



Supervisors' Safety Update

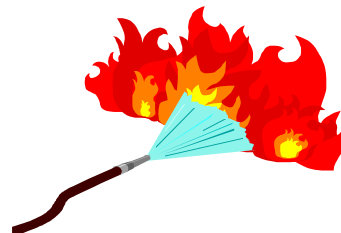
Ideas and Strategies for Leaders



SSU 2007-11

FUELING OPERATIONS Preventing Fire & Explosion

by SeaBright Insurance Loss Control



Instinct and common sense warn you to approach wild animals with caution and respect. Like tigers or bears, fuels are inherently dangerous, but can be kept under control if properly contained. When a wild animal is being transferred from one cage to another is when the unexpected is most likely to occur. The same is true of fuels.

Just being near a fuel supply might be considered hazardous, but fueling operations pose the greatest danger. It is during transfer that the fuel's vapor has the best chance of reaching an ignition source. Fuel *vapor* is the most significant hazard, because it is the vapor that ignites, not the liquid. Just as in a vehicle's fuel injection system, fuel is mixed with air to a specified percentage. If the ratio has too much air (mixture is too lean) the engine will run poorly. If there is excess fuel (the mixture is too rich), the engine won't start when a spark (ignition source) is added. The right ratio in the wrong situation, like the wild animal, could take your life.

LIQUID FUELS

Gasoline: There are many types of liquid fuels today. However, common gasoline is the one most of us will encounter. Because of this familiarity, and the safeguards built into such things as gas station equipment, most people overlook the hazards of gasoline. Many people are not aware of the properties and dangers of this liquid fuel. The same properties that make gasoline a good combustion fuel also makes it extremely dangerous. Here are several reasons why:

- ✓ **Low Flash Point** – The temperature at which a flammable liquid turns into an ignitable vapor is called the “flash point.” Gasoline’s flash point is quite low, with its flashpoint range in the area of 36°F to 50°F *below zero*. Because of this very low flash point, very few places are cold enough to keep uncontained gasoline in its liquid form, for an extended period of time without vapor being generated.
- ✓ **Wide Vapor-to-Air Explosive Range** – Once gasoline vapor is generated, it must mix with air to become an ignitable mixture. The lower end of this range is called the LEL or “lower explosive limit” and the upper end of the range is called the UEL, or “upper explosive level.” The amount of gasoline vapor that is required to form an ignitable mixture is between 1.3% (LEL) and 7.6% (UEL) by volume of air, a wide range as compared to other liquids. This is one of the characteristics that make gasoline so fuel-efficient. You can't tell if it's too rich or too lean. Guessing the mixture is a dangerous game.
- ✓ **High Density** – Gasoline vapors are heavier than air. They also behave like water, flowing downhill and pooling in low spots. Spilled liquid or vapors, and vapors released when a vapor recovery system is not in use, can settle in pipes, sumps, drains, and underground vaults. These vapors are invisible, but remain ready to ignite under the right conditions.

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◆ Precautions When Working With Gasoline:

1. **All smoking and hot work must be prohibited** while fueling or doing any type of work with gasoline. Never do any hot work (including grinding) on a container that has previously contained gasoline unless the container has been thoroughly purged of all vapors. Then, a combustible gas meter must have been used to verify that the vapors remaining in the tank are less than 10% of the lower explosive limit by OSHA standards. Never assume or guess! If you are wrong, there is a very high likelihood that your error will result in serious injury or death. You must know for certain.
2. **Do not overfill any tank or container.** Gasoline vapors expand as fuel or the container warms up during the day. Spilled or leaked gasoline will easily vaporize and combine with air into an ignitable mixture.
3. **Use pumps and hoses approved for gasoline use.** To prevent a static discharge when transferring liquid fuel, use hoses that are approved for flammable liquid transfer. All components of these will be electrically interconnected. If properly maintained, this will minimize the likelihood that flowing liquid will create a static charge.
4. **Never fuel indoors.** Released vapors will be contained within the building and can concentrate into an ignitable mixture, as they settle into a low point in the building. There are usually more potential sources of ignition inside a structure than outdoor.
5. **Use appropriate portable containers.** While it is certainly safer to refuel from a properly constructed and maintained fueling facility, such as a gas station, there are times when portable containers need to be used. These containers must bear a label indicating that they are for use with flammable liquids. This label is your assurance that the container was designed and built in accordance with a recognized and proven safety standard. Among the safety features will be a self closing cap to prevent spills if the container falls over, a vent to release vapor pressure in the event of heat build-up, and a flame arrestor. The flame arrestor is the metal screen near the bottom of the neck or spout. This screen is not a filter, and must not be removed.
6. **Never use gasoline as a cleaning agent.** This is just too dangerous. Remember, gasoline is produced to do one thing: burn rapidly under a wide range of conditions.



