

Fuel Storage

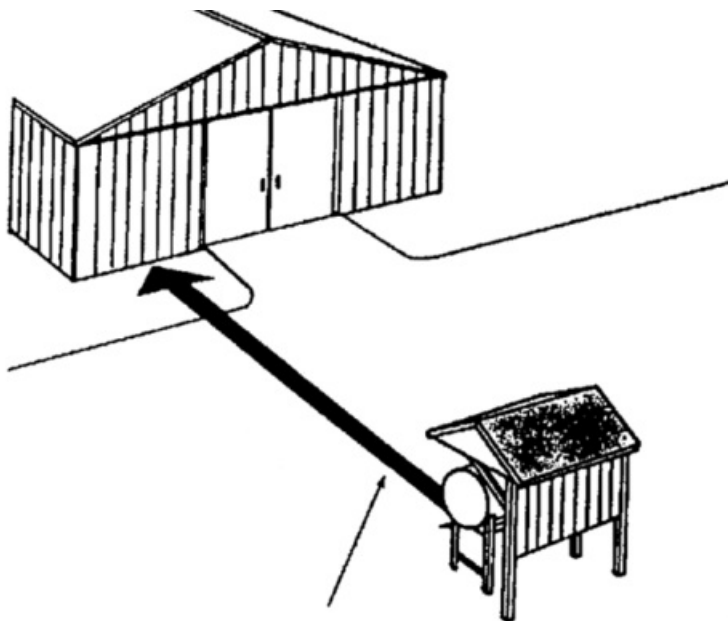
Storage of fuel can be extremely hazardous. Liquid or compressed gas fuels by their nature are highly combustible and should be treated separately than other storage items.

Choice of Storage Location

Any location used to store fuel should follow a few basic rules.

Fuel storage should always be separate from other stored items! Fuel should have its own storage location, outside of a main facility. A fuel storage location should be:

- At least 10 meters from the nearest warehouse or storage location (ideally more).
- As far away from offices and residences as possible. If possible, store fuel in a different location than where people live and work entirely.



Minimum 10 metres

Access to the fuel storage locations should be controlled, and only authorized persons should have the ability to enter. All staff working around fuel storage should be informed of risks and safety procedures.

Fuel storage areas should be well ventilated to avoid the build-up of fumes, and should ideally be shaded to avoid excessive temperatures. Never store fuel in fully enclosed spaces such as shipping containers with the doors closed. Pressure, heat and increase in fumes can lead to combustion.

NEVER store fuel next to any form of chemicals that may cause a violent energetic reaction.

General Storage Considerations

The overall size and consumption needs will determine the configuration of fuel storage arrangement. A few general rules to consider:

- Avoid storing fuel in drums as much as possible, and as much as the operation permits. Emphasize storage in tanks or bladders.
- Gasoline/Petrol should only be stored in small quantities, and in above ground, well ventilated places. Petrol is volatile and degrades quickly in ambient temperatures, and should be ordered in low volume, frequent quantities.
- Diesel fuel can generally last for up to six months before it shows signs of deterioration. Planners should aim to only store fuel for up to six months' worth of anticipated demand.
- Diesel can be stored above and below ground, but storage areas should always still be well ventilated.

Irrespective of the storage modality, planners should also consider key elements when developing fuel storage:

- Fuel storage should be on solid, firm ground, ideally purpose built for storage. Fuel in large quantities can be extremely heavy.
- Consider environmental impact. Depending on the arrangement, sawdust or sand may be scattered on the ground to absorb any spills.
- All storage locations should be well ventilated, and have adequate drainage.
- All fuels are corrosive and should not be used with plastic accessories, such as plastic buckets or plastic pipes. Also avoid contact with Teflon and tire inner-tubes.
- Managers should develop a spill response plan, and fire response plan. Plans should be continually communicated to employees or persons handling fuel.

Some general guidelines for site Identification include:

- Sites should be situated away from other potential hazards that might increase the likelihood of accidental fire.
- Fuel storage areas should have easy access for tanker trucks, if required. If vehicle refuelling is happening on site, pumps with counters should be readily available.
- There should be proper structures to accommodate shade and ventilation requirements of fuel.
- Site should have emergency exits in warehouses and perimeter walls.
- Area should not be prone to lightning strikes or seasonal fires.

Example Storage Structures:

Built-up Fuel Storage Room

- Next to generator storage area.
- Enclosed, but well ventilated.
- Separated from other storage locations.
- Fire extinguisher on site.
- Lockable door/access controlled.
- Mostly used for storage of drums/other moveable containers.



Covered Fuel Dispensing Shed

- Easy access for vehicles.
- Covered to prevent direct sunlight.
- Fire extinguisher on hand.



Recessed / Below Ground Tank Storage

- Large volume tanks, interconnected.
- Requires powered pumping system.
- Segregated sections for different types of fuel.
- Professional installation.
- Remote monitoring equipment in place.



