Course Learning Outcomes for Unit VI

Upon completion of this unit, students should be able to:

3. Explain how the properties of fire influence design and installation criteria.
   3.1 Consider the fire dynamics of cooking oil on the design of fire protection.

5. Examine emerging technologies related to fire protection.
   5.1 Describe standpipe classifications and components.
   5.2 Recognize the possible impairments to standpipe and hose systems.

Course/Unit Learning Outcomes	Learning Activity
3.1	Unit VI Lesson Chapter 5 Paper: *Characterization of Facility Response Planning at Facilities That Handle, Store, or Transport Animal Fats or Vegetable Oils* Unit VI Course Project
5.1	Unit VI Lesson Chapter 5 Unit VI Course Project
5.2	Unit VI Lesson Chapter 5 Unit VI Course Project

Reading Assignment

Chapter 5: Standpipe and Hose Systems

In order to access the following resource, click the link below.

Davis, D. B., Hunt, W., Yoshioka, G., Holler, E., & Kennedy, M. B. (2002, July). *Characterization of facility response planning at facilities that handle, store, or transport animal fats or vegetable oils.* Paper presented at the 2002 Freshwater Spills Symposium, Cleveland, OH. Retrieved from https://archive.epa.gov/emergencies/content/fss/web/pdf/bdavispaper.pdf

Unit Lesson

Standpipe and Hose Systems

Most of us have seen the movie *Die Hard*, where the character John McClane pulls the fire hose from the standpipe cabinet, wraps the hose around his waist, and jumps off the roof of the high-rise just before it explodes (Gordon & McTiernan, 1998). Several movies have used a standpipe fire hose in realistic and unrealistic ways. What are standpipe and hose systems? Do individuals really use them to fight fire?

Standpipe and hose systems are designed as a first defense to quickly control fire and, in many cases, may be the only fire protection available. When high-rise buildings are out of reach of aerial ladders and fire hoses, firefighters use standpipe systems to engage in firefighting by connecting their hose to the 2.5 inch outlets. Many fire departments have standard operating procedures of not using the hose system in the cabinet due to not knowing if the hose has been tested or the condition of the hose. Standpipe systems are a network of vertical or horizontal pipes and components in large structures and multiple story buildings. In large structures, there are multiple outlets throughout the area. In high-rise buildings, there could be one per floor or several depending on the size of the structure. The diameter of the piping can vary and is normally 4–6 inches in diameter for the riser. There are three different classes of standpipe systems, and the National Fire Protection Association (NFPA) 14: *Standard for the Installation of Standpipe and Hose Systems* outlines the requirements for design and installation (Brakhage, Abrams, & Fortney, 2016). There are five different types of standpipe systems identified as automatic wet, automatic dry, semiautomatic, manual wet, and manual dry (Brakhage et al., 2016).

Points to Ponder Scenario

Upon receiving the initial alarm through the pre-action fire alarm control units (FACUs), two workers previously trained as a part of the fire brigade chose to investigate the alarm. After arriving in the area, the workers noted the sprinkler system protecting the storage of aerosol cans, large amounts of cooking oil, plastic bags of coffee products, and cleaning products was at a minimum. Fire was spreading horizontally from rack to rack, and the sprinkler system's pressure was too low to effectively control the combustible products. The workers reported the high-pile rack storage, which contained 275-gallon intermediate bulk container (IBC) totes with cooking oil inside, had ignited and spread pools of fire running under pallets and other IBC totes. The workers attempted suppression activities using the single-jacket fire hose from the hose cabinet. The single-jacket fire hose was a part of the existing structure before the renovation and had several leaks reducing the pressure. Even with low pressure, when they hit the burning oil, it caused small explosions and caused the burning oil to disperse even further and spread the fire. The workers were slipping and sliding as they tried to fight the fire from the large amount of cooking oil mixed with water as it ran out of the loading dock doors. The fire provided minimal light with large amounts of thick black smoke. The water pressure was too low to make any headway, forcing the workers to take a defensive position. Once this occurred, fire quickly spread vertically and horizontally throughout the high-pile storage racks.

During the investigation, it was noted that the lack of water pressure from the Class II automatic wet standpipe system was due to a reducer that was rusted to the point of partially blocking the opening. In addition, the single-jacket hose had multiple areas where the jacket was rotten at the folds. In addition, cooking oil from the fire covered the parking lot, running into the storm water system. The storm water system was already at maximum height due to flooding, and it overflowed into the canal system connected to a river, resulting in a massive fish kill. It was also discovered that the facility had 10 IBC totes (275 gallons per tote) of cooking oil stored in high-pile racks.

In the scenario, what actions and steps should have been taken prior to this event to ensure the check valves were properly working? Who should have been responsible for the maintenance and checking the single-jacketed fire hose? Were there any hazards with the cooking oil? Was there a need for any type of spill plans? Are they required to have incident action plans?

