

American Burn Association

GASOLINE SAFETY

Educator's Guide

A Community Fire and Burn Prevention Program Supported by
the
United States Fire Administration Federal Emergency
Management Agency

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GENERAL BACKGROUND INFORMATION

Gasoline, when ignited in a controlled manner to power engines, serves a very useful purpose. Because it is so commonplace, however, we sometimes take its presence for granted without realizing how dangerous it can be. The same quality of explosive ignition that makes gasoline so valuable as a fuel can cause terrible injuries when it is handled carelessly or used for a purpose for which it is not intended. Gasoline and other flammable liquid-related burns, however, are a preventable problem.

These accidents are often associated with careless use (misuse) of gasoline. Most accidents occur in the summer months due to an increased use of gasoline for farming or recreational purposes (i.e. bonfires, burning leaves, boating, yard work, etc.). A lack of understanding of the explosive nature of gasoline by the general public seems to contribute to both its improper storage and misuse as a solvent, engine primer or fire starter. Gasoline burns decrease markedly in winter months except burns associated with carburetor priming to start cars.

Although anyone can be injured in a gasoline or flammable liquid related incident, the highest rate of gasoline-related injuries occurs among those whose use gasoline in their work, such as mechanics, yard maintenance, heavy duty and light power equipment operators. Gasoline associated with recreational activities such as boating, camping and barbecue grilling can cause burn injuries.

Most injuries associated with these products occur in the home, however, where the improper use and storage of gasoline and other flammable liquids can result in the both body and property damage. Knowing how to prevent these injuries can protect you and those you love from a devastating burn injury. The first step to ensure a safer home environment is to increase your awareness and identify potential hazards. The next step is to make the necessary changes in behavior and your environment. Change in the environment and modifying high-risk behaviors involves eliminating the cause of the problem, thereby reducing the risk.

Gasoline-related injury statistics

Accidents with gasoline are a major cause of thermal burns in the U.S. It has been reported that gasoline-related burns account for 13,000 - 15,000 ED visits per year. According to the United States Fire Administration, there were an estimated 463 burn injuries caused by the misuse of gasoline in 1998. However, since USFA data are based on reports of incidents to which fire departments responded, they do not include injuries where those sustaining burns from gasoline were transported directly to hospitals by other means.

Since injury statistics are organized according to numerical code sets which lack a separate code for gasoline as a cause of burn injury, the total number of such injuries is unknown. However, such injuries can be very severe, as is evident in their frequent transfer for treatment at one of the nation's 125 specialized burn care facilities. In the USFA report, about 80% of the victims were males and the incidence was remarkably well distributed by age (with a spike at age 30) from birth until about age 45. At that age, incidence drops off considerably and remains low through older age.

A 2000 report by the National Fire Protection Association, based on 1993-1998 data, provided the following gasoline-related annual estimates: Community Fire & Burn Prevention Programs Gasoline Safety Campaign

- Over 140,000 fires, including 120,000 in vehicles (most of them unoccupied, fortunately).
- Over 6,000 residential fires.
- About 500 deaths.
- Thousands of hospital emergency room visits.
- Nearly \$500 million in direct property damage costs from gasoline-related fires.

(Source: *The U.S. Home Product Report, 1993-1997, Flammable or Combustible Liquids*, National Fire Protection Association, Fire Analysis and Research Division, Quincy, MA, August 2000).

Technical Background

The severity of a gasoline or flammable liquid burn depends upon three factors - the flash point, vapor density and flammable range. The flash point is the minimum temperature at which the liquid will give off sufficient vapor to form an ignitable mixture with air. The vapor density is the ratio of density of vapor to the density of air. Substances with a vapor density greater than 1 are heavier than air and tend to accumulate in low or enclosed spaces. The flammable range is the range of vapor density within which a flammable substance will ignite.

Flammables are gases and/or liquids that can burn, release vapors or explode at any temperature close to room temperature or below (under 100 degrees Fahrenheit). In the case of gasoline the flash point is so low that it can explode at virtually any temperature: it doesn't have to be warm.

