orange cables with a black shrouding. For example, the Nissan Altima HEV has cabling that is completely covered by a black casing on the underside of the vehicle. Some models have plastic paneling on the underside of the vehicle to decrease wind resistance, which also obscures the cables. In earlier models, the orange cables on the underside of the vehicle are more commonly visible.

One of the most prominent informal indicators is the **battery vents**. The purpose of these vents is to keep the high voltage battery from overheating during the normal charge and discharge process by keeping air flow around the case. Battery vents are located in the general vicinity of the battery to ensure proper airflow. Often look like HVAC vents or speakers. Not all vehicles have visible vents.

Plug-in hybrids and electric vehicles have **charging ports** that help identify them. The charging ports will have a cover that may look like the cover of a gas filling port, but they are usually located either in the very front of the vehicle, or on the driver's side front fender

To make a determination of whether or not a vehicle is an HEV, PHEV or EV, use all possible information available. Even if indicators are not immediately noticeable, take time to determine whether the car is an HEV, PHEV or EV. In the absence of a visible badge due to extensive vehicle damage, continue to look for additional clues.

Telematics

Telematic systems are electronic vehicle safety and security systems that monitor a vehicle's status. In the event of a crash these systems can not only notify your dispatch center of the location and nature of the call but they can also relay information to responding personnel as to the type of vehicle involved.

The use of telematics is increasing and multiple vendors are now marketing vehicle systems.

- OnStar (GM)
- Blue Link (Hyundai)
- BMW Assist (BMW)

IMMOBILIZE

The next step in initial response actions is to immobilize the vehicle. This procedure needs to happen all of the time on every incident, regardless of whether or not the vehicle is a HEV/PHEV/EV. When approaching a vehicle involved in an incident, be sure to do so from the sides. Never approach a vehicle directly from the front or rear, because until it is immobilized and positively shut down, there is always the potential for it to move unexpectedly.

As soon as you get to the vehicle, immediately deploy wheel chocks to prevent any type of accidental movement. Then, engage the parking brake and place the vehicle in park. If the vehicle has a manual transmission, place it in gear after it has been disabled, but you should know that manuals are rare in hybrids and currently nonexistent in electric vehicles.

It is important to engage the parking brake at this stage, because in some models, the parking brake is electronic and cannot be engaged once you disable the vehicles electrical system.

Useful Information

"Joystick" shifters that always return to the same position regardless of gear selection are standard on some models such as the Toyota Prius.

Putting the vehicle into "Park" may require pushing a button on the dash that actuates an electrical parking pawl mechanism on some models. Electronically operated parking brakes will not engage after battery power has been cut from the vehicle.

DISABLING PROCEDURES

The third step in initial response actions is to disable the vehicle.

There are two methods for disabling the vehicle.

The primary method

In the primary method, a standard protocol is followed for both conventionally powered vehicles and for HEVs, PHEVs and EVs, when the ignition can be accessed. This procedure should occur at any crash where personnel are interacting with a vehicle. This standard protocol includes the following steps.

1. Shut off the vehicle ignition.

   This could either be a traditional ignition switch or a push button ignition with a proximity key.

2. Disconnect the 12v DC battery.

Many vehicles now offer smart or proximity key systems with push button ignition switches. These can be found in HEVs, PHEVs and EVs, and in standard model vehicles. Proximity keys bi-directionally communicate with the vehicle. They allow the user to unlock the doors and start the vehicle as long as the key is nearby, such as in a pocket or purse.

Responders should attempt to secure the key from the driver as well as ask any other occupants if they have keys. Manufacturers generally recommend moving these keys a minimum of 16’ away from the vehicle.

If the driver is unconscious, it will likely be difficult to secure the key. It may be possible to find one key but not be able to determine if there is another in the vehicle. In that event, just follow normal ignition shutdown procedures by pushing the button to turn the vehicle off and then disconnecting the 12v battery. Once the 12v battery is disconnected, even if the power button is pushed again with the key in the car, it will not start.

The secondary method

The secondary method is used if the vehicle ignition cannot be accessed on the HEVs, PHEVs and EVs.

1. Disconnect the 12v DC battery.

   Disconnecting the 12v DC battery alone may not be sufficient to shut down the high voltage system in a HEV, PHEV or EV, depending on the vehicle. The converter may continue to provide power to the vehicle until the ignition is shut down or until the high voltage system relay fuse is removed.

