

# Module

# 4

## Storage and Dispensing Locations

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### Terminal Objective

Upon the successful completion of this module, participants will be able to discuss common and unusual needs for storage and dispensing of ethanol-blended fuels.

### Enabling Objectives

1. Describe the three common types of storage tanks at tank farm facilities.
2. List potential benefits and challenges associated with fixed fire suppression systems at fuel storage facilities.
3. Prepare a list of agencies that may be called upon for support during an event at a fuel storage or dispensing location.

**Instructor Note:**

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**Module Time:** 1 hour

**Materials:** Worksheet 4.1

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# Introduction

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## **Instructor Note:**

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*Ask participants if they know how many ethanol plants there are in the United States.*

*Answer: As of the end of 2008, there are 170 operational facilities, and 20 under construction.*

*Source: Renewable Fuels Association. (2008). Retrieved May 5, 2008, from [!](#)*

## **Instructor Note:**

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Often when the response community thinks of storing and dispensing ethanol-blended fuels we fail to think of the three-pump gas station on the corner. As a result, we can believe that if there is no bulk storage operation or production operation in our jurisdiction, we have little to worry about. This could not be further from the truth.

## Terminal Storage of Ethanol-Blended Fuels

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During 2008, the most common mixture of ethanol-blended fuels stored at terminal facilities is known interchangeably as denatured or fuel ethanol (E-95). Common consumer formulations, such as E-85 and E-10, are generally blended on site during the loading process for transport to distribution facilities or retail outlets. The blending process at a terminal commonly consists of bottom-loading unleaded gasoline and denatured ethanol in the correct proportions into the tank truck. The two-blend components may go through an in-line mixing system to ensure thorough blending from the outset. The components may also be batch loaded, whereby mixing occurs en route to its destination.

Any large volume of denatured ethanol will typically be stored in conventional carbon steel storage tanks, such as those that are suitable for gasoline and other flammable fuels. A denatured ethanol tank may be smaller than other fuel storage tanks at a terminal. Yet as consumption increases, larger ethanol tanks will become increasingly prevalent.

There are three general types of storage tanks at tank farm facilities: cone roof (closed-top) tanks (see Figure 4.1), external floating roof (EFR) tanks which have an open top with a floating pan, and internal floating roof (IFR) tanks with a closed top and an internal floating pan. The majority of existing EFR tanks have been converted to IFR in recent years. Denatured ethanol will typically be stored in one of these IFR tanks.

Denatured ethanol is commonly delivered to a terminal by tank truck or rail car; it is also being transported by barge. At this writing, there is no common pipeline delivery method for denatured ethanol, but efforts are underway to develop a commercially viable ethanol pipeline.



**Figure 4 – 1: Cone Roof Storage Tank**

Some larger facilities have built-in fire protection systems. *Fixed systems* are a combination of devices including foam concentrate storage, proportioning, and delivery devices that are permanently installed to provide fire protection to above-ground fuel storage tanks, manifolds, and loading/unloading racks. The systems can be activated manually or by a detection device. However, if tanks have been converted to store ethanol-blended fuels, the systems may no longer be appropriate. Topside application foam systems may require much higher application rates for ethanol-blended fuels than for previously stored fuels. Subsurface injection systems may not work at all with ethanol-blended fuels. Fire department personnel should be working closely with terminal operators to keep abreast of changes in fuel storage at tank farm facilities.

More importantly, many built-in fire suppression systems are rendered inoperable at the onset or during a fire or explosion emergency involving bulk storage tanks. Emergency responders should be prepared for the likelihood of this situation. Preplanning for potential events at tank farm facilities is extremely important. Fire department personnel should develop good working relationships with the tank farm facility operators and should be very familiar with their operations. Fire departments that help provide protection to tank farm facilities should have access to high-flow fire fighting foam equipment and should have large supplies of compatible foam available on hand. In some areas this has been done by establishing caches of foam and equipment through consortiums organized between multiple tank farm operations and the fire department. Fire department personnel should also be aware that they may not be able to contend with a major tank farm fire operation and may need to contact outside resources for ultimate control of an emergency. Fire departments are encouraged to establish healthy working relations with these groups and with the storage facilities in their response area prior to an emergency arising.

