

Instructor Manual

Module

5

Storage and Dispensing Locations

Module Objective

Upon completion of this module, participants should be able to discuss common locations for storage and dispensing of ethanol-blended fuels and will provide a basic understanding of these storage/ dispensing sites.

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:

Module Time: 40 minutes/ 55 minutes

Materials:

- Activity 5.1
 - Worksheet 5.1
- Emergency Response Considerations video – (Show the video segment from 9:31 to 12:13)

Instructor Note:

Show the video Emergency Response Considerations (9:31 to 12:13).

Introduction

Instructor Note:

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

- **Answer:** As of June 2015, there were 213 operational facilities. Source: Renewable Fuels Association. (2015). For the most current information go to www.EthanolRFA.org

Often when the response community thinks of storing and dispensing ethanol-blended fuels we fail to think of the retail fueling 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. Today nearly all gasoline in the United States is blended with some level of ethanol. Ethanol and ethanol-blended fuels are found at production facilities, bulk tank farms, rail transload facilities, construction sites and retail fueling stations within your community and throughout the country. It is important for local fire departments to be familiar with the facilities in their locations.

Storage Tank Types

Any large volume of denatured fuel ethanol will typically be stored in conventional carbon steel storage tanks, such as those that are suitable for gasoline and other flammable fuels. Denatured fuel ethanol can also be stored in stainless steel storage tanks, these tanks are less common. Yet as consumption increases, larger ethanol tanks will become increasingly prevalent. These storage tanks should be identified by markings corresponding with the fuel stored.

Storage Tank Design

There are three general types of storage tanks at tank farm facilities: cone roof (closed-top) tanks, external floating roof (EFR) tanks which have an open top with a floating pan, and internal floating roof (IFR) tanks (see Figure 5.1 in the Participant Guide), with a closed top and an internal floating pan. The majority of existing EFR tanks have been converted to IFR in recent years. Denatured fuel ethanol will typically be stored in one of these IFR tanks. The most common denatured fuel ethanol bulk storage tanks are internal floating roof tanks. Key characteristics to look for on internal floating roof tanks are: closed roof, internal floating pan, eyebrow venting, and fire protection system.

Figure 5.1: Internal Floating Roof Storage Tank



Spill Containment

Spill containment dikes are required to contain the volume of the largest tank plus rainfall within the contained area. Additional fluid from a fire fighting operation could lead to overfilling/breaching of the dike. As a side note, large, horizontal tanks that are elevated do not fall under the same regulatory requirements for containment. These are much more common at smaller distribution facilities and in agricultural settings.

Tank Fire Protection Systems

Some storage tanks have fixed (built-in) fire protection systems. Fixed systems are a combination of components including foam concentrate storage, proportioning valves, and delivery devices that are permanently installed to provide fire suppression protection. These same fixed systems can service multiple storage tanks, manifolds, and loading/unloading racks. The systems can be activated manually or by a detection device. 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 liquid product terminals. It is important to ensure the fire protection systems are meeting current industry standards and codes. It is also important that emergency responders know how to activate the fire protective systems at a liquid product terminal.

Built in Fire Protection Systems

See correlating slide (module 5, slide 9) for an illustration showing built-in fire protection system on a bulk storage tank containing ethanol.

Foam Deflector Device

The foam deflector device is attached to most Type II fixed foam chamber discharge outlets. The deflector directs foam down and over a large area of the inside of the tank wall and onto the top of the burning liquid inside of the tank. Before fire/ foam attack can begin on a tank, responders need to calculate available space within the tank. Working with facility operators to calculate the available space in gallons will allow responders to know if the product needs to be removed from the tank before operations can begin or allowed to burn off to reduce product in tank. Fire operations have to account for finished foam going into the tank so as to not overflow contents. Expansion needs to be taken into consideration. This would be the ratio of volume of foam formed to the volume of solution used to generate the foam. For example, an eight expansion means 800 gallons of foam from 100 gallons of solution. Keep in mind foam drain time will continue throughout operation.

Emergency Response Pre-planning

Pre-planning for potential events at liquid product terminals is extremely important. Fire department personnel should develop good working relationships with the terminal operators and be very familiar with their operations. A significant piece of this pre-planning must include consideration for mutual aid partners. Fire departments that help provide protection to liquid product terminals should have access to high-flow firefighting foam equipment and access to large supplies of compatible Alcohol-Resistant Aqueous Film-Forming Foam (AR-AFFF). In some areas this has been done by establishing caches of AR-AFFF and equipment through consortiums organized between multiple terminal operations and the fire department. Fire department personnel should also be aware they may not be able to contend with a terminal 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.