Gasoline produces ignitable vapors that are very dense, 3 to 4 times heavier than air. These vapors are ignitable at a wide range of mixtures with air, from 1.6 to 7.2 times the density of air.

They can travel for great distances along the ground or floor and they tend to accumulate in low enclosed spaces, the same areas where pilot lights on appliances tend to be located. A nearby open flame from the pilot light of a water heater or furnace can easily ignite vapors from these products. Because of its low flash point, high vapor density and wide flammable range, these products are highly explosive. A small spark that causes gasoline to explode may lead to a large fire, which can then lead to an even larger explosion.

GASOLINE SAFETY FACT SHEETS *FOR COMMUNITY DISTRIBUTION*

- Portable gasoline containers
- Portable container and vehicle filling procedures
- Small engines and gasoline powered equipment
- Static electricity and gasoline
- Automobile carburetors
- Transporting and storing gasoline
- Barbecue safety
- Propane grill safety
- Inappropriate uses of gasoline
- First aid for exposure to gasoline

PORTABLE GASOLINE CONTAINERS

The Uniform Fire Code only approves one and two gallon metal or plastic containers for the indoor storage of Class I-A flammable liquid.

- The container must have a tight fitting cap for both the spout and vent.
- The container must be predominantly red in color and properly labeled, "GASOLINE". To be approved. It must also bear the warning label about the dangers of gasoline.
- Metal containers when grounded, provide the greatest protection against fires caused by static electricity.
- Never use glass or plastic bottles for transporting or storage of gasoline

Several organizations have developed standards for portable gasoline containers, including the American Society for Testing and Materials (ASTM), Underwriters Laboratories (UL) and the Canadian Standards Association (CSA).

ASTM F 852 Standard Specification for Portable Gasoline Containers for Consumer Use.

ASTM D 3435 Standard Specification for Portable Plastic Containers (Jerry Cans) for Petroleum Products (discontinued).

UL 30 Metal portable gasoline safety containers

UL 1313 Plastic portable gasoline safety containers.

CSA B 376 Portable Containers for Gasoline and Petroleum Fuels.

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PORTABLE CONTAINER AND VEHICLE FILLING PROCEDURES

Never siphon gasoline by mouth. It can be fatal if swallowed.

Because portable containers are much smaller than vehicle fuel tanks, they fill a lot faster. To prevent over-filling or a spill, the consumer needs to control fuel flow. This is why the nozzle trigger-valve should be left open while filling a portable container.

The container should be filled only 95% full. The remaining air space allows room for the gasoline to expand if it warms up later. Otherwise, expansion could force liquid gasoline out of the container or distort the container. In most areas, gasoline pump nozzles are equipped with an accordion-like sleeve to reduce emissions of gasoline vapor during fueling. The sleeve helps return the vapor in the vehicle's tank to the service station's tank. The sleeve must be compressed to activate the nozzle. When fueling a vehicle, this happens naturally when the nozzle is inserted into the filler spout. The same procedure isn't practical with a container, because inserting the nozzle into the inlet far enough to compress the sleeve will activate the nozzle's shut-off mechanism when the container is only partially full. The customer should compress the sleeve with one hand while controlling the nozzle valve with the other. This allows the customer to see that the nozzle is in contact with the container. It also allows the customer to monitor the rising fuel level and to stop at the appropriate time.

The filling location should be a safe distance (about five feet) from the consumer's vehicle and other vehicles. Engines that have just been turned off have hot surfaces (exhaust manifold and catalytic converter) that could ignite gasoline vapor.

SMALL ENGINES AND GASOLINE POWERED EQUIPMENT

Small engines and gasoline-powered equipment, such as those found on power mowers, weed eaters, personal watercraft, chain saws, etc., and require special filling methods. It is suggested using a portable container to fuel these engines. The gasoline flows slower from the portable container and therefore less static electricity is generated.

Consumers who choose to fill such equipment on a truck or trailer directly from a dispenser should make sure they keep the dispenser nozzle in contact with the fuel tank fill tube. Failure to do so can result in the possible build up of a static electrical charge and may ignite the gasoline.

