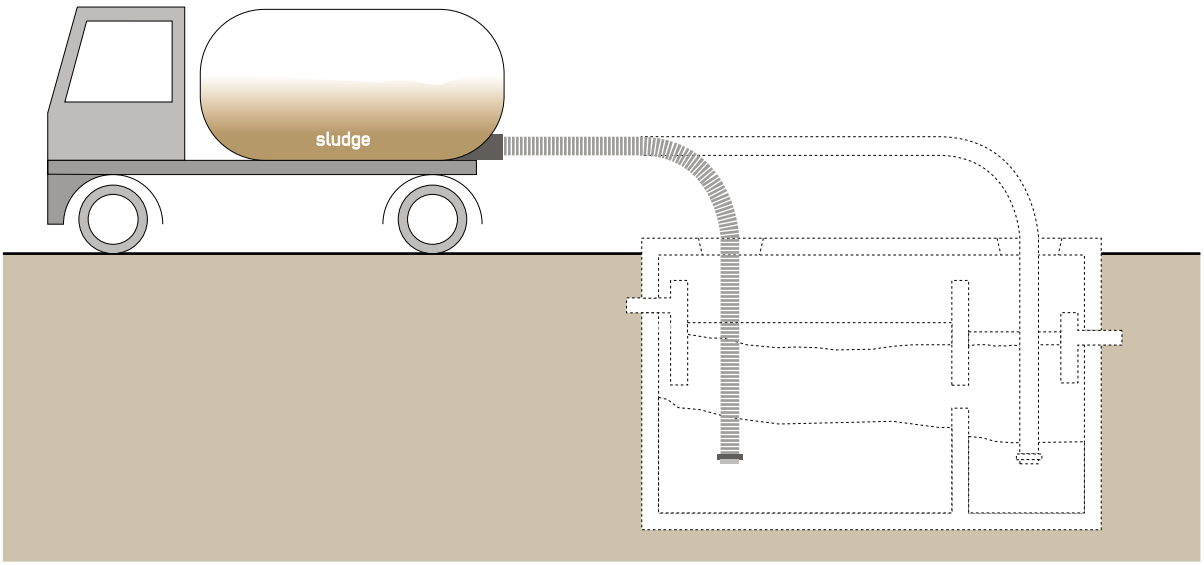
Motorised Emptying and Transport

Phase of Emergency	Application Level / Scale	Management Level	Objectives / Key Features
** Acute Response ** Stabilisation ** Recovery	** Household ** Neighbourhood * City	Household * Shared ** Public	Emptying and transport, Efficiency of emptying
Space Required	**Technical Complexity**	**Inputs / Outputs**	
** Medium	** Medium	● Sludge, ● Blackwater, ● Effluent, ● Urine, ● Stored Urine	



Motorised Emptying and Transport refers to a vehicle equipped with a motorised pump and storage tank for emptying and transporting faecal sludge, septage, wastewater and/or urine. Service technicians are required to operate the pump and the hose. The sludge is not manually lifted or transported.

A truck, or a tractor with a tank on a trailer, is fitted with a pump connected to a hose that is lowered into a tank **(e.g. S.13–S.15)** or pit **(e.g. S.1–S.4)**, and the sludge is pumped into the holding tank on the vehicle. This type is often referred to as a vacuum truck. Alternative motorised vehicles or machines have been developed for densely populated areas with limited access. Designs such as the Vacutug or ROM desludging units carry a small sludge tank and pump and can navigate narrow pathways.

Design Considerations: Generally, storage capacity of a vacuum truck is between 3 to 12 m^3. Local trucks are commonly adapted for sludge transport by equipping them with holding tanks and pumps. Modified pick-up trucks and tractor trailers can transport around 1.5 m^3, but capacities vary. Smaller vehicles for densely populated areas have capacities of between 500 to 800 L. These vehicles use, for example, two-wheeled tractor or motorcycle engines and can reach speeds of up to 12 km/h. Some are equipped with an integrated high-pressure pump for fluidising sludge. Pumps are usually effective to a depth of 2 to 3 m (depending on the strength of the pump) and must be located within 30 m of the pit. In general, the closer the vacuum pump is to the pit, the easier the pit is to empty.