Some organizations may wish to make one large central fuel repository to serve as a distribution center for other bases or other agencies operating in the area. Fuel depots or "fuel farms" can be a good idea if operations are running at sufficient scale, and managers understand the demand over the coming months, however they require specialized planning and management.

If agencies are planning specific fuel depots, things to consider:

- The fuel depot should be strategically located near consumption, but still in a safe location.
- Depots may require their own stand-alone locations, and require their own management and security on site.
- Depots should be in safe locations, free from flooding or persistent violent crime, and not near potential targets.
- Depots should have sufficient and easy access for vehicles and refueling tanker trucks.
- Fuel storage sites should have specialized access control for visitors.
- Some countries may have heightened regulations for fuel storage locations over a certain size, including safety and security.
- Fuel depots should have an advanced fire prevention and fire suppression system in place, installed by a professional company.

Monitoring Systems

There are a variety of monitoring systems available, including visual and remote monitoring systems.

Remote/Electronic Monitoring – Electronic monitors can be used to monitor both temperature

and volumes of fuel storage tanks. Electronic monitors require specialized sensors to be manually inserted into fuel tanks that continually monitor the condition of the fuel. Electronic sensors are useful in that:

- They can be used to generate reports, such as stock outs.
- They can be set to trigger alarms in case of high heat or low volumes.
- The readout device does not need to be next to the fuel itself, and can be in an office or even communicate to mobile phones/computers.

Electronic monitors must be correctly installed and calibrated. When obtaining an electronic monitor, please follow manufacturer guidelines and consult with the seller.

Example remote fuel monitoring devices:



Visual Monitoring – Many tank or storage containers come with gauges or “sight tubes” that allow managers to quickly look at fuel levels without having to open the containers. Visual sight tubes are by far the easiest and safest way to visually inspect fuel levels; other monitoring devices such as sensors or gauges can degrade over time or simply be calibrated wrong, but visually seeing fuel levels is significantly harder to misinterpret.

Example Sight Tube:



In case site tubes and regular gauges are not available, managers can use what is called a “no-spark” dipstick - any clean wooden stick or ruler can be used to identify height within drums or tanks. Dip sticks work by inserting the stick into the fuel container at a 90 degree angle, and visually inspecting where the stick makes contact with the fuel.

Due to the nature of storage solutions, irregular shaped containers may make getting accurate readings difficult. It is advisable to make visual markings next to sight tubes or physically on dip sticks when adding fuel for the first time. As an example – place 20 litres (or whichever unit of measure makes sense) in the container, and then mark the relative height. Repeat with the same pre-defined interval until the container is full. This will enable faster and more accurate tracking of fuel levels.

Temperature Changes and Fuel

Ambient and outside air temperatures can greatly impact fuel stored over any period of time.

Flashpoints – A flashpoint is the temperature at which fuel is combustible. Different types of fuel are only flammable at different ambient temperatures, meaning each one of them has an independent minimum flash point. It should be noted that even though external temperatures may not reach flashpoints for certain fuels, enclosed containers, enclosed storage spaces, or containers in direct sunlight can still reach unsafe limits.

Fuel Type	Minimum Flash Point
Ethanol (70%)	16.6°C (61.9°F)
Gasoline (Petrol)	-43°C (-45°F)
Diesel	52°C (126°F)
Jet Fuel (A/A-1)	38°C (100°F)
Kerosene*	38-72°C (100-162°F)

*Mixture dependent

Liquid fuel also expands and contracts in changing temperatures at a higher rate than water. For example, diesel fuel stored at 25 degrees centigrade is approximately 2.5% more voluminous than diesel fuel stored at 0 degrees centigrade. Though that may seem like a small overall percent, it can certainly impact physical structures and can impact storage and consumption planning. Fuel delivered on a cold day but stored in an underground temperature regulated environment will expand, meaning users will have slightly more fuel than anticipated. The inverse is also true, however, and fuel stored in warm conditions may functionally be less than planned at the point of consumption. It should be noted that engines that consume liquid fuel still generally consume the same volume of fuel for the same activities, meaning more fuel will generally be consumed in colder climates.

When planning large reservoirs of liquid fuel to be used over a long period of time, planners should anticipate changes to volumes based on the location of storage and seasonal temperature changes.

Change in density in diesel fuel per temperature:

Temp	-	-	0	5	10	15	20	25	30	35	40	45	50	55	60
C	10	5													

Litre per KG	1.175	1.180	1.185	1.189	1.194	1.199	1.204	1.209	1.213	1.218	1.223	1.228	1.234	1.239	1.24
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KG per Litre	0.851	0.848	0.844	0.841	0.837	0.834	0.831	0.827	0.824	0.821	0.817	0.814	0.811	0.807	0.80
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