MODULE V: EMERGENCY OPERATIONS

TERMINAL OBJECTIVES

Analyze simulated crash scenes to determine appropriate actions.

ENABLING OBJECTIVES

The students will be able to:

1. *Identify unique extrication challenges presented in crashes involving P/HEV/EVs.*
2. *Determine appropriate actions to extinguish a P/HEV/EV fire.*
3. *Determine appropriate actions to handle a fire involving a P/HEV/EV battery.*

INTRODUCTION

Many procedures for response to an incident involving a P/HEV or EV are the same as those used in a response to a conventional vehicle incident. However, there are some differences that will be highlighted throughout this module.

EMERGENCY OPERATIONS

There are several steps that emergency responders must take at every vehicle crash and extrication. These steps include:

1. Scene size-up.
2. Utilize appropriate PPE for operations.
3. Identify, immobilize, and stabilize the vehicle.

EXTRICATIONS

Stabilization

Standard cribbing methods are acceptable to stabilize an HEV, PHEV, or EV. Always place cribbing at structural points on the vehicle. Avoid placing cribbing under fuel lines or high voltage cabling.

Extrication

Manufacturers have designed these vehicles so that the high voltage components and wiring are not located in typical vehicle “cut points”. As in a traditional vehicle, always be aware of the location of the occupant protection systems before cutting operations take place. Always be aware of the location of high-voltage components when conducting extrication operations.

Certain advanced extrication techniques may become an issue based on the location of the battery. In some cases trunk tunneling may be necessary to get to the battery. Some model’s batteries are located behind the rear seat. Emergency responders should refer to NFPA’s EFG for the location of the battery in current models.

Through the floor if it is necessary to go through the floor, the high voltage wiring and batteries may be a problem. Keep in mind that neither of these two techniques is used on a regular basis.

There are additional considerations for extrication operations involving P/HEVs and EVs. More vehicles are constructed with high strength steel. This material is not unique to P/HEV/EVs. In order to increase fuel economy high strengths/low weight metals are used with more frequency in some P/HEVs and EVs than in standard vehicle models. To be successful, tools that are rated for these materials must be used.

Battery breaches

Breaches are unlikely events due to the position of the battery in most vehicles and due to the fact that HEV/PHEV/EV batteries are dry cell batteries. If an individual cell is crushed it would only leak a very small quantity of electrolyte, a few drops per cell. Some models will leak liquid coolant.

There is a high voltage electrical shock hazard present if a battery pack is damaged or breached. Responders should follow their department's medical protocols related to patient treatment for exposure to a corrosive material, if there is exposure to the battery's electrolytes.

If PPE becomes contaminated from contact with the electrolytes in the battery, follow the PPE manufacturer's recommendations for decontamination, cleaning and inspection.

SUBMERGED VEHICLE/ VEHICLE IN STANDING WATER

Because of the design of the vehicle, coming into contact with the HEV/PHEV/EV vehicle's shell should not be a shock hazard. Making contact with the vehicle shell and an exposed high voltage conductive surface could be a hazard. This could occur if there is metal in contact with conductive metal parts of the high voltage system.

AC and DC current found in HEVs, PHEVs and EVs does not "energize" the water. Grounds Fault Circuit Interrupters (GFCI) s are in place for additional protection on AC circuits.

Procedures for handling vehicle in water are:

1. Follow standard shutdown procedures for the vehicle.
2. If access prevents these shutdown procedures remove the vehicle from the water and then shut it down.

Impurities in the water cause conduction which results in micro-bubbling. Electrolysis occurs, causing micro-bubbles of oxygen and hydrogen to be produced when the water molecules are split. Positive and negative terminals of the high voltage battery are submerged in water, electricity travels through water from positive to negative. However, the surrounding water is not energized. There is a shock hazard only if direct contact is made with unprotected cabling.

VEHICLE FIRES

Recommended practices

Use NFPA complainant firefighting PPE, respiratory protection, and standard equipment for extinguishing a vehicle fire. Do not use equipment to pierce hood, due to HV components and cabling near surface. Follow normal emergency shutdown procedures.

Manufacturers typically recommend the use of copious amounts of water in the event of a vehicle fire. Electrical systems are designed to NOT energize water (including fire streams).