Hose Cabinets, Hose, Hose Racks, Reels, and Nozzles

Class I and Class II hose cabinets are normally metal enclosures that are either recessed in the wall or surface-mounted on the wall. Class III hose cabinets can be made from fiberglass or metal and can be freestanding, recessed, or surface-mounted on the wall. Hose cabinets can have a rack hose or reeled hose holding fire protection equipment. Fire hose cabinets come in various sizes and must be large enough to hold the fire hose, nozzle, and other equipment needed for fighting fires. NFPA 14 states there must be at least 1 inch around the valve handle to ensure the valve can be opened easily. The fire hose cannot be more than 100 feet in length on Class II and Class III and can be either a collapsible or a non-collapsible hose. Class II systems must operate at pressures so that untrained occupants will be able to manage the hose line.

Cooking Oil Hazards and Flammability

Cooking oils made from animal fats and vegetable oils are hazardous to the environment and are not considered flammable until the autoignition point is reached. The impact to the environment is similar to petroleum oil products and is regulated under 40 CFR 12. The physical properties of cooking oil coat everything that it comes into contact with, changing fire dynamics of all the combustible products such as cardboard and plastic. In addition, cooking oil in large quantities is toxic and forms toxic products, and cooking oils from animal fats and vegetables cause hypothermia, dehydration, and diarrhea in coated animals, and it depletes oxygen in the water, suffocating marine life (Environmental Protection Agency [EPA], 2017).

The EPA has rules that apply to spills from animal fats and vegetable oil. The rules are the Facility Response Plan (FRP) rule and the Spill Prevention, Control, and Countermeasure (SPCC) rule. These rules require any facility that handles, stores, or transports cooking oil made from animal fats and vegetable oils have a response plan that deals with spills of small, medium, and worst-case discharge. The rules also differentiate between groups of oils based on specific gravity (EPA, 2017). Animal fats and vegetable oils are divided into groupings of Group A, Group B, and Group C. The response plan must list the quantity of cooking oils and any discharges that may have occurred. The plan must include training and drills or exercises and how to handle the hazards.

Buda-Ortins (2010) states that the autoignition of cooking oil is 750 to 815 degrees F (400 to 435 degrees C). In the scenario, the cooking oil was stored in 275-gallon IBC totes. The IBC totes were exposed to the fire from other products burning that softened the polyethylene until the totes failed, catastrophically releasing the cooking oil. According to Quintiere (2017), when heated, polyethylene starts to lose its structure, melting at about 250 to 293 degrees F. When the cooking oil covers cardboard boxes and cardboard debris, it allows the cardboard to autoignite at a lower temperature. Cardboard's ignition temperature is 800 degrees F (427 degrees C). Quintiere (2017) suggests the autoignition temperature of a substance within a specific concentration range is the lowest temperature at which it will ignite spontaneously.

Conclusion

Standpipe and hose systems have been used for many things in movies—some realistic and others not. Standpipe and hose systems were designed to be used in the control and extinguishment of fires in the most effective way. Firefighters, fire brigades, and occupants have used them throughout history to fight fire. Standpipe and hose systems are found in large and high-rise structures and must be maintained and tested.

Fire hazards in structures can vary depending on the business and occupancy. In the scenario, the fire hazards involved several products to include cooking oil stored in IBC totes. For the workers and firefighters mitigating the warehouse fire, the cooking oil presented several challenges and explosion hazards. It is important to understand fire dynamics and how fire affects these products in order to provide a safe work environment and minimize injury to those preforming firefighting tasks.

References

Brakhage, C., Abrams, A., & Fortney, J. (Eds.). (2016). *Fire protection, detection, and suppression systems* (5th ed.). Stillwater, OK: Fire Protection Publications.

Buda-Ortins, K. (2010). *Auto-ignition of cooking oils*. Retrieved from https://drum.lib.umd.edu/bitstream/handle/1903/11333/Buda_Ortins_ResearchPaper.pdf

Environmental Protection Agency. (2013). Vegetable oils and animal fats. Retrieved from https://www.epa.gov/emergency-response/vegetable-oils-and-animal-fats

Gordon, C. (Producer), & McTiernan, J. (Director). (1988). *Die hard* [Motion picture]. USA: Twentieth Century Fox.

Quintiere, J. G. (2017). *Principles of fire behavior* (2nd ed.). Boca Raton, FL: CRC Press.

Suggested Reading

In order to access the following resources, click the links below.

You are encouraged to view the videos on standpipes and hose systems as well as the fire hazards of intermediate bulk container totes.

Fire Equipment Manufacturers' Association. (2013, November 8). *Standpipe rack hose system for fire protection in commercial buildings* [Video file]. Retrieved from https://www.youtube.com/watch?v=znp4TWiJluQ

Click here to access the transcript for the video above.

National Fire Protection Association. (2011, May 2). *Joe Noble on NFPA 14* [Video file]. Retrieved from https://www.youtube.com/watch?v=3j1vejBUg14

Click here to access the transcript for the video above.

National Fire Protection Association. (2014, April 8). *Contain IBC fire risk* [Video file]. Retrieved from https://www.youtube.com/watch?v=eHBxJ1WbxM8

Click here to access the transcript for the video above.