Emergency Response Planning

Instructor Note:

Ask participants who “these groups” are.

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

Fixed fire systems are currently the best protection for bulk storage tanks. Fire department personnel should be extremely familiar with these systems and pre-calculate their required flow rates. They should also pre-plan operations supplying these systems. Practice exercises should be scheduled at least annually to make sure responders are familiar with the pre-established plans.

Key Considerations

Keep in mind that there are many different challenges involved in firefighting operations at a liquid product terminal. There may be limited access in both the terminal itself and in tank design for firefighting equipment. At times some locations may have inadequate water supplies to fight any type of significant fire. Personnel may have to contend with containment dikes and their systems, along with miles of exposed product piping. Liquid product terminals may also have loading racks subject to fire emergencies. Liquid product terminal operations can be very complicated, and responding to a fire emergency can be very dangerous to personnel. It is also not unusual for terminals that were originally built in remote areas to now be surrounded by commercial and residential growth.

Working Relationships

Again, pre-planning is extremely important, and pre-established working relations between the fire department and the facility operators cannot be over-emphasized.

Terminal Size Considerations

Smaller bulk distribution storage facilities may pose unique challenges 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 in modest quantities. 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 and are typically unstaffed.

Large bulk distribution storage facilities also pose unique challenges to local fire departments. Storage tanks in these facilities have high capacity and high throughput. A variety of different storage tanks may be present: vertical, horizontal, above ground or below ground or a combination of all of these. Flammable liquids including gasoline and the ethanol-blended fuels are stored at these facilities in significant quantities. These facilities have detailed emergency response plans due to the shear volumes stored on site.

Pre-established working relations between the fire department and the facility operators is extremely important. Pre-planning cannot be over-emphasized.

Group Discussion

Instructor Note:

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.

Storage at a Production Facility

Both denatured and undenatured/ neat ethanol can be stored at a production facility. The most common is denatured fuel ethanol (E95, E98). Ethanol blended fuels found at retail fuel stations are not generally found at a production facility. There will be denaturant stored at a production facility such as natural gasoline or unleaded gasoline. Denaturants are added to ethanol through inline blending systems prior to the final product storage tanks.

Transloading Sites

A transload facility conducts product transfers from a mobile tank to a mobile tank. This image is an example of a rail tank car to cargo tank truck transload operation. As shown a portable pump system is in use. This give the operators flexibility in the unloading process as it can occur at any location within the facility.

Retail Dispensing Stations

There are currently 153,000 retail fueling stations throughout the U.S. The average number of tanks at a retail fueling station is 3.3 with some stations having many more than the average especially truck stops. Storage tanks configuration at retail include both above ground and below ground.

Retail Fuel Storage

Depending on the geography, throughput volume, fire code and many other variables impact whether an above-ground or below-ground storage tank is used. Above ground storage tanks can be either vertical or horizontal in design; nearly all underground storage tanks are horizontal. Inventory is brought to the retail station by cargo tank trucks.

Most Common Retail Tank Configuration

At retail sites, the most common tank configuration is horizontal underground tanks. 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 or double walled fiberglass. 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.

Summary

Denatured fuel ethanol (E95, E98) is most commonly stored in storage tanks made of carbon steel. Denatured fuel ethanol can also be stored in stainless steel storage tanks, these tanks are less common. Pre-planning for potential events at liquid product terminals is extremely important. Fire department personnel should develop good working relationships with the terminal operators and should be very familiar with their operations. Liquid product terminals will likely be equipped with fixed fire suppression systems, it is important to remember these systems could be rendered inoperable at the onset of an incident. From the liquid product terminals the ethanol-blended fuel arrives at local retail fueling stations. These stations will use underground storage and above-ground storage tanks. Although the amount of fuel stored at each retail fueling station is small, especially when compared to liquid product terminals, the sheer number of retail fueling stations requires that each possible emergency be pre-planned.

Activity 5.1: Ethanol in Your Jurisdiction

Purpose

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

Instructor Note:

Time: 10-12 minutes

Materials: Worksheet 5.1

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 5.1 and write down their answers.*
3. *After about five minutes call time and conduct a discussion covering each item.*
4. *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 5.1 and write down your answers.
3. Be prepared to discuss with the class.

Worksheet 5.1: Ethanol in Your Jurisdiction

1. Approximately how many people live in your jurisdiction? _____
2. How many retail fuel stations in your jurisdiction have been pre-planned?

3. Do you have any industries that would use or store large quantities of ethanol or ethanol-blended fuels? _____
4. If so, how many are there? _____
5. What are 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.

7. 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 fuel station in your jurisdiction? At a storage facility in your jurisdiction?