Diesel Fuel is much safer than gasoline but can still be dangerous under certain conditions. This fuel comes in many grades, and is also commonly known as fuel oil. Diesel is not considered a “flammable liquid” but is classified as a “combustible liquid.” This is because, in order for it to vaporize, it must be heated to over 100°F. Dangers associated with diesel fuels include:

- √ **Spills** - Most often a diesel fire occurs when the fuel is spilled onto a hot surface such as an exhaust manifold or hot steam pipe. A hot surface will both vaporize and ignite the fuel oil mix.
- √ **Leaks** - Other fires can be caused by a small high-pressure leak--causing the fuel oil to vaporize. After it is vaporized the fuel-air mixture can be ignited by any nearby heat source.

◆ Precautions For Handling Diesel Fuels:

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1. **Do not transfer diesel near hot surfaces.** If the fuel tank or fill nozzle is around any heated surface, allow that surface to cool before fueling. Remember, you may not intend to spill, but accidents can happen. Do not allow a minor spill to turn into a disaster.
2. **Inspect pressurized systems daily for leaks.** If one is found, shut the system down and repair it immediately.

FUEL GASES

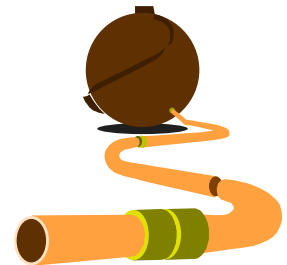
LPG and LNG: Liquefied Petroleum Gas (LPG) and Liquefied Natural Gas (LNG) are the two most common gases used to fuel equipment or machinery. Compressed Natural Gas (CNG) once known primarily as a heating gas is now growing in its use for powering equipment. LPG sometimes referred to as Propane or Bottled Gas, is by far the most common fuel gas.

Fuel gases are delivered in liquid form. This allows greater fuel volume per container. For example, one gallon of LPG produces approximately 245 to 275 gallons of the fuel in its gaseous state. There are two ways to liquefy a gas: chill it so it is very cold (LNG boils at a temperature as low as 263° F below zero); or pressurize it. Pressurization of LPG is the most common method, but this presents the greatest danger associated with this gas:

- √ **Leaking, Expanding Fuel** - The danger of liquid gas is that leaking fuel will vaporize as soon as it is released from containment. This release will expand into a large volume of flammable/explosive gas.

◆ Precautions For Handling Fuel Gases:

1. **Prevention of leaks is a primary concern.** To prevent leaks, inspect tanks, valves and piping every day. If a leak is found, move the container outside and away from any building. Barricade the area to keep possible sources of ignition away and call the fire department or other emergency responders.
2. **Keep the fuel distribution system leak-free.** Intact hoses and fittings are a must. Close the tank's fuel valve at the end of the day. This will help prevent leakage in the event of a fuel distribution system defect. Never store gas cylinders or tanks inside a building except under conditions defined by the National Fire Protection Association (NFPA). Consult with your local fire department to be certain of the limitations.
3. **Never fill a tank to capacity.** Liquids and gases expand as they warm. When a tank is topped, this can cause the tank to over-pressurize. Fill it only to the "full" mark on the gauge. This will leave room in the tank to accommodate expanding gases. Even if this is done, under certain circumstances, the pressure of expanding gasses can exceed the capacity of the tank. For this reason, pressure relief valves are installed. When the tank pressure increases to a pre-determined point, the valve opens, releasing the flammable gas into the air. If allowed to build up, these vapors could ignite. Cooling the tank with water or moving it from the direct sun will usually stop the venting.
4. **Be alert to odors.** For your safety, all fuel gasses are odorized. If you can smell the gas, you probably have a leak and your system needs immediate attention.



BATTERIES

Batteries are used in nearly all industries. The most common are lead acid batteries, such as car batteries. Lead acid batteries are refueled by a process called recharging. While the battery itself is not considered flammable, there are hazards associated with refueling:

- √ **Explosion and Fire** - This can take place during the recharging process.
- √ **Acid Spills** - Batteries also contain a dangerous acid which can be distributed during an incident, compounding the problem.

◆ Precautions For Refueling Batteries:

1. **Always recharge batteries in a well-vented area.** During recharging, explosive hydrogen gas is released from the electrolyte. You do not want any gas build up, nor do you want any potential sources of ignition nearby.
2. **Inspect the battery, especially around the connections.** If the connecting posts or terminals are loose or show cracks, you may have a bad internal connection. This could cause the battery to explode during charging if the connection electrically arcs in the presence of the liberated hydrogen gas. This gas-off occurs more often than you might realize. To lessen internal gas build up, some battery manufacturers may instruct you to remove the vent/fill caps during recharging.
3. **Do not charge at a high rate.** This can shorten battery life, create excessive heat, and can actually cause the electrolyte liquid to boil.
4. **Prior to charging, be sure the electrolyte liquid fully covers the plates.** If the plates are not covered, distilled water should be added. Never add additional acid.
5. **Wear proper personal protective gear.** When working around lead acid batteries, eye *and* face protection, in addition to an apron or other impervious clothing, must be worn. During charging, a battery can explode unexpectedly, violently throwing case fragments and acid.

NEVER FOOL WITH FUEL—ALWAYS PLAY IT SAFE!

It's hard to imagine getting along without modern fuels. We've come a long way from "rubbing two sticks together." However, like the wild tiger, fuels must be respected and handled carefully. Don't take them for granted. Keep them captive. The potential of fire and explosion is nothing to fool around with!