LEARNING BRIEF

A guide to septage transfer stations

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While significant progress has been made in reducing open defecation and increasing access to sanitation facilities, which in the developing world are predominantly on-site and communal systems, this has not led to a healthier living environment in many dense urban settings. There is overwhelming evidence that the majority of faecal sludge ends up in the residential environments, drains and receiving waters, which presents both public and environmental health problems. It has been found that when distances from the emptied pit to a regulated disposal facility is greater than 500m, this often results in illegal dumping of sewage in creeks and rivers, since it is not possible for operators to travel the long distances and get enough trips done in a day to make it financially viable.

This learning brief presents highlights from the learning paper *'A guide to septage transfer stations'* providing salient aspects of selecting, designing, building, operating and maintaining a septage transfer station, as a response to the aforementioned problem. The research drew on available published literature, technical insights by the author and experiences of sector participants shared through an online discussion. Both the learning brief and learning paper were prepared by SNV Netherlands Development Organisation and the Institute for Sustainable Futures at the University of Technology Sydney, as part of their partnership for research and learning to improve urban sanitation sector knowledge and practice.

Advantages of transfer stations

- Reduces transