Participant Guide Module

7

General Health and Safety Considerations

Module Objective

Upon the completion of this module, participants should be able to determine the potential spill control methods, proper personal protective equipment (PPE), and detection and monitoring devices for responding to ethanol-blended fuel incidents.

Enabling Objectives

1. Discuss the possible combinations of fuel/ ethanol-blended fuel spills.
2. Determine the tools/ personnel/ steps necessary to clean up spills of various fuels.

Introduction

Understanding the properties and characteristics of both gasoline and ethanol will help emergency responders mitigate incidents involving ethanol-blended fuels. Gasoline blended with up to 10% ethanol will retain hydrocarbon fuel chemical characteristics. In an incident of this type absorbents and booms that are designed to pick up oil-type substance are effective. Blends with greater than 10% ethanol will start to take on polar solvent characteristics. If available absorbents and booms that are designed to pick up polar solvents should be used.

When water is introduced to a gasoline ethanol blend, phase separation may start to take place. Phase separation occurs after the fuel blend reaches the water saturation point. The water will then attract the ethanol and form a water/ethanol solution in the bottom of the tank. In this situation, an oil-type boom or absorbent will pick up the remaining gasoline on top leaving the water/ethanol solution.

https://www.youtube.com/watch?v=-o5D-nic9WM is a video of hydrocarbon and ethanol fuels burning.

Fuel Spill Control

It is important to recognize the various types of spill control measures that may be needed in an emergency response. Different tactics will be needed for land spills versus water spills. It is also important to recognize what type of spill containment products will be needed.

It is important to notify the appropriate local, state and/or Federal authorities having jurisdiction in an incident the event of a spill.

Best practices would be to establish good working relationships with these organizations who have statutory responsibilities and/or functional capabilities well in advance of an incident.

This ensures a more pro-active incident response instead of a reactive incident response which will place first responders and the community at a potentially greater risk.

Special Considerations

The water/ ethanol solution can be picked up with water absorbing boom or absorbent. Keep in mind that depending on the water-to-ethanol ratio, the solution may still be flammable.

Also remember that if an AR foam blanket is used to contain the ethanol-blended fuel vapor, a portion of the foam solution will absorb into the ethanol-blended fuel, forming a solution that sinks below the gasoline level. This solution again will have water/ ethanol properties, which will require a water-type boom or absorbent.

The ethanol-blended fuel located just below the foam membrane will require an oil-type absorbent since the ethanol/gasoline blend will still maintain hydrocarbon characteristics.

Control Zones

Control zones are the areas established around a hazardous materials incident and indicate the safety level and degree of hazard in that specific zone. Control zones are initially established using the *U.S. DOT Emergency Response Guidebook*. There are three control zones that must be established: hot, warm, and cold.

- The hot zone is located immediately around the release of a material. This area encompasses materials that are hazards. It is the area of greatest danger and contamination. It is commonly referred to as the zone immediately dangerous to life and health or IDLH.
- The warm zone is located immediately outside of the hot zone and is the area where decontamination takes place.
- The cold zone begins where the warm zone ends. The command post, as well as other support functions, in the cold zone. Personal protective clothing in this area may be limited to safety equipment and normal working clothes.

After the control zones are established, detection and monitoring are used continuously to refine and/or modify the perimeter of the control zones as the incident changes.

Detection and Monitoring

Detection and identification of hazardous materials using monitoring equipment is normally performed by responders at the technician/specialist level. Monitoring equipment is a crucial resource for responders to use during an ethanol-blended fuel incident for assessment and mitigation.

Monitoring equipment will help responders determine the vapor concentration levels of hazardous materials and make response decisions based on these readings. Utilizing a multi gas meter can detect LEL, CO, H2S and O2. Monitor readings will help responders determine how best to protect themselves and others from the effects of the material and how far the public should be removed from the contaminated area.

The use of two (2) multi-gas detectors allows the responders to focus on each individual aspect of the ethanol-blended fuel incident. One responder focuses on hydrocarbon identification while the second responder focuses on ethanol identification.