STATIC ELECTRICITY AND GASOLINE

Fires initiated by sparks can be prevented if static electricity is not allowed to build up, particularly on conductors. One defense is to dissipate electrical charge by creating paths that allow it to flow to ground.

Placing a container on the ground makes it easier for electrical charge to escape. Cement or dirt is better conductors of electricity than asphalt and, therefore, better grounding surfaces. While vehicles that are driven to a service station may not appear to be grounded, they are. Tires are good enough conductors to allow electrical charge to escape to ground.

Keeping the dispenser nozzle in contact with the container at the inlet or with the fuel tank fill tube creates another path by which electrical charge can escape. This is because the dispenser is grounded and the nozzle is bonded to the dispenser hose.

When a vehicle or other equipment can't be placed on the ground, a second defense is to fuel more slowly. The slower gasoline flows, the less static electricity is generated. This is why gas companies suggest using a portable container to fuel gasoline-powered equipment (motorcycles, personal watercraft, snowmobiles, lawn mower, etc.) being transported on a truck or trailer. People usually pour fuel more slowly from a portable container than is delivered by an automatic dispenser.

AUTOMOBILE CARBURETORS

A relatively common cause of burn injuries involves pouring gas into a carburetor in an attempt to start a car. When a vehicle runs out of fuel, an airlock can develop in the fuel line between a newly filled gas tank and the carburetor. To provide adequate fuel-air mixture, gas may be placed directly into the carburetor to prime the engine. ***This practice is both dangerous and unnecessary and can produce explosion or fire.***

Explosions may occur by 3 mechanisms:

1. Contact of the gasoline or its vapors with hot metal (i.e. engine)
 2. Gasoline ignition caused by a spark from the electric system of the automobile
 3. Ignition due to excessive gasoline in the intake manifold - causes backfire.
- Prevention education should be aimed at drivers education and auto repair classes. Community Fire & Burn Prevention Programs Gasoline Safety Campaign

TRANSPORTING AND STORING GASOLINE

Guidelines for Transporting Gasoline

- When transporting gasoline, make sure that it is stored in an approved container with the lid tightly closed.
- If you are transporting gasoline in a car, keep the container in the trunk and keep the trunk lid ajar for ventilation.
- Secure the container to prevent sliding if the gasoline is being transported by truck.
- Remove the container and store it properly-never store a gasoline container in a vehicle.
- Wipe the outside of the container to remove any liquid or gasoline residue.
- Do not leave the container of gasoline in direct sunlight, or in the trunk of a car that is in direct sun. Heating the gasoline will build up pressure in the container.
- Gasoline should be transported only a short distance. Do not include transporting gasoline along with a list of other errands you need to accomplish.

Guidelines for Storing Gasoline

- Don't store gasoline in the house or garage!
 - Always store a gasoline container in a cool and well-ventilated area. Keep it away from any source of heat or sparks such as a water heater, electric motor or car engine.
 - Never store more than one gallon of gas.
 - Always store the container in a shed away from the house or any habitable structure.
 - When not in use, keep gasoline locked up at all times.
 - Have a class B type extinguisher located near gasoline storage area.
 - Always keep gas out of reach of children.
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BARBECUE AND PROPANE GRILL SAFETY

Barbecue Safety

Every year, there are thousands of barbecue type burn injuries from the careless use of unapproved lighter/starter fluids and the misuse of approved fluids or gas. These injuries are preventable. Here are a few safety tips for around the barbecue.

- NEVER EVER use gasoline as a starter fluid or accelerant for charcoal grills.
- Always use an approved lighter/starter fluid for charcoal grills.
- After soaking your coals with lighter/starter fluid, wait for a minute for the heavy concentrations of explosive vapors to disperse.
- When using lighter/starter fluid, place the container well away from the barbecue before attempting to light the coals.
- Be very careful not to spill any fluid on your clothing, or in surrounding area of the barbecue.
- Wear an insulated fire retardant barbecue mitten when lighting your presoaked coals.
- Never add lighter/starter fluid to hot or even warm coals. An explosion can happen causing serious injury.

