UNHCR
The UN Refugee Agency

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Briefing note on water trucking in refugee settings

Water trucking can be a very quick method of providing a refugee population with access to life-saving quantities of safe drinking water. However, water trucking operations can be inefficient, expensive, time consuming to administer, hard to monitor and difficult to get out of once started. If a decision is made to start water trucking it must be carried out in a sanitary manner to ensure that water does not

Audience

This UNHCR technical guideline has been prepared for anyone involved in planning and implementing water trucking in refugee contexts including UNHCR staff, WASH organisations, water trucking contractors, governments and individuals. This guideline may also be of interest to non-technical staff (e.g. procurement staff that may be responsible for tendering water trucking services).

When and when not to truck water?

Water trucking is generally used when there is an urgent and immediate need for water that cannot be met in any other way. Scenarios when water trucking may be appropriate include:

i) When there is a large population movement and insufficient drinking water available locally.

ii) When there is damage or contamination of an existing drinking water system and an alternative water source is required while the source is repaired or treated.

iii) When the refugee population poses too great a burden on an existing water supply system and temporary supplemental water sources are required.

Water trucking should not be considered if there is an existing water service that can quickly be adapted or extended to meet the needs of the refugees.

Exit strategies

Water trucking is inefficient, expensive, and hard to monitor. All water trucking operations should be carried out with a frame of mind that they are a short-term, life-saving option of last resort to ensure a refugee population's emergency water requirements are met until more durable water solutions can be brought online. Water trucking should not be started unless there is a clear 'exit strategy' in place that plainly states both the date when the water trucking is expected to stop, and the parallel water supply activities that are required to ensure that water trucking can be stopped. Water trucking should never be carried out more than six months beyond the emergency period unless there is no alternative.

Safety and protection

All water trucking operations should be carried out in a way that prevents risk to refugees. UNHCR staff and WASH organisations must ensure that all beneficiaries, regardless of social status, are able to access the water that is provided, especially when water is in short supply. Water delivery points should be installed in places that are safe to access with full participation of all users, in particular women and girls. In some situations the water distribution points may require supervision to adequately organise and control crowds. In all scenarios, steps should be taken to understand why

sections of the population may be at risk and how the intervention may be adapted to reduce the risk.

Drinking water is an economic good and there is the possibility it can be misused for financial gain or other forms of exploitation. WASH organisations should ensure that water truck drivers and staff act professionally, honestly, and with due consideration of UNHCR's Staff Code of Conduct (in particular sexual abuse and exploitation).

To avoid risk of accident and loss of life, all water truck drivers must drive safely and below 10 km/hr when operating within populated areas. WASH organisations may choose to monitor the location and speeds of the water trucks engaged in their programs in real-time through the use of the UNHCR Android Water Truck Tracker App.

Implementation models

There are many ways that water trucking operations may be carried out. The decision to implement a particular model for water trucking should be based on the local context in addition to local availability and capacity of transport service providers. Options include:

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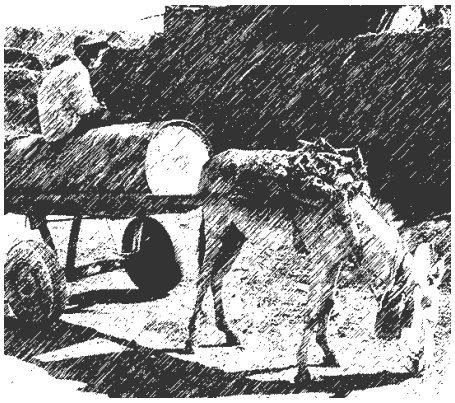
- **Direct implementation by UNHCR or WASH actor.** This may be the best option if there is no local government sector water trucking capacity, no existing private sector water trucking services, and/or private contractors are unwilling to operate in the target location.
- **Direct assistance support to local municipalities.** This may be the best solution where existing municipal water trucking services can be extended to meet the needs of refugees. Support to the municipality or local government service provider may include the provision of water trucks, fuel, spare parts, salaries, training or technical assistance.
- **Direct contracting of the private sector.** This is often the typical solution where there is a vibrant water trucking private sector. A tender is typically launched at the national or sub-national level and water haulage companies are awarded the contract based on the competitiveness of their unit rates (price per m^3) and their reputation. The advantages of this approach are economies of scale and lower transaction costs. The disadvantages are that local small-scale water vendors (e.g. with one or two trucks, or animal pulled carts) may not have the capacity or scale to compete with national actors. A sample contract agreement can be found on wash.unhcr.org.
- **Indirect contracting of the private sector through the use of 'water vouchers' or as part of multi-purpose cash grants.** This is the ideal solution where there are existing private sector services available with sufficient capacity to absorb the additional demand for water delivery services. The advantage of this approach is that it can be implemented quickly with benefits to existing local small scale service providers and the local economy. A disadvantage of this approach is that vouchers, or multi-purpose cash, may be used or exchanged for services other than water. In addition the use of vouchers requires good analysis of the local tankered water markets otherwise there is a risk the water voucher scheme may drive up prices for refugees and local residents.