Since current multi-gas detectors are not “smart” and therefore cannot identify the gas or vapor being analyzed; the use of two detectors helps minimizes confusion as to which vapor or gas has been detected and what conversion factor must be applied.

Personal Protective Equipment (PPE)

Ethanol and ethanol-blended fuel burns similarly to gasoline fires; therefore, it is critical that all responders wear appropriate firefighter PPE. Protective clothing is designed to protect the wearer from head to toe and has proven to reduce the severity of injuries as well as save the lives of many firefighters. The following components constitute a general set of firefighter PPE:

- Helmet with either a face shield or eye protection
- Protective hood
- Turnout coat
- Turnout pants
- Gloves
- Boots
- Respiratory protection

Respiratory protection is especially critical since the respiratory system is the primary route of exposure into the body for hazardous chemicals. There are three types of respiratory protection:

- Air-Purifying Respirators (APR) and Powered Air-Purifying Respirators (PAPR);
- Supplied Air Respirators (SAR); and
- Self-Contained Breathing Apparatus (SCBA)

Remember that all personnel responding to a spill or fire must wear and be trained in the use of the specific PPE required for a given emergency (see Figure 7.1 in the Participant Guide).

Figure 7.1: Firefighter Wearing Full Set of Protective Clothing

Decontamination Recommendations

Post response decontamination is required to prevent contamination outside the incident zones (secondary contamination). Decontamination should include surfactant and water based cleaner. All decontamination runoff should be contained, tested and disposed of properly.

Summary

In this module we learned that regardless of whether you are confronted with a spill or a fire, there are certain procedures that must be followed to ensure safe incident management.

Knowing the type of fuel that has spilled or is burning is essential to the success of your operation. In addition, you should take steps to contain the incident.

If offensive foam operations are going to be initiated, then appropriate quantities of AR-AFFF foam concentrate and the necessary foam application equipment must be obtained and staged at the incident scene. Personnel must have been trained IN ADVANCE on how to utilize the specialized foam firefighting equipment.

It is very critical that all emergency responders wear the appropriate PPE when responding to emergencies involving ethanol-blended fuels.

Activity 7.1: Incident Procedures

Purpose

To become familiar with the correct order of steps in the following procedures and the rationales behind them.

Participant Directions

1. Use Worksheet 7.1 to properly order the steps in the procedures.
2. You can work individually or in groups.
3. Be prepared to discuss the correct order and the rationales behind each step.

Worksheet 7.1: Non-Fire Spill and Leak Procedures

A. Establish a safety zone using conventional detection devices. Normal gas detection meters will still detect the lower explosive limit (LEL) of the gasoline component since the gasoline has a lower LEL than ethanol. Since both the gasoline component and the ethanol component are heavier than air, predict the vapor travel to be down and to lower levels of elevation.

B. Determine which approach to use:

- If the ethanol-blended fuel is spilled on dry surface, "oil only" absorbents, pads, and booms will contain the gasoline component of the product. Plugging containers or over-packing may also be considerations.
- If the ethanol-blended fuel is spilled into a waterway, the ethanol will precipitate out of the fuel mixture and blend with the water. Depending on water to ethanol quantities, the water/ethanol solution will become non-flammable at high water ratios. The ethanol will become essentially inseparable from the water in field conditions. The remaining gasoline components will remain on the surface of the water and can be contained with normal "oil only" booms or underflow dam systems.
- If vapors present a problem at the spill location, covering the spill with foam should be a consideration. Foam, however, can make remediation and cleanup more difficult.

C. Cleanup and remediation can be accomplished with standard booms, absorbents, and pads keeping in mind that if water or foam is present, it will take a two-step process.

D. Attempt to identify the product by placards, labels, shipping documents, and other identifying factors, staying upwind and uphill and using appropriate PPE. Physical properties will also aid in identification. High concentrations of ethanol will give the fuel a lighter color and a "sweeter" odor.