Propane Grill Safety

- When using propane grills, check all connections leading from the propane tank to the inlet connection of the grill for leaks. A leak can be detected by spraying soapy water at the connections, if bubbles surface, there is a leak. SHUT TANK VALVE OFF and tighten connections. If the connections continue to leak, have a certified dealer check before using.
- Always shut off the valve to propane tanks when not in use.
- Never start a gas barbecue with the lid to the grill closed. The propane or natural gas may accumulate inside, and when ignited, could blow the lid off causing injury.
- Periodically, clean the venturi tubes that displace the gas under the grill. When tubes become blocked by insects, gas is forced out somewhere else within the system. Use manufacturer's instructions for cleaning.
- Have a 2A 10 BC type extinguisher located in the barbecue area.
- Always store full or empty propane bottles in a well-ventilated shed away from the house or any habitable structure.
- Always store propane bottles away from potential sources of flame such as furnaces, water heaters or any appliance with a pilot light.

As a reminder, never wear loose fit clothing while cooking on a barbecue and always keep children at a safe distance especially when lighting the grill.
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INAPPROPRIATE USES OF GASOLINE

Gasoline Sniffing

Gasoline sniffing is a popular form of solvent abuse for young children and adolescents. It predominately occurs in children ages 5-15. Sniffing gradually increases from age 5 to 11; it increases again from age 11-14 before peaking at age 15.

During gas inhalation, 15-20 breaths result in euphoria, ataxia, and disorientation lasting five or six hours. Effects of this intoxication are similar to those of alcohol and hallucinogenics. In addition to the neurological and physiological effects, sniffers are at a significant threat of severe burn injury or death. This may occur as a result of ignition of vapors or from extensive physical contact the gasoline.

Gas sniffers often sustain severe injury as a result of altered sensorium. They spill gas on their clothes and are unable to extinguish the flames because of their stupor.

Gasoline should never be used as:

- A solvent
 - A cleaning solution
 - An accelerant
 - An insecticide
 - A weed killer
 - A weapon
 - A fuel in devices designed for other fuels, such as kerosene
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FIRST AID FOR GASOLINE EXPOSURE

- ☐ **ALWAYS REMOVE VICTIM FROM ANY FLAME SOURCE IMMEDIATELY!**
- ☐ **DIAL 911 TO START EMERGENCY MEDICAL ASSISTANCE**

What if someone becomes ill from breathing gasoline?

The product is flammable. Take proper precautions (remove from any source of ignition). Take proper precautions to ensure your own safety before attempting reuse. Remove source of contamination or move victim to fresh air. Perform CPR as necessary and immediately transport to emergency facility.

What if gasoline gets on someone's skin or clothing?

Avoid direct contact. Wear protective clothing and eyewear if necessary. Under running water, remove contaminated clothing and shoes. Quickly and gently blot or brush away excess chemical. Wash gently and thoroughly with water and non-abrasive soap for 5 minutes or until the chemical is removed. If irritation persists, repeat flushing. Obtain medical advice immediately. Clothing and shoes contaminated with gasoline should be stored out of doors away from sources of ignition until thoroughly cleaned.

What if someone gets gasoline in their eyes?

Avoid direct contact. Quickly and gently, blot away chemical. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 5 minutes or until the chemical is removed, while holding the eyelid(s) open. Obtain medical advice.

What if someone swallows gasoline?

Never give anything by mouth if victim is rapidly losing consciousness or is unconscious or convulsing. Have victim rinse mouth thoroughly with water. **DO NOT INDUCE VOMITING.** Have victim drink 8 to 10 oz. of water. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Repeat administration of water. Perform CPR as necessary and immediately transport to emergency care facility.

REFERENCES/RESOURCES

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Websites

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www.api (American Petroleum Institute): gasoline safety standards

www.nfpa.org (National Fire Protection Association): fire data reports

www.pei (Petroleum Equipment Institute): gasoline pumps and static electricity

www.usfa.fema.gov (U.S. Fire Administration): fire data, prevention guidelines
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