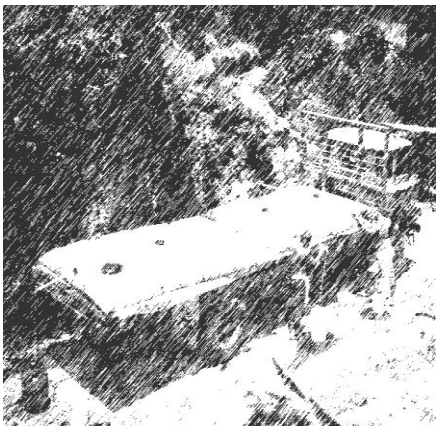
- **Water trucking as a livelihood project.** WASH organisations may be restricted by their donor's procurement rules to competitively tender water trucking services which risks undermining local small-scale water vendors. One way to ensure the water trucking operations do not undermine local actors is to set up the activity as a livelihood project directly building the capacity of small-scale water vendors or vendor cooperatives. It may even be possible to provide resources so the refugees can take charge of delivery of their own services.

Vehicle inspection and approval

All water hauling vehicles should be inspected and approved at the start of the water trucking operation to ensure they are suitable for transporting drinking water in a safe, legal and sanitary manner. The inspection should look at:

i) The type of vehicle and whether it is suitable for hauling water.
ii) The condition of the vehicle and whether it is road worthy.
iii) The condition of the water reservoir and whether it is sufficiently sanitary for storing of potable drinking water.
iv) The tanker, driver, and company's paperwork to check they have the correct legal registrations, permits, insurance and operating licenses to haul drinking water.

A sample water tanker inspection checklist and certificate of acceptability can be found on wash.unhcr.org.



What types of tanker are acceptable?

Water tankers that have been specifically designed for the function of transporting water will be significantly more stable, safe, reliable and economical than temporary water tankers made from standard vehicles with portable water storage tanks attached. Other options for tankering water include:

- Milk trucks, trucks used by breweries or drink factories
- Military water trucks
- Flat-bed trucks fitted with reservoirs
- Tractor pulled trailers
- Animal pulled trailers

All trucks that have been used for hauling substances other than potable drinking water should be carefully evaluated on an individual basis. Tankers that have been used to transport fuel, chemicals, or sewage should be avoided.

Truck road worthiness

The success of the water trucking operation is often highly dependent on the road worthiness of the vehicles that are engaged in trucking. Water is a heavy material and water trucking can put excessive strain on the truck's engine, superstructure, brakes, wheel bearings and tyres. At a minimum, all water trucks that are used in water trucking operations should have an up to date Ministry of Transport technical inspection certificate and should legally be permitted to drive on the road. In addition all vehicles should have valid accident and third-party liability insurance and the driver should hold valid credentials to drive the type of vehicle.