Materials: The required materials – a vehicle, a tank and a pump – are usually available locally. Second-hand trucks are often used, which can reduce costs but often also reduce efficiency. Fuel is needed to operate the pump and the vehicle; a fuel shortage can be a limiting factor during an emergency.

Applicability: Motorised Emptying and Transport is possible in areas accessible to vehicles, and in all phases of an emergency. High faecal sludge density may hinder pumping. In such situations, it is necessary to fluidise the solids with jets of water to improve the flow. Solid waste and sand mixed with the sludge can clog the pipe or pump. To minimise costs, the treatment site must be reasonably accessible to the serviced areas. Greater distances result in greater costs per trip. Transfer Stations **(C.6)** may be necessary when using small-scale motorised equipment. The costs of conveyance must be balanced to be affordable for users and to sufficiently cover operating costs. Effectiveness may be reduced by travel speed, and the ability of vehicles to negotiate slopes, poor roads and narrow lanes. Both sanitation authorities and private entrepreneurs can operate vacuum trucks. The price and level of service may vary significantly. All operators should be properly incentivised to discharge sludge at a certified facility. Private and public service providers should work together to cover the whole faecal sludge management chain.

Operation and Maintenance: Most pump trucks are manufactured in North America, Asia or Europe. Thus, in some regions it is difficult to locate spare parts and a mechanic to repair broken pumps or trucks. New trucks are expensive and sometimes difficult to obtain. Therefore, older trucks are often used, but savings are offset by high maintenance and fuel costs that can account for more than two thirds of total costs incurred by a truck operator. Truck owners should set aside some funds for repair and maintenance. Regular vehicle maintenance can prevent the need for major repairs. Additionally, solid waste in the pits can damage the pumps. Chemical additives for desludging can corrode the sludge tank and are therefore not recommended.

Health and Safety: The use of a vacuum truck presents a significant health improvement over manual emptying. Service personnel, however, do still come into contact with faecal sludge and need to wear personal protective equipment. It is not uncommon for camps to become flooded which restricts access for emptying tanks; therefore, a backup or contingency plan should be in place to avoid serious health impacts.

Costs: Investing in a vacuum truck can be expensive, but also potentially lucrative for private entrepreneurs. The major operational cost is fuel. Fuel costs depend on the distance from the source to the discharge point or treatment facility. Operation and maintenance costs are usually included in the emptying fee that is paid by the customer (or responsible Government unit/humanitarian organisation) and directly impact the affordability of the service. Cost for spare parts may also be high and spare parts may not always be available in the local market.

Social Considerations: Truck operators can face difficulties such as not being well accepted in the community and finding appropriate locations to discharge the collected sludge. It is thus important to publicly recognise the importance of the sanitation transport service, and identify authorised discharge points (as well as prevent unauthorised discharges). If putting solid waste in the pits is a common practice it should be addressed as part of hygiene promotion or other awareness raising activities **(X.12)**, and through a proper solid waste management scheme **(X.8)**. If Motorised Emptying and Transport is considered as a longer-term solution without external assistance it should be kept in mind that hiring a vacuum truck may be unaffordable for poorer households.

Strengths and Weaknesses:

- ⊕ Fast, hygienic and generally effective sludge removal
- ⊕ Efficient transport possible with large vacuum trucks
- ⊕ Potential for local job creation and income generation
- ⊕ Provides an essential service to unsewered areas

- ⊖ Cannot pump thick, dried sludge (must be thinned with water or manually removed)
- ⊖ Cannot completely empty deep pits due to limited suction lift
- ⊖ Not all parts and materials may be locally available
- ⊖ May have difficulties with access

→ **References and further reading material for this technology can be found on page 193**