2. Pull the high voltage system control fuse or relay.

   The high voltage system control fuse or relay can be found under the hood. This action cuts off the 12v DC power source from the relay in the high voltage battery. The result is that the power is cut from the high voltage battery.

Important Safety Note!

Both steps (Cut 12 VDC battery and pull HV fuse) are critical for disabling both the HV system and the airbags. If the vehicle ignition was not shut off, the DC-DC converter can still provide 12 VDC power to the HV battery relays. Pulling the HV system fuse interrupts current from both 12 VDC power sources to the HV battery, opening the HV relays, and shutting down the HV system.

Reference NFPA's Emergency Field Guide (EFG) or the manufacturer's ERG to determine which one to pull (not all models recommend this method). Secondary disabling for procedures for that model. If unsure, pull them all.

High Voltage System Drain Down

Some models have capacitors that can retain HV energy for up to 10 minutes. After system is shut down, the high voltage battery still retains its charge. Always assume they system is still energized.

Service Disconnects

Recommendations for use and required safety equipment vary by manufacturer. Consult appropriate ERG before using service disconnect. Located on the battery. Cuts off the battery from the high voltage system.

SUMMARY

If you don't see a badge immediately—take the time to look for informal clues to identify the vehicle. Once the scene is secure and the vehicle is identified, the vehicle should be secured, immobilize and disable.

Specific knowledge of the HEV/PHEV/EV is necessary to maintain safety for responders and victims. The Emergency Field Guide can be used to obtain specific vehicle information.

Activity 4.1

Identification Drill

Purpose:

To identify vehicles as a HEV, PHEV, or EV

Directions to the Students:

1. You are going to be shown a series slides, each with a picture of a vehicle or component of a vehicle on it.
2. You will be given a few moments to determine if:
   a. The vehicle is an HEV or EV
   b. The vehicle is NOT an HEV or EV
   c. Cannot Tell. The information is not sufficient to determine if an HEV or EV is involved or not.

Slide #1_____

Slide #2_____

Slide #3_____

Slide #4_____

Slide #5_____

Slide #6_____

Slide #7_____

Slide #8_____

Slide #9_____

Slide #10_____

Activity 4.2

Size Up: Identification

Purpose

Identify HEVs and EVs using formal and informal information.

Student Directions

1. You will be shown a series of progressive slides of two incidents that may involve a HEV, PHEV, or EV.

2. After each slide, you will be given a few moments to size up the scene. When your group believes they can correctly determine if the vehicle is a HEV, PHEV, or EV, notify the instructor.

3. Be prepared to justify your decision.

Activity 4.3

Size Up and Securing the Vehicle

Purpose:

To size up a crash scene involving an HEV, PHEV or EV, and identify the best procedure for securing the vehicle.

Directions to the Students:

1. Working in your small group, review and discuss the assigned scenario. Use your experience to fill in any missing details.

2. Answer the questions listed below for your scenario. You must use your Emergency Field Guide (EFG) to answer question #3.