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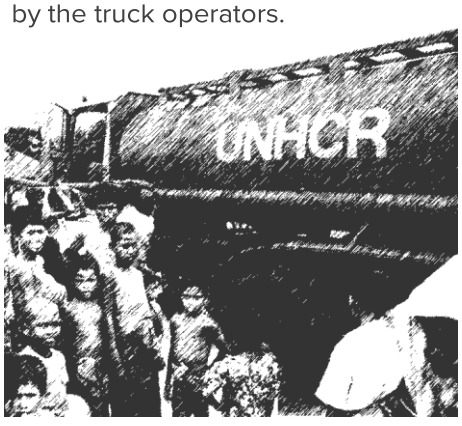
Tanker water reservoir condition

It is not just the vehicle but also the reservoir used to transport potable water that should be in good condition. Ideally the water reservoir material or liner should meet national standards for food grade contact material that is non-corrodible (e.g. stainless steel, fiberglass, plastic, or an approved epoxy liner). The interior of the water reservoir should be spotlessly clean, free from rust, mould, scum and sediment. Similarly hoses, nozzles and other equipment used in the transport and delivery of water should also ideally be constructed of food grade materials and should be spotlessly clean. Water tankers used for bulk drinking water transportation should not be used for any other purpose (i.e. hauling non-potable water) and should ideally be painted blue and permanently labelled with the words 'DRINKING WATER ONLY'.

Legal paperwork and permits

In countries where drinking water hauling vehicles require Government authorization, the haulage company should ensure that the water tanker has the correct permits to legally transport drinking water.

All tankers should have adequate insurance that ensures that the truck, water pumps, materials, tools and equipment are fully insured from any possible accidents, theft and third party liabilities including damage of property, accidental injury, or loss of life, to employees or passers-by. Any contracts should ensure that all liabilities are borne by the truck operators.



Water quantity

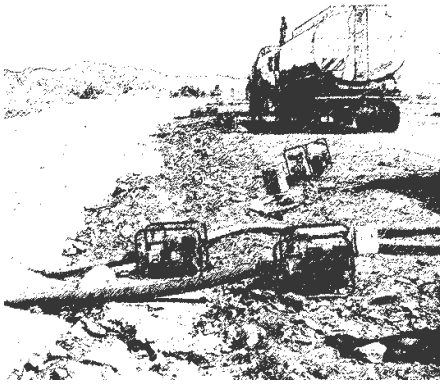
The human body's basic survival drinking water requirement lies in the range of 3-7 litres / person / day, depending upon the climate, workload and other environmental factors. Taking into account the need for additional water for cooking and basic personal hygiene, it is essential that UNHCR and WASH actors provide the UNHCR emergency standard of at least 15 litres / person / day. If there are no alternative water sources then this quantity of water must be transported by truck. It is also important that the refugee population fully understand that trucked water is extremely expensive and should not be wasted. If the refugees require additional water for activities such as brick making, agriculture, or animals, it may be cheaper to find alternative water solutions rather than use potable tankered water.

Sources of water

All water to be trucked to refugees must be fit for human consumption and should ideally be obtained from a local government monitored municipal supply, or a water source that has been approved by UNHCR. All water sources should be accessible at all times including during the rainy season. All water sources used for trucking should be routinely tested for bacteriological and chemical contaminants as part of the ongoing water quality surveillance initiatives.

Water chlorination

Chlorine should be added to the water being transported to prevent the build-up of organic matter within the storage reservoir and ensure protection of the water up to the point of consumption. A sufficient amount of chlorine should be added to the water during filling to achieve a free chlorine residual of 1.0 mg/l during the process of transportation and delivery. This is regardless of whether the water has already been chlorinated. The free chlorine residual at the point of delivery should be confirmed by independent routine testing. The driver should also be equipped with a chlorine pool tester and should note the delivery free chlorine residual level in delivery logbook.



Safe loading and handling of water

At all times the water truck and associated equipment must be operated and maintained in a sanitary manner to ensure that water does not become contaminated. Appropriate measures to protect the water and its source, the storage tank, and all equipment from contamination during loading, storage, transportation and delivery include:

- **Hoses** should be stored in a sealed container during transport to protect them from being contaminated. If possible, hoses should be prevented from entering the water source, the truck's water reservoir, or the delivery water reservoir. When not in use hoses should be stored off the ground and should be capped. They should not be allowed to come in contact with the ground during loading and offloading. Before and after each use they should be flushed with the source water.
- **Hose nozzles** should be cleaned and sanitized daily using a 100 mg/l chlorine bleach solution.
- **Backflow prevention.** To prevent contamination of the water source by loading and offloading through an air-gap.
- **Sanitary inspections** should be conducted at the start of the programme to ensure access hatch seals are in good repair and are providing a proper sanitary seal.
- **Emergency disinfection** should take place following a contamination incident (e.g.: hose falling on the ground). See box 15.1 on the following page for the procedure.

