Quality Assurance of Fuel

Purchasing Fuel

Fuel impurities often start at the level of the supplier. After an emergency, or in less developed markets, pure quality fuel may be difficult to come by, and agencies must take active steps to ensure that they monitor and prevent fuel purity problems from impacting their operations. In appropriate or impure fuel in particular can damage vehicles and generators, costing significantly more money in the long run.

Some fuel impurities might include:

- Mixing of liquid fuel and water – this may be accidental or intentional on behalf of sellers to increase profits.
- Dirt and organic mater.
- Intermixing of different fuel types (example: petrol and diesel).

Agencies should monitor fuel as it's delivered and conduct their own purity checks. Ongoing issues with purity may indicate fraud, or at least will point out unreliable or poor quality suppliers. Any problems identified with purchased fuel must be recorded and actions should be taken against suppliers that provide poor quality fuel.

When purchasing fuel in drums, each container should be opened and checked with a no-spark measuring stick. If available and required, inspectors should also use "water detecting paste" – when applied to a measuring stick, water detecting paste changes color when it comes into contact with water, and is a useful way to identify impure mixtures early on.

Filtration/Settling

Impurities in liquid fuel and intermixtures of different types of fuel can be addressed through the process of letting the fuel settle.

- **Debris** - Organic debris, rust, fuel biproducts and other solid contaminants are usually heavier than liquid fuel, and will eventually sink to the bottom.
- **Phase separation** - Liquid impurities, such as water and other fuel components are different densities, and will eventually separate themselves into distinct layers through a process called phase separation.

Once liquid fuel has been delivered to a storage location, it is advisable to let the fuel settle for a minimum of 3 days before using it. This will allow sediment to fall to the bottom, while also allowing for different compounds to separate. If fueling from a drum, never move the drum just before withdrawing fuel.

A quick method for identifying impurities on the spot is to fill a glass jar or transparent jerry can with samples from the liquid fuel. After drawing sample fuel from the bottom of the container, place the clear full container in a shaded location and let it sit for 30 minutes, making sure to not disturb or move the container in any way. A full separation of different impurities including water will take several hours, but observers will still be able to identify problems early on.

If there is an ongoing issue with the quality of fuel as it arrives, then agencies may wish to invest in a separate settling tank system. This includes placing fuel in a dedicated settling tank that is only used to monitor and remove impurities before being pumped into other longer

term storage tanks.

When pumping liquid fuel, never pump the last 10 % of fuel in a tank. As water is heavier than diesel fuel, and water and most of the impurities will also go to the bottom of the tank. The remaining fuel in the tank must be filtered with care or used in the workshop for cleaning or other purpose.

When pumping fuel between two containers, it's advisable to use a mesh filter of some kind. Drums secured and delivered in remote locations can still accumulate debris inside, even after settling. It's also advisable to sue a water retention funnel when pumping directly into a vehicle. Even fuel has been properly stored and settled, water can still build up inside containers from condensation, and excess water in fuel can damage engines of vehicles.

Ongoing Quality Assurance

It is strongly advisable to use only dedicate pieces of equipment to each type of fuel.Never use the same pumping tools (pump, filter,funnels, etc...) for different fuels as this may lead to intermixing and impurities. These dedicated items must also always be kept clean and dust free.

Tanks will also need to be periodically emptied and cleaned. The frequency of needing to clean tanks depends on the purity quality of the fuel itself. A general rule is tanks should be cleaned every 2-5 years, or more frequently if required. Cleaning of tanks can be facilitated by having two tans of identical capacity - simply emptying one tank into the other for the duration of the cleaning.

When cleaning a fuel tank, persons should use proper protective gear:

- Gloves
- Respirator mask
- Protective goggles
- Adequate and safe clothing

The cleaning process includes:

- Allowing all fumes to escape after all fuel has been removed - open the lid to the tank and leave open for at least 24 hours.
- Removing excess debris or grime using a shovel.
- Scrubbing the interior of the tank with steel brush or steel wool.
- Ideally cleaning can occur using only hot water, but cleaning solvents can be used as long as they are completely washed from the tank at the end.
- Once debris has been removed, the tank must be let to thoroughly dry.
- All debris from the tank must be disposed of in a safe and ecologically friendly manner.

Shelf Life

Liquid fuels degrade and go "stale". There is no predetermined rate for fuel expiration because there are multiple factors that lead to the degradation of fuel:

- **Hydrolysis** – Fuels exposed to water over a long period of time began to chemically break down.
- **Microbes** – Microorganisms can live in liquid fuels in certain conditions, and will reproduce rapidly, eventually breaking down the fuel.
- **Oxidation** – Excessive exposure to oxygen produces acids as a biproduct.

In all forms of degradation, the result is liquid fuel turning into sludge or a gummy compound that can no longer be used and can damage engines. Excessive exposure to temperatures above 30 degrees centigrade will make the degradation process even faster.

Though there is no specific shelf life, the general rule to follow is:

Fuel Type	Shelf Life Duration
Petrol	6 Months
Diesel	6-12 Months
Jet Fuel	6-12 Months
Kerosene	12 Months (if delivered by pumping) – 5 years (if in original unsealed container)
Propane	5 Years+ (also depends on how long the sealed container can last)

In reality, agencies should only purchase and store as much fuel as they plan on using I the next 3-6 months wherever possible. Excessive fuel stored on site can be dangerous and attract thieves.

Accounting

Fuel should be accounted for just like any stored item. There should be logbooks or stock cards that capture the inflow-outflow of fuel, including quantities, dates, intended use and persons involved in the transaction.

Because most fuel is delivered in liquid form, it can be challenging to properly measure consumption. There are a few strategies for proper accounting for liquid fuels:

Strategy	Example
Only dispense into containers of known sizes	Pump fuel into a completely empty 20 litre jerrycan, and record the deduction from stock as 20 litres.
Use equipment with flowmeters where possible.	Some hand cranks and powered pumps come with flowmeters - instruments that measure flow through a hose over the duration of the pumping. Use the reading as the number of litres deducted from stock.
Measure empty space in before pumping	If delivering fuel from a tanker truck or other delivery mechanism, and fuel is being delivered to a tank that is not empty, use a measuring stick to determine the volume first, then fill the tank to 100% full. Record the difference between the two numbers as deducted from stock.
Only dispense full containers	When handing out fuel, only dispense full 200 litre drums or full canisters of compressed gas, and record the deduction from stock. This method only works for some operations at scale however.

It is very important to remember that fuel contracts noticeably with temperature decreases, and that fuel itself can evaporate. There may be variations in the long run that make perfect accounting impossible. Best practice tips for tracking fuel include:

- Keep lids to fuel containers tightly sealed when not in use.
- Record the outside temperature on the stock card when fuel is first delivered and try to measure levels at or around the same temperature.
- With seasonal changes, expect a 2.5% +/- in overall volume as an acceptable variance. Fuel delivered in cold weather may appear as gaining volume while fuel delivered in hot weather may lose volume.