Once fire is extinguished, determine whether there is high voltage battery involvement. Using a thermal imaging camera is an effective method to determine whether heat in the battery is sustained or increasing.

In the case of battery involvement, it may be preferable to allow a fire burning internally in the battery pack to burn itself out. For most battery designs it will not be possible to get water inside the battery pack to extinguish the fire. The only way to extinguish the fire is by constant cooling of the outside of the battery in an attempt to prevent the fire from moving to adjacent cells within the battery. If the entire electrolyte is burned out of the battery then there will no longer be any potential for stored electricity.

Harmful products of combustion are common with the smoke generated when conventional vehicles burn as well, so the use of full PPE including SCBA remains standard procedure. . Each battery type produces different byproducts when burning. Be aware of bystanders who may also be exposed.

Avoid all high voltage components during overhaul. Towing can cause damage to HV components. Manufactures recommend flat beds. There is a potential that the relays in the high voltage battery could be damaged in the closed position from the heat of the fire. The high voltage components should always be treated as if they are hazardous, even after emergency shutdown procedures.

INCIDENTS INVOLVING CHARGING STATIONS

Level I and II charging stations are commonly used. Treat as any energized electrical fire in a structure. Shut down power to charging station. Perform extinguishment operations.

Charging stations may also be damaged from a collision. Shut down charging station power source. If a vehicle is struck while at a charging station, turn off the power source supplying the charging unit before attempting any operations. Identify, immobilize, and disable.

SUMMARY

Many procedures for response to an incident involving a HEV, PHEV or EV are the same as those used in a response to a conventional vehicle incident.

Some situations involving HEV/PHEV/EVs such as a breach of a high voltage battery require extra care.

Special response considerations include: identification, shut down and immobilization, avoiding high voltage components, battery involvement

and considerations given to high strength metals used in some new vehicles which might create extrication difficulties.

There are possible hazards at charging stations when there is a fire or damaged from a collision.

Activity 5.1

Emergency Operations

Purpose:

To size up and develop an action plan for an incident involving a HEV/PHEV/EV.

Directions to the Students:

1. You are going to be shown three scenarios: each is an emergency incident involving a HEV, PHEV or EV.

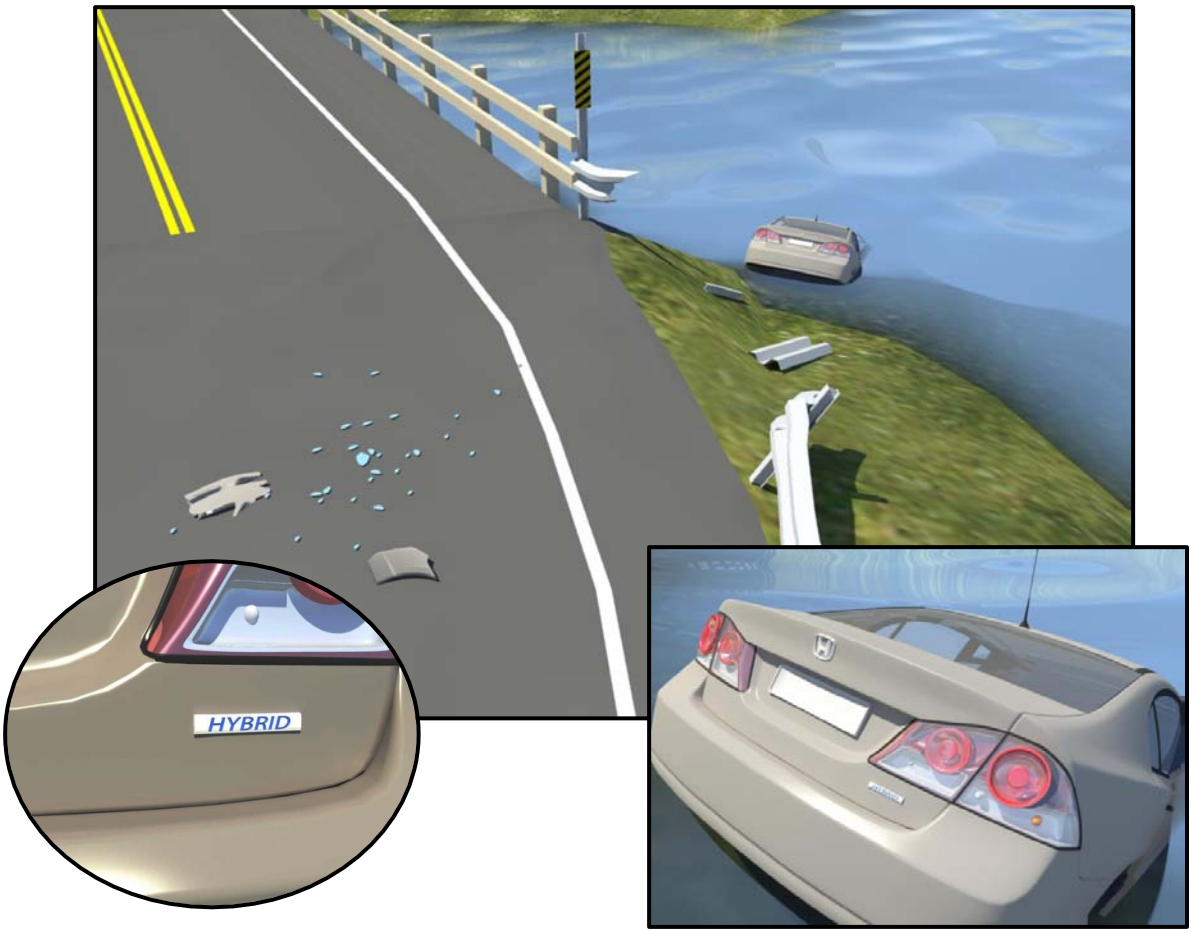
2. Working in your assigned group, answer the following questions for each scenario when directed by the instructor.