Water quality monitoring

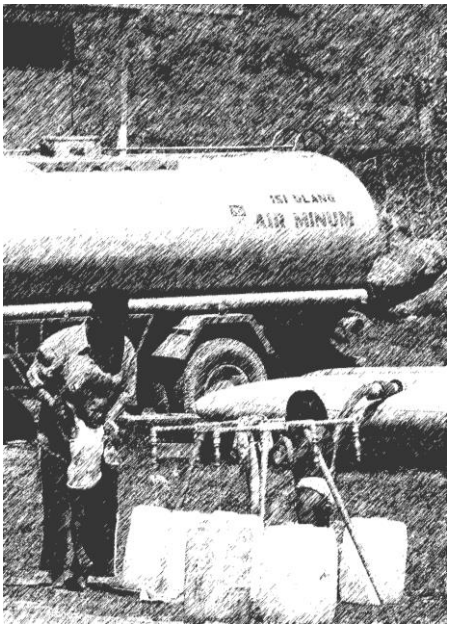
The water from water hauling vehicles should be tested at regular intervals to ensure they are being maintained in sanitary condition. At a minimum, samples of drinking water from the water tanker reservoir should be submitted for bacteriological testing, chlorine residual, turbidity and pH on a monthly basis. More guidance for water tanker operations is covered on page 96 of the World Health Organization publication Guidelines for Drinking Water Quality (4th Ed).

Water Safety Plans are considered by the WHO as the most effective means of maintaining a safe supply of drinking water in all settings including refugee locations. Water Safety Plans are produced by mapping the water supply process, identifying hazards, risks, mitigative actions, and monitoring activities at every step in the 'water chain' from catchment to consumer. An example Water Safety Plan for a water trucking operation can be found on wash.unhcr.org.

Sanitary surveys can be used as a risk assessment tool during part of the Water Safety Plan process. An example sanitary survey form for water trucking operations can be found on page 162 of the WHO publication Guidelines for Drinking Water Quality (2nd Ed – Volume 3 – Surveillance and Control of Community Supplies). WHO recommends that sanitary surveying of every truck is undertaken at the start of operations and then annually.

Tanker cleaning and shock disinfection

Periodic cleaning and shock chlorination of the tanker's water reservoir is essential if the truck is being used for the first time, or emergency disinfection is required due to contamination. Following this the water reservoir should be shock chlorinated every month. The procedure for cleaning and disinfection can be found in box 15.1 below. During disinfection the tank, and all hoses, pumps and storage equipment should be filled overnight with water containing at least 50ppm of chlorine for 12 hours. If HTH is being used this requires a dose of 80g of HTH per 1,000 litres.



Tank Capacity	HTH
5,000 litres	400g
10,000 litres	800g
15,000 litres	1.2kg
20,000 litres	1.6kg
25,000 litres	2.0kg

Table 15.1 Quantity of HTH required to achieve a chlorine dose of 50ppm for 12 hours

Box 15.1 UNHCR Cleaning and shock disinfection procedure for water tankers

Shock chlorination of the water hauling tank, hoses, pump and storage equipment is recommended on a monthly basis, if the water tanker is being used for the first time, or the water tanker and equipment needs to be decontaminated. The procedure is as follows:

