ETHANOL – A New Challenge for Fire Fighters?

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As a result of new federal regulations aimed at reducing toxic exhaust emissions and the need to develop renewable alternative fuels to reduce the dependence on refined gasoline, enormous quantities of ethanol and ethanol-blended fuels are being produced and shipped all over the United States. Currently, 145 ethanol bio-refineries have a production capacity of 8.3 billion gallons. Add to that 55 additional facilities currently under construction or expansion, with a potential to increase production by five billion gallons—bringing the total to 13.5 billion gallons by 2009. In the United States, the consumption rate of gasoline is 140 billion gallons per year.

Since ethanol is blended with gasoline at bulk storage facilities (tank farms), where the tank trucks are loaded for delivery to local gas stations, the produced "denatured" ethanol needs to be shipped from the production site to the bulk storage facility. Depending on the location of the production facility, the ethanol is shipped by rail, tank truck, barge, and in some areas, by pipeline (or a combination of all modes). According the Federal Railroad data, ethanol is now the number one commodity shipped by rail, surpassing LPG. Over 122,000 carloads of ethanol, each carrying approximately 29,000 gallons, were shipped by rail in 2007. The number of carloads is expected to increase to 260,000 by the year 2009.

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Ethanol-blended fuels come in several varieties. The most common, particularly in urban areas, is E10 (10% ethanol/90% gasoline). However, other blends can include E20 or E85. The transition to higher percentages of ethanol is directly related to the availability of vehicles equipped with engines that have the ability to use ethanol-blended fuels greater than E10. As more such cars are built, there will be an increased demand for these fuels.

One of the most critical issues for the fire service is product identification. A variety of DOT placards can be used with ethanol and ethanol-blended fuel shipments. Gasoline and E10 can both use the UN1203 placard. Any blends above E10 and up to E95 can be placarded with the new UN3475 (effective December 2008). Denatured ethanol (E95) can be shipped using UN1987 or UN1993 (which can be used for flammable liquid NOS). It should be noted that UN 1993 is often identified with diesel fuel, fuel oil, and similar products.

The importance of confirming the product is critical. In addition to placards, confirm the information with the driver or with shipping documents, or by contacting the carrier through CHEMTREC if necessary.

The risks associated with ethanol and ethanol-blended fuels can be significant, but can also vary greatly. Risks to a community with a production facility will be different from risks to a community with a bulk-storage facility. If your community borders a major rail line, waterway or highway, the transportation risk to your community may be greater than you realize. So the first step is to understand what your community's potential risks are by conducting a risk analysis. This will help you define any gaps between what your current capability is versus what might be needed. (Note that the focus of this article is on bulk quantities of ethanol and ethanol-blended fuels in production, storage or in transit, not vehicle fuel tanks between 20 and 60 gallons.)

It is important to understand that ethanol is not an exotic or complicated flammable liquid, but it does have some unique characteristics that need to be understood in order to effectively handle a spill or fire. Ethanol is water miscible, so it requires an alcohol-resistant (AR) foam. AR foam contains a special polymer that creates a protective membrane between the surface of the liquid and the foam blanket to prevent degradation. Ethanol generates a lower heat energy (BTU) than gasoline when burning; in addition, it generates much less smoke. When blended with gasoline, the flammable range is significantly increased as compared to pure gasoline. These factors should be considered when responding to a spill or fire involving ethanol-blended fuels.

From a tactical perspective, it is also important to understand the quantity of foam that will be required to mount an attack on a bulk flammable liquid incident, based on the incident scenario. The quantity will be based on the foam type (3%, 6%, etc) that a department chooses. For example, for a fire in a loaded tank truck of 8,000 gallons of ethanol-blended fuels, a minimum supply of 300 gallons of concentrate (3%) would be recommended. Other factors, including application rates, combining attack with dry chemical agents are also important considerations. Foam application nozzles and applicators are also critical to ensure that the proper foam/air mixture is being produced. A number of clamp-on devices are available that can be affixed to standard structural firefighting nozzles to make them foam-capable. The use of dry chemical extinguishers in combination with foam can be very effective in dealing with three-dimensional fires involving equipment, piping and valves, or product under pressure.

If larger quantities of foam are needed based on the risk, consider larger foam containers, such as totes (265 gallons). Some departments have pallets of five gallon pails. While these containers may be easier to handle, the labor required to unload pails into tanks or other containers may be a challenge. The disadvantage of using the larger tote containers is that they require a vehicle such as a forklift or other system to off load/move the container.

It is recommended that fire departments work together regionally to combine foam resources in the event that larger

quantities of foam are needed. However, it is important to keep in mind that different concentrates should not be mixed together. Mixing dissimilar concentrates can cause them to gel and in some cases solidify, rendering the foam unusable. Mixing finished foam of similar types is generally not a problem.

Some fire departments include airport crash or ARFF units as a resource for responding to bulk flammable liquid emergencies. While those units certainly can be of value, in many cases, they do not carry AR-type foam. That does not mean these units should not be used, it simply means that non-AR foam may not fully extinguish an ethanol-blended fuel incident. It is very important to know the capability of specialized resources and how they will be used in the event of an incident.

Another major factor that is sometimes overlooked when considering response to a flammable liquid incident, including ethanol blended fuels, is water supply. A sustained foam operation, if it includes master stream devices, multiple handlines, supplying fixed facilities, etc. will require significant water supply. Can the fire departments deliver the needed water? Is large diameter hose (LDH) used for the supply line? Is the domestic water supply enough to provide water to allow a sustained operation? Transportation incidents that may involve limited access to domestic water supply may require water tenders (referred to as tankers in some jurisdictions).

Since ethanol-blended fuels are blended at tank farms, fire departments having responsibility for protecting bulk storage facilities should know that one or more of the large tanks will likely have denatured ethanol. Like any other bulk tank, they need to have a good understanding of the fixed fire protection systems that protect loading racks, storage tanks, blending and vapor recovery systems, and other facilities. Similar to standpipe and sprinkler systems on buildings, fire departments should be familiar with how they will support the fixed systems, locations of connections, how AR foam will be supplied, and other issues.

In conducting a risk analysis, it may be determined that the local fire department does not have the capability to deal with a bulk ethanol-blended fuel incident due to limited foam resources, the necessary nozzles and other delivery equipment; limited staffing, or other factors. The tactical decision may be to simply recognize that any attempt would unduly risk responders; therefore, in areas where there are no critical infrastructure or life safety exposures, letting the liquid burn off is certainly a viable option. However, there may be situations where local transportation infrastructure or other facilities are exposed, and "let it burn" is not the best option. In those situations, it is important that effective risk analysis be conducted and a determination made of what is required in terms of equipment and other resources.

It communities where industry has a role in creating the risk, whether it is a fixed facility or a transportation operation, industry has a responsibility to ensure that appropriate protection is provided, including supporting the resources that are required. Developing cooperative relationships with the local industry to provide firefighting resources, conducting onsite exercises, and developing emergency response plans is critical. The time to meet the industry representative is not on "game day."

The dramatic growth in the production, distribution, and use of ethanol and ethanol-blended fuels is certainly a new challenge for the fire service. However, it is not one that cannot be effectively managed. Like any other hazardous material, ethanol and ethanol-blended fuels are flammable liquids that have unique characteristics that may require different resources and tactics. Being prepared by understanding those characteristics, getting the needed resources, and training firefighters to execute the required tactics will help address the challenge.