   a. What pertinent information did you gather from the dispatch information and your size up, i.e. what hazards are present?

   b. What action must be taken to ensure a safe work environment for this operation?

   c. In general, what action should be taken to mitigate the incident?

3. Be prepared to share your answers with the class.



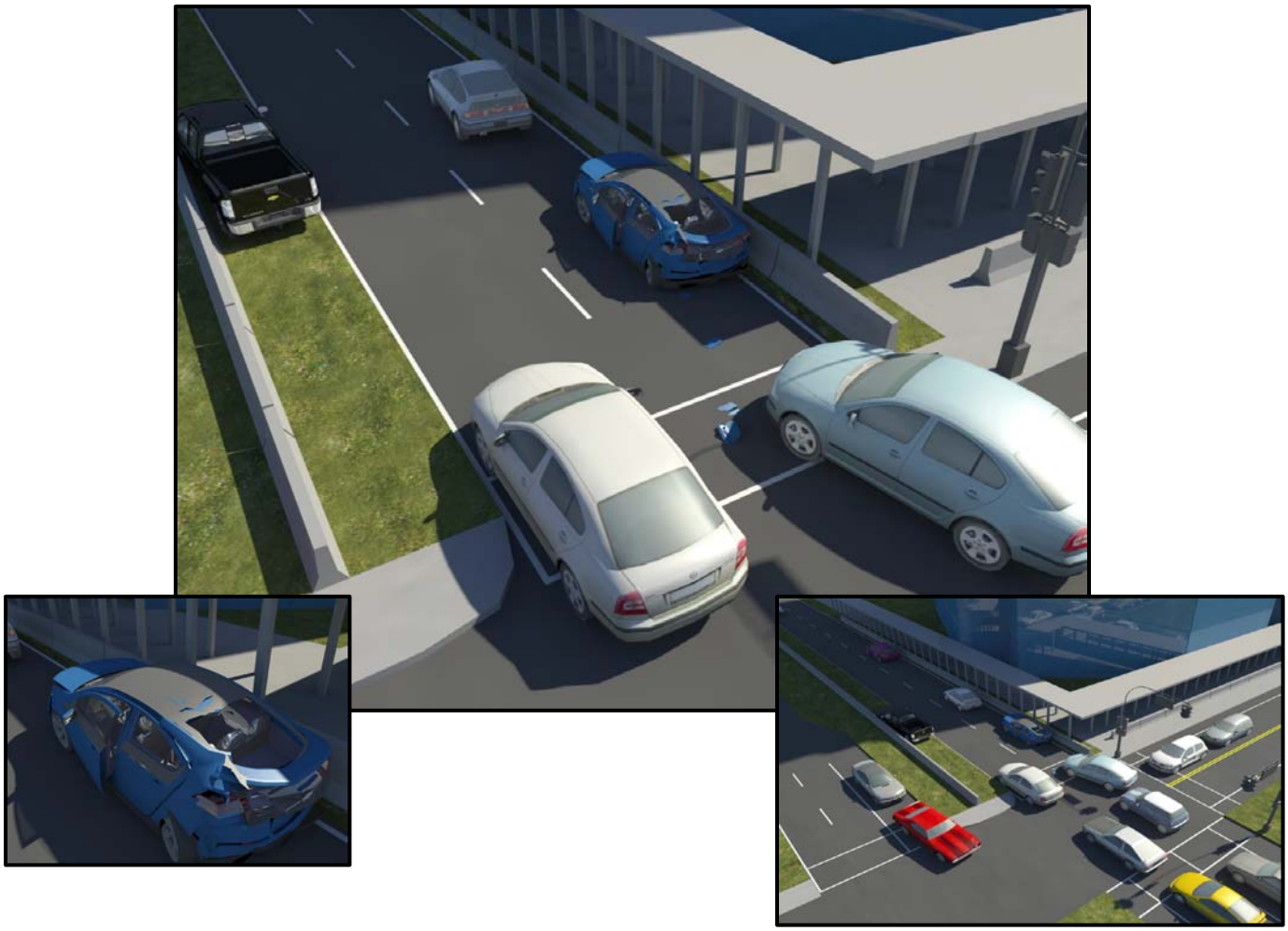
Scenario 1: Vehicle in Canal

You are dispatched to a reported car in the canal. It is 3:00 pm on a Saturday, 91°F and sunny. The canal is very popular with boaters on the weekends. On arrival, you find a single Honda Civic hybrid, partially submerged in the canal. The vehicle has gone through the guard rail and stopped with the front half of the vehicle in the canal. There is no other damaged vehicle at the scene, but there are pieces of broken lenses and glass on the roadway, indicating a collision did occur. Bystanders state the driver is still in the car and appears to be unconscious. They also state that airbags have deployed.

1. What pertinent information did you gather from the dispatch information and your size up, i.e. what hazards are present?

2. What action must be taken to ensure a safe work environment for this operation?

3. In general, what action should be taken to mitigate the incident?



Scenario 2: Rear End Collision at Stoplight

You are dispatched to a reported motor vehicle crash. The reporting party stated that he rear-ended a car stopped at a stoplight. It is Friday at 5:15 pm. It is 78°F and sunny. The location of the incident is on a four lane highway that has a high volume of commuter traffic. En route, dispatch reports that OnStar called and