1. Completely drain the water reservoir.
2. Scrub the interior of the water container with soap (e.g. household washing powder) and warm water using a stiff brush or high pressure hose (if available). All rust, sediment, biofilm and scum should be removed. Hoses and pumps should also be filled with soap and warm water.
3. Flush the tank, hoses and pump with clean water to remove all traces of soap.
4. Fill the tank to at least half of its total capacity with potable water.
5. Add sufficient chlorine (HTH) to the tank to achieve a dosage of 50ppm when the tank is full (see table 15.1 above for dosage). The HTH should be mixed into a bucket of water before adding to the main tank.
6. Fill the water tank to its maximum capacity with potable water and close the lid.
7. Disinfect hoses and pumping equipment by running chlorinated water through them & closing the valves.
8. Leave the chlorinated water in the tank and in the associated hoses and pumping equipment overnight for a minimum of 12 hours to allow adequate contact time for disinfection.
9. After disinfection, drain the chlorinated water from the tank and associated piping and equipment, and thoroughly rinse the system with drinking water.
10. Dispose of the heavily chlorinated water into a drain and rinse water appropriately. Chlorinated water should never be disposed in rivers or ponds as the high chlorine levels are likely to kill fish and plant life.

Health and Safety

Chlorine is an extremely dangerous and corrosive substance. Ensure that all staff performing this procedure are wearing personal protective equipment (gloves, apron, boots, eye protection) and the location is well ventilated. Extreme care should be taken if staff are required to enter the water reservoir at the cleaning / scrubbing stage. Steps should be taken to reduce the risks of slipping, falling, drowning and asphyxiation. If staff are working inside the reservoir make sure that someone remains at the opening at all times.

Schedule of deliveries and dispatching

Water trucking is expensive and open to exploitation and fraud, therefore all water trucking operations should be organised around a fixed Schedule of Deliveries agreed by all parties. If water delivery is being contracted then the Schedule of Deliveries should form part of the contract documentation and the company should only be paid for deliveries that are made in accordance with the water sources, the required quantities, and the list of approved delivery locations as per the Schedule of Deliveries. Any updates or changes to the daily Schedule of Deliveries should be approved by both the WASH organisation and haulage company and should be annexed to the contractual documentation.

Once a daily schedule of deliveries has been defined the dispatch plan for each vehicle can be calculated taking into account distances between filling stations, delivery locations, road-conditions, quantities to be hauled, volumes of haulage vehicles, maximum speeds when loaded, maximum speeds when empty, and waiting times for filling and offloading.

Hours of delivery and uninterrupted services

WASH organisations should try to ensure that there is a predictable uninterrupted service of water trucking every day for example between the hours of 06:00 to 12:30 and 14:00 to 17:30. If the water delivery is being contracted then hours of delivery should be written into the contract. The water haulage company should inform the WASH organisation immediately if there are events or unforeseen circumstances that may lead to a break in daily provision. All efforts must be made to provide a continuous daily service.

If water is being delivered by a contractor the agreement should be structured so there is no incentive for the company to deliver more water one day and less another day. If they do not deliver the agreed quantities to the agreed sites as per the daily schedule of deliveries they do not get paid.

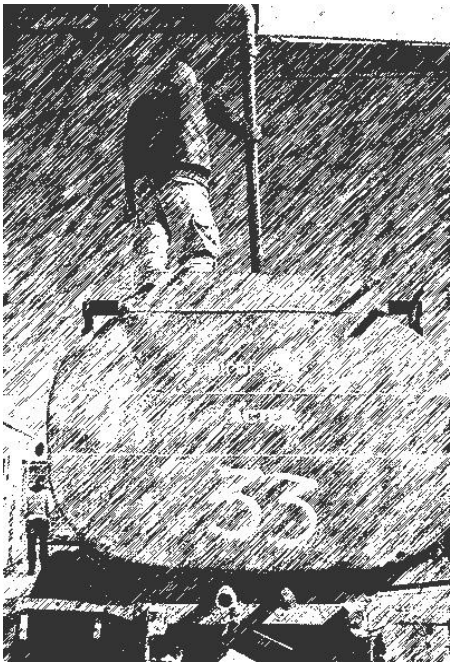
Vehicle maintenance and fuel supplies

Once water trucking starts, the vehicles will need to be kept in good condition. Even if brand new vehicles are used then time must still be allocated for maintenance and repairs. All vehicles will need to change fuel, air and oil filters on a regular basis and large operations may require dedicated workshop facilities and maintenance staff. Fast wearing spare parts should be procured in advance and stock levels should be closely monitored to prevent stock rupture. In remote locations it may be difficult to find qualified and experienced maintenance staff.

