

**Application Level:**

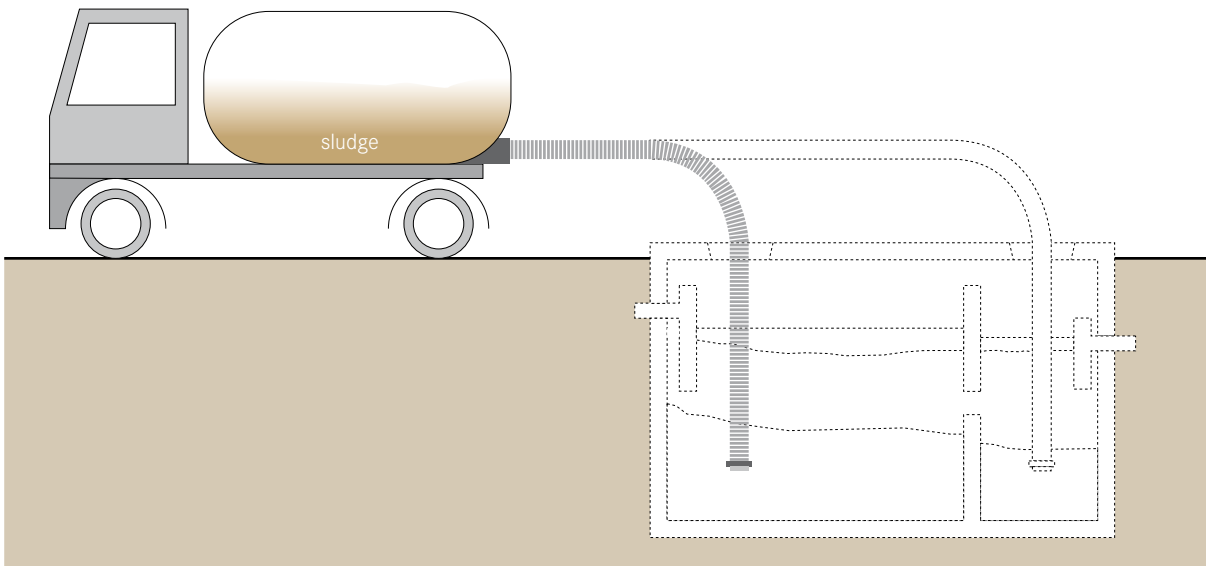
- ★★ Household
- ★★ Neighbourhood
- ★ City

**Management Level:**

- Household
- ★ Shared
- ★★ Public

**Inputs/Outputs:**

- Sludge
- Blackwater
- Effluent
- Urine
- Stored Urine



**Motorized emptying and transport** refers to a vehicle equipped with a motorized pump and a storage tank for emptying and transporting faecal sludge and urine. Humans are required to operate the pump and manoeuvre the hose, but sludge is not manually lifted or transported.

A truck is fitted with a pump which is connected to a hose that is lowered down into a tank (e.g., Septic Tank, S.9) or pit, and the sludge is pumped up into the holding tank on the vehicle. This type of design is often referred to as a vacuum truck.

Alternative motorized vehicles or machines have been developed for densely populated areas with limited access. Designs such as the Vacutug, Dung Beetle, Molsta or Kedoteng carry a small sludge tank and a pump and can negotiate narrow pathways.

**Design Considerations** Generally, the storage capacity of a vacuum truck is between 3 and 12 m<sup>3</sup>. Local trucks are commonly adapted for sludge transport by equipping them with holding tanks and pumps. Modified pick-ups and tractor trailers can transport around 1.5 m<sup>3</sup>, but capacities vary. Smaller vehicles for densely populat-

ed areas have capacities of 500 to 800 L. These vehicles use, for example, two-wheel tractor or motorcycle based drives and can reach speeds of up to 12 km/h. Pumps can usually only suck down 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 can be to the pit, the easier it is to empty.

**Appropriateness** Depending on the Collection and Storage technology, the sludge can be so dense that it cannot be easily pumped. In these situations it is necessary to thin the solids with water so that they flow more easily, but this may be inefficient and costly. Garbage and sand make emptying much more difficult and clog the pipe or pump. Multiple truckloads may be required for large Septic Tanks.

Although large vacuum trucks cannot access areas with narrow or non-driveable roads, they remain the norm for municipalities and sanitation authorities. These trucks can rarely make trips to remote areas (e.g., in the periphery of a city) since the income generated may not offset the cost of fuel and time. Therefore, the treatment site must be within reach from the serviced areas. Transfer Stations (C.7) and adequate treatment are also

crucial for service providers using small-scale motorized equipment. Field experiences have shown that the existing designs for dense urban areas are limited in terms of their emptying effectiveness and travel speed, and their ability to negotiate slopes, poor roads and very narrow lanes. Moreover, demand and market constraints have prevented them from becoming commercially viable. Under favourable circumstances, small vehicles like the Vacutug are able to recover the operating and maintenance costs. However, the capital costs are still too high to sustainably run a profitable business.

Both the sanitation authority and private entrepreneurs may operate vacuum trucks, although the price and level of service may vary significantly. Private operators may charge less than public ones, but may only afford to do so if they do not discharge the sludge at a certified facility. Private and municipal service providers should work together to cover the whole faecal sludge management chain.

**Health Aspects/Acceptance** The use of a vacuum truck presents a significant health improvement over manual emptying and helps to maintain the Collection and Storage technology. Still, truck operators are not always accepted by the community and may face difficulties with finding appropriate locations to dump the collected sludge.

**Operation & 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 very expensive and sometimes difficult to obtain. Therefore, older trucks are often used, but the savings are offset by the resulting high maintenance and fuel costs that can account for more than two thirds of the total costs incurred by a truck operator. Truck owners must be conscientious to save money for the purchase of expensive replacement parts, tires and equipment. The lack of preventive maintenance is often the cause for major repairs.

The addition of chemical additives for desludging is not recommended because they tend to corrode the sludge tank.

### Pros & Cons

- + 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)
- Garbage in pits may block hose
- Cannot completely empty deep pits due to limited suction lift
- Very high capital costs; variable operating costs depending on use and maintenance
- Hiring a vacuum truck may be unaffordable for poor households
- Not all parts and materials may be locally available
- May have difficulties with access

### References & Further Reading

- Boesch, A. and Schertenleib, R. (1985). *Pit Emptying on-Site Excreta Disposal Systems. Field Tests with Mechanized Equipment in Gaborone (Botswana)*. International Reference Centre for Waste Disposal, Dübendorf, CH.  
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(Comprehensive summary of technical components, performance with different sludge types, and maintenance)
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Available at: [www.susana.org/library](http://www.susana.org/library)  
(Includes a detailed analysis of field experiences with the Vacutug)
- Strande, L., Ronteltap, M. and Brdjanovic, D. (Eds.) (2014). *Faecal Sludge Management. Systems Approach for Implementation and Operation*. IWA Publishing, London, UK.  
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(Detailed book compiling the current state of knowledge on all aspects related to FSM)