**Instructor Note:**

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*Ask participants who “these groups” are.*

*Answers will vary but could include mutual aid with industrial facilities or nearby jurisdictions*

As mentioned previously, built-in fire suppression systems may become inoperable or overtaxed during a large-scale emergency; however, they are currently the best protection for bulk storage tanks. Fire department personnel and government officials should strive to promote the use of these systems on existing bulk storage tanks and make sure facilities comply with current requirements on new installations. Fire department personnel should be extremely familiar with these systems and pre-calculate their required flow rates. They should also preplan operations supplying these systems. Practice exercises should be scheduled at least annually to make sure responders are familiar with the pre-established plans. Keep in mind that there are many different challenges involved in fire fighting operations at tank farms: Bulk storage tanks generally provide limited access for fire fighting equipment, there may be inadequate water supplies in the area, personnel may have to contend with containment dikes and their systems, there may be miles of exposed product piping involved, and there may be unprotected loading rack facilities (just to name a few). Tank farm operations can be very complicated, and responding to a fire emergency can be very dangerous to personnel. It is also not unusual for tank farm facilities that were originally built in remote areas to now be surrounded by commercial and residential growth. Again, pre-fire planning is extremely important, and pre-established working relations between the fire department and the facility operators cannot be over-emphasized.

## Bulk Plant and Distribution Facilities

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Smaller bulk distribution storage facilities may pose the greatest challenge to local fire departments. These facilities are located throughout communities to better distribute fuel to end-users. Storage tanks in these facilities can be of a multitude of styles and layouts, depending on age and location. Storage tanks may be vertical, horizontal, or a combination of both. Normally the flammable liquid fuels, including gasoline and the ethanol-blended fuels, are stored at these facilities, on the order of several tank trucks or rail cars. Bulk distributors are normally established to store and distribute heating fuel to local areas. Gasoline or ethanol-blended fuels on site are for the distributors' use in their vehicles or for some limited customers such as local farm operations. These fuels are normally stored in underground tanks or small volume above-ground steel tanks. These tanks may be vertical or horizontal in design. If ethanol-blended fuel is stored at these locations, it will most likely be an E-10 mixture. Most of these facilities do not have built-in fire protection systems. These facilities are normally designed with limited fuel spillage containment structures or areas. Spill diking is usually designed to contain as much volume as that of the largest tank in the facility. Incidents involving multiple tanks in the facility may overtax the designed containment area. It is important for local fire departments to be familiar with the facilities in their locations.

### **Instructor Note:**

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*Ask participants if they are aware of any of these types of facilities in their jurisdictions. Answers will vary.*

*Follow up by asking participants if they have planned their response to potential events at these facilities.*

## Retail Dispensing Stations

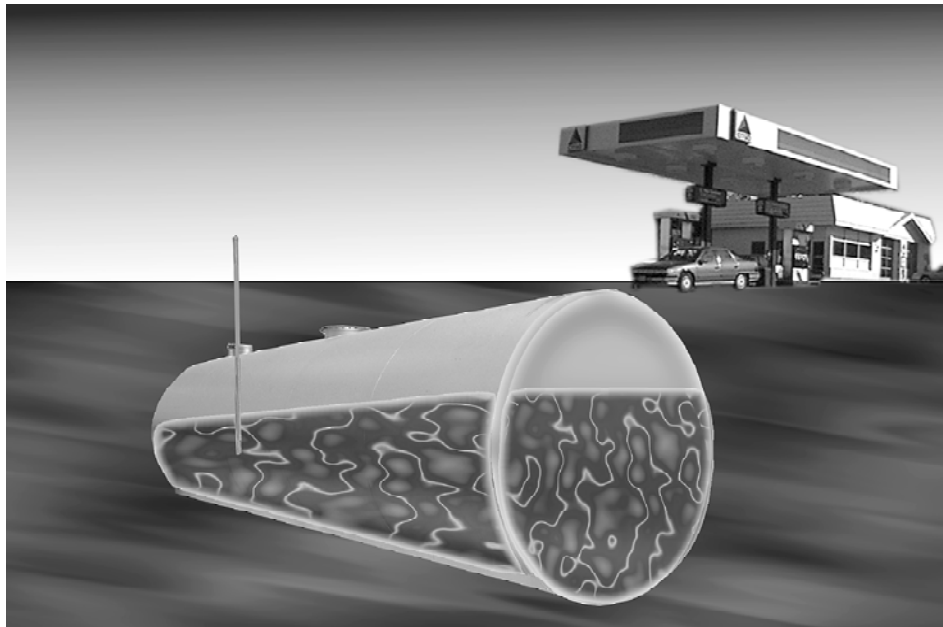
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The majority of retail gas stations have underground storage tanks. These facilities are relatively small in terms of storage volume but very large in terms of their number throughout the country. Depending on location, they may or may not have vapor recovery systems associated with the sites. Some of the larger volume gas stations may have above-ground storage tanks similar to those at the bulk distributor. In most areas these gas stations are filled by tankers coming directly from tank farm facilities. Many of these facilities have multiple loads of fuel that are being delivered daily. As of 2008, there were over 1,900 fueling sites handling E-85 throughout the country. The majority is located in the Midwest, but more sites are being developed daily.