Water trucking operations can consume large quantities of fuel and dedicated storage facilities and logistics may be required if local supplies of fuel are unreliable. Fuel storage levels should be closely monitored to prevent stock outs. Vehicle fuel consumption should be carefully tracked to reduce fraud.

Contingencies and back-up capacity

Water trucking operations should be arranged so that at all times there is at least one available back-up water truck (or 1 truck for every 20 in larger water trucking operations – whichever number is higher) available for immediate replacement to cover break-downs or periods when the trucks are off-site for maintenance or repairs. If water is being delivered by a water haulage company this should be written into the contract.



Filling stations

Loading of water should take place as quickly and efficiently as possible. Water tanker hire is expensive and the best way to speed up loading is through the use of filling stations that have been designed so that the tanker arrives, quickly fills through a large overhead pipe (commonly called a 'giraffe') and departs for delivery. Queuing of water tankers at a filling station is an indication that the water trucking operation is poorly designed. Filling stations may be improved by adding additional filling points, increasing the diameter of the filling pipes, adding additional elevated storage at the filling station to 'buffer' supply and demand, or by installing booster pumps. It should not take more than 20 minutes to fill a large tanker.

Water delivery / storage

Water storage reservoirs such as demountable tanks, PE roto tanks, bladder tanks or onion tanks should be installed as soon as possible. The water tankers themselves should be used to transport water and NOT as a static distribution point, unless there is no other option. Tanker hire is expensive and the most efficient operations require that the tanker arrives, quickly offloads and returns back to the water source to undertake another round of deliveries. Options for emergency water storage include:

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- **Demountable tanks** (Oxfam tanks) are used extensively in emergency refugee settings and consist of a kit of curved corrugated steel panels that are bolted together with an inner rubber liner. The tanks come in various sizes including 11m^3, 45m^3, 70m^3 and 95m^3. Assembly can take anything from several hours to half a day depending upon the size of the tank and experience of the assembly crew.
- **Polyethylene tanks** are locally manufactured in almost every country in the world and are used extensively in emergency settings. PE tanks come in various sizes typically up to 20m^3. The advantages of PE tanks are that they are cheap, lights, durable, require no assembly, and can be used for both emergency and post-emergency water storage.
- **Bladder tanks** are very easy to transport and install and come in various sizes including 2.5m3, 5m3, 10m3 and 20m3. To ensure sufficient pressure head for distribution the bladders should be placed at least 80cm higher than the tapstand on higher ground or a platform. Platforms can be made of various materials but should be strong enough to support the weight (up to 20 tonnes). Platform options include:
  i) Earth mounds
  ii) Backfilled earth platforms
  iii) Sandbag platforms
  iv) Masonry platforms
  v) Wooden platforms
  vi) Oil drum platforms

Care must be taken on ground that is sloped to ensure the platform is perfectly flat and the bladder is secured. The site should be free of sharp objects that could puncture the material. Smaller bladders can be installed on the back of flatbed or pickup trucks and used as temporary water tankers. The main disadvantage of bladders is their need for a raised platform, and the fact they are difficult to clean.

Monitoring

All water trucking programmes need close monitoring. Water is an economic good and a way bill should be used every time it is transported. Way bills should be issued at the water filling station, handed over to the truck driver and signed by the refugee camp committee on arrival at the camp. In addition refugee water point monitors can be used to verify deliveries at water points and prepare weekly water delivery reports. The UNHCR Android Water Truck Tracker App may be downloaded and used to track every tanker journey in real time. Payment should not be made without justifying documents.

All bulk water hauling vehicles should keep a log book in the vehicle that keeps a record of:

i) Driver's name
ii) Date, time, mileage, location, and quantity of each water fill and each delivery.
iii) Quantity of chlorine added during the fill.
iv) Chlorine residual at delivery.
v) Any other observations, maintenance, or problems.

Further information

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