one of the vehicles involved in the crash is a Volt and that airbags have deployed. On arrival, you find one vehicle (a 4-door sedan) against the inside guardrail with severe damage to the rear of the vehicle. The other vehicle (a minivan) is against the outside guardrail. Both vehicles are oriented in the direction of travel. There are at least two passengers in the sedan and at least one passenger in the minivan.

1. What pertinent information did you gather from the dispatch information and your size up, i.e. what hazards are present?

2. What action must be taken to ensure a safe work environment for this operation?

3. In general, what action should be taken to mitigate the incident?

Scenario 3: Vehicle Fire in Engine & Passenger Compartment

You are dispatched to a reported vehicle fire in the parking lot of a local shopping mall. As you approach the parking lot you see a small column of smoke coming from a group of cars parked close to an entrance. It is Saturday at 11 am, 75°F, there is a mild breeze. On arrival, you find a hybrid Highlander SUV with smoke and flames coming from the engine compartment area and heavy smoke coming from the passenger compartment through the driver window. The parking spaces on both side of the vehicle are empty; however, the spaces immediately in front of the vehicle are filled. The owner meets you and tells you that no one is in vehicle.

1. What pertinent information did you gather from the dispatch information and your size up, i.e. what hazards are present?

2. What action must be taken to ensure a safe work environment for this operation?

3. In general, what action should be taken to mitigate the incident?