E-85 ethanol-blended fuel is normally stored in underground tanks and dispensed through standard fuel-dispensing equipment. There are thousands more sites handling E-10 (reformulated gas), particularly in metropolitan non-attainment areas where reformulated fuels are required in order to meet National Ambient Air Quality Standards (NAAQS). As production and product acceptance increases, these sites and facilities are expected to increase in number.

At retail sites the ethanol-fuel blends are stored in horizontal underground tanks (see Figure 4.2). The maximum pressure under which any underground tank is capable of holding its contents is 0.5 pounds per square inch gauge (psig). Tank capacities range from a few thousand gallons up to 20,000 gallons. These tanks are typically constructed of steel and are double walled. Emergency shut-off valves will vary for each container due to design and construction differences. Loading and unloading points will vary due to design and construction. Risers for multiple tanks will be color-coded or marked to identify the product.

**Figure 4.2: Underground Horizontal Tank**



## Summary

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The most commonly found ethanol-blended fuel at terminal facilities is E-95. It is typically stored in carbon steel storage tanks that are suitable for the storage of gasoline. Although these bulk storage facilities will likely be equipped with fixed fire suppression systems, it is important to remember that these systems will often be rendered inoperable at the onset of an incident. Preplanning for potential events at tank farm facilities is extremely important. A significant piece of this preplanning must include consideration of sources of mutual aid. As the ethanol is moved along its distribution route, the next stop will often be a regional bulk plant. These are smaller facilities that will often have underground storage in place without any fixed fire suppression system. They may rely more heavily on containment than suppression as a way to react to spills and leaks. Finally, the ethanol-blended fuel arrives at local gas stations. These stations will use underground storage and above-ground dispensing units. Although the amount of fuel stored at each station is small, especially when compared to bulk storage operations, the sheer number of them may be a cause for concern.

## Activity 4.1—Ethanol in Your Jurisdiction

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### **Purpose**

To allow participants to determine the potential for ethanol emergency in their jurisdictions.

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#### **Instructor Note:**

*Time:* 10–12 minutes

*Materials:* Worksheet 4.1

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#### **Instructor Directions:**

1. *Participants should work individually or in groups of two (if both are from the same jurisdiction).*
2. *Have participants read the items in Worksheet 4.1 and write down their answers.*
3. *After about 5 minutes call time and conduct a discussion covering each item.*  
*As participants discuss the items, point out differences. Depending on the audience, it is likely that participants may have vastly different guesses for the number of retail stations in their jurisdictions.*

### **Participant Directions**

1. For this activity you will work individually or in groups of two.
2. Read the items in Worksheet 4.1 and write down your answers.
3. Be prepared to discuss with the class.

## Worksheet 4.1: Ethanol in Your Jurisdiction

- 1) Approximately how many people live in your jurisdiction?
- 2) How many retail gas stations are in your jurisdiction?
- 3) Are there any industries that would use or store large quantities of ethanol or ethanol-fuel blend?
- 4) If so, how many are there?
- 5) What is the likely routes ethanol will be transported to or through your jurisdiction?
- 6) Compile a list of agencies in your jurisdiction that you can call upon during an emergency at a fuel storage or dispensing location.

Based on all the information discussed in this class, what do you think would be the major concerns (logistical, mitigation, environmental, mutual aid, etc.) at an ethanol emergency at a retail gas station in your jurisdiction? At a storage facility in your jurisdiction?