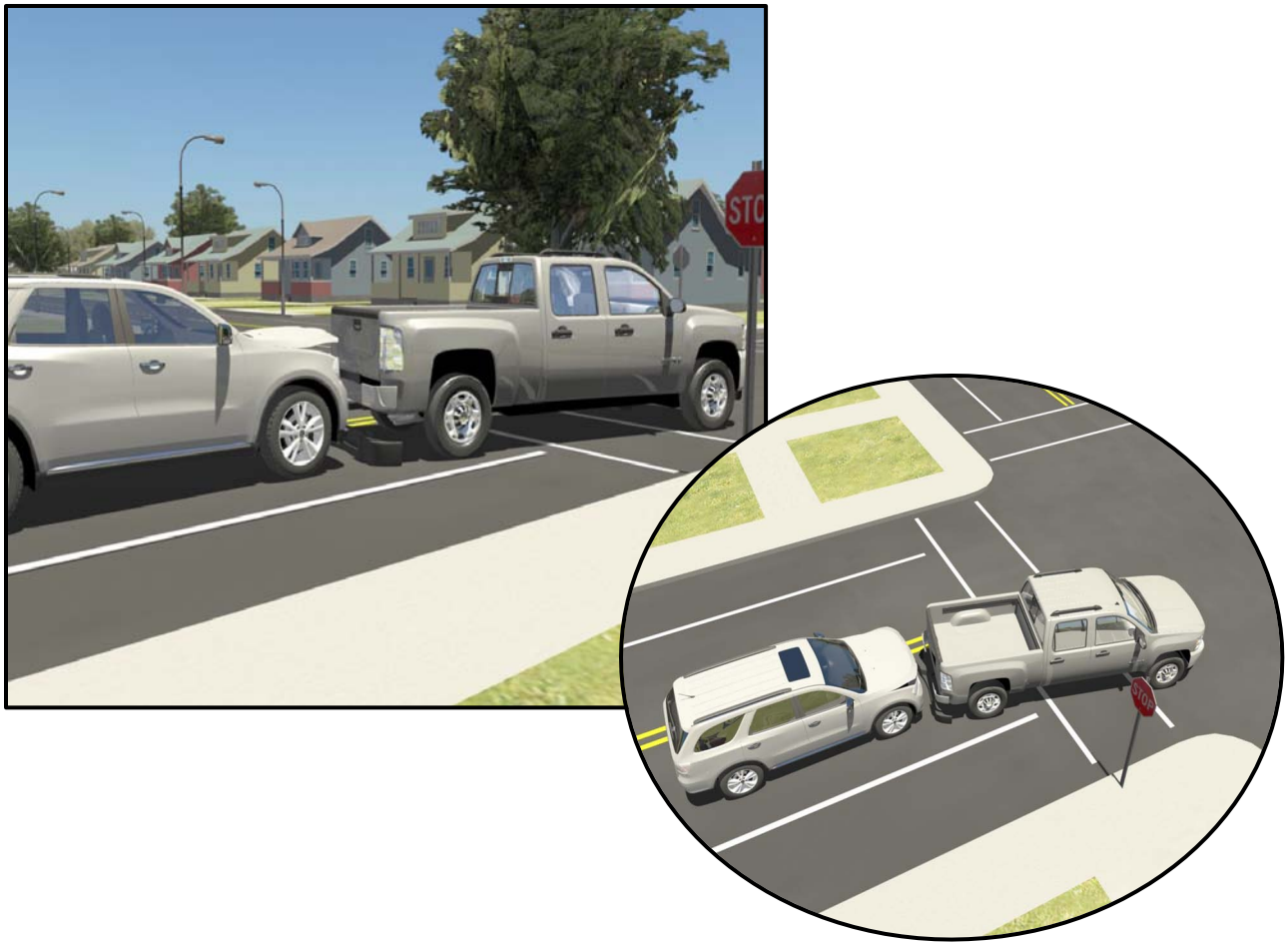
   a. What hazards are present in this scenario?

   b. What are your scene safety priorities?

   c. What methods would you use to secure and disable this vehicle?

   d. What vehicle-specific response concerns are indicated in the Emergency Field Guide?

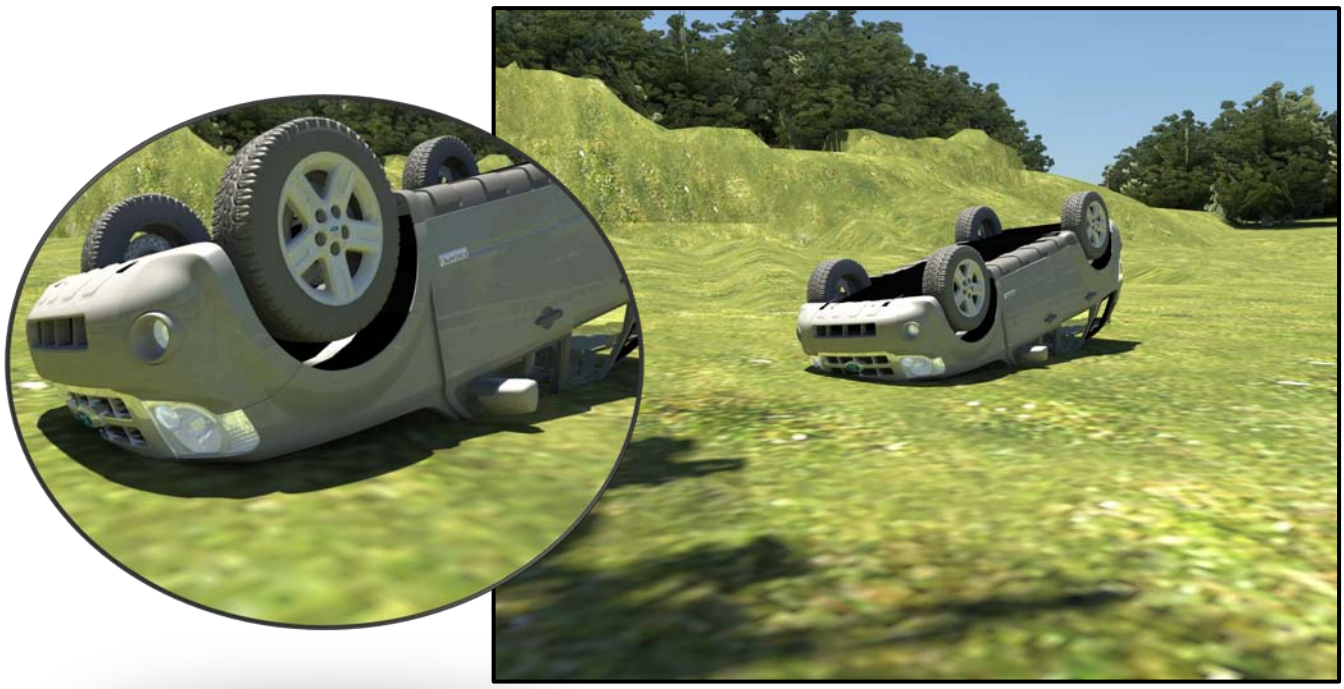
3. Select a spokesperson to share your answers with the class.



Scenario 1

You are dispatched to a traffic crash at the A and 1st Streets. It is 5:30 p.m.. Temperature is 60°F, sunny and calm. On arrival you find two vehicles involved in a rear end collision. A GMC Yukon ran into the back of a pickup that was stopped at the red light. There is extensive damage to the front end of the Yukon. The badge on the Yukon indicates it is a HEV. There is a small amount of fuel leaking from the pickup and engine coolant is leaking from the Yukon. The airbags in both vehicles are deployed. The driver of the Yukon is still in the vehicle but appears to be conscious. The driver of the pickup is standing on the sidewalk.

1. What hazards are present in this scenario?
2. What are your scene safety priorities?
3. What methods would you use to secure and disable this vehicle?
4. What vehicle-specific response concerns are indicated in the Emergency Field Guide?



Scenario 2

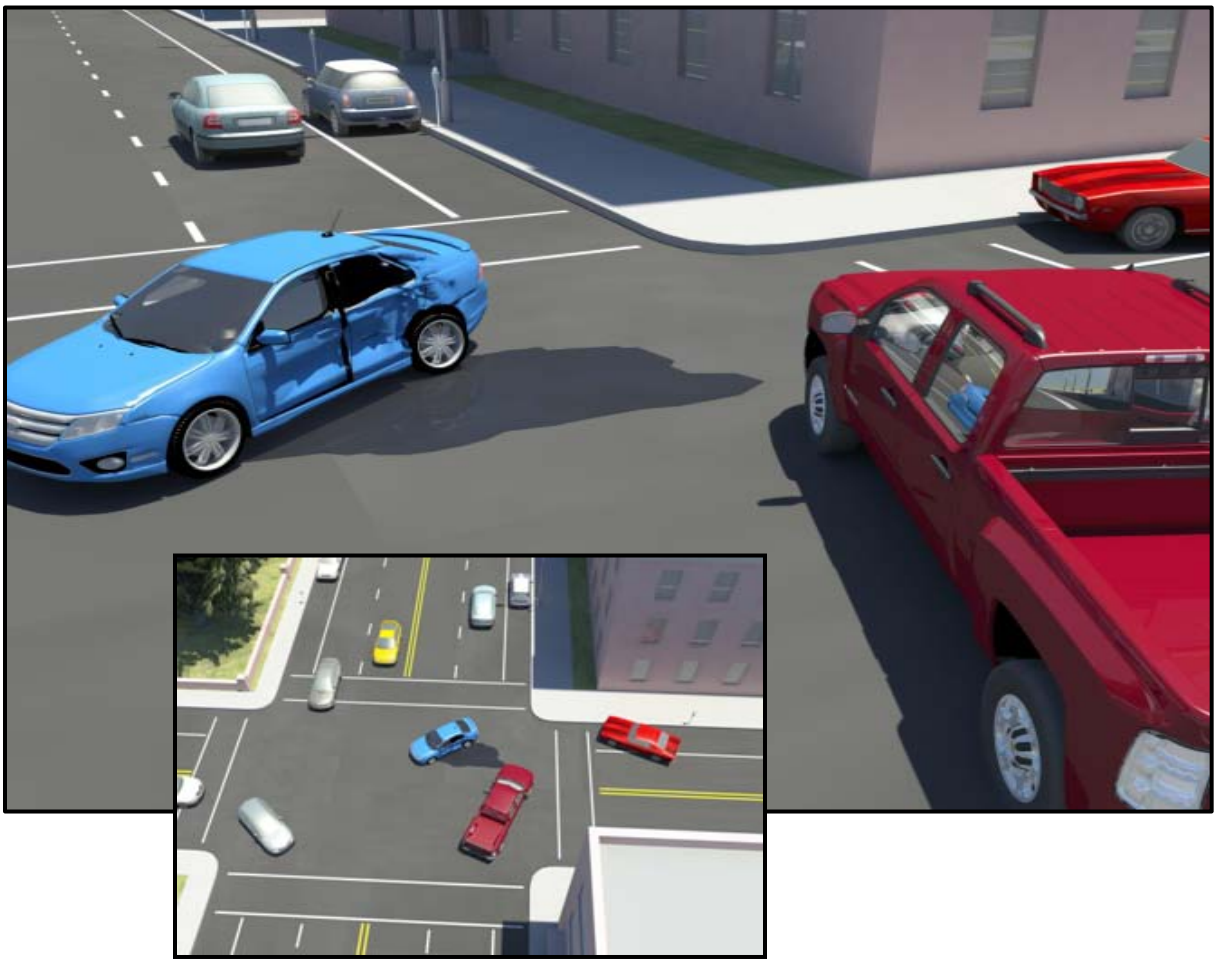
You are dispatched to a possible rollover on County Rd. 185. You know this section of road is a gravel surface which periodically causes drivers to lose control of their vehicles. The reporting party states there are two people trapped in the vehicle. It is 2:00 a.m., 18°F, and calm. En route, the dispatch center informs you that the vehicle is a Ford Escape hybrid and the airbags have deployed. On arrival you find the vehicle in a field approximately 100 feet. from the road, on its roof. It appears to have rolled end over end several times. The roof of the vehicle is collapsed approximately 2 feet. You observe two passengers in the vehicle. They are both conscious and talking to you. Both passengers are wearing their safety belts. There are two sheriff deputies on scene and they have the road blocked to traffic.

1. What hazards are present in this scenario?
2. What are your scene safety priorities?
3. What methods would you use to secure and disable this vehicle?
4. What vehicle-specific response concerns are indicated in the Emergency Field Guide?

Scenario 3

You are dispatched to a reported head-on collision on State Highway 12, approximately ½ mile east of downtown. It is 4 p.m., 21°F and some freezing rain. The roads are ice covered and very slick. There have been numerous crashes around the city in the last 2 hours. On arrival, you find two late-model cars that ran head-on in an intersection. One or both apparently could not stop on the ice. Both are SUVs. One is a Dodge Durango that is badged as a hybrid. Passengers are still inside the Dodge Durango but do not appear to be injured. The body is damaged in the area in front of the doors, making it impossible to open the front doors. The passengers from the other vehicle are in a bystander's car staying warm. There is glass and debris scattered around the vehicles. Due to the call volume, no police officers are available to provide traffic control. Both vehicles are leaking fluids from the engine compartments.

1. What hazards are present in this scenario?
2. What are your scene safety priorities?
3. What methods would you use to secure and disable this vehicle?
4. What vehicle-specific response concerns are indicated in the Emergency Field Guide?



Scenario 4

You are dispatched to a reported traffic crash at the intersection of Rolling Rock and Meadow Lane. It is 2:30 p.m., 85°F, and there is a moderate wind. On arrival, you find a two-vehicle crash. It appears that one vehicle may have run a red light and struck the other vehicle in the passenger door. The vehicle that was struck in the door is a Ford Fusion that is badged as a hybrid. There is extensive damage to the Fusion and the driver appears to be unconscious. She is the only occupant of the vehicle. The airbags have deployed on both vehicles. There is a great deal of liquid under the Fusion which smells like gasoline. The occupants of the other vehicle appear to be conscious with only minor injuries. Traffic is still moving by the crash scene.

1. What hazards are present in this scenario?
2. What are your scene safety priorities?
3. What methods would you use to secure and disable this vehicle?
4. What vehicle-specific response concerns are indicated in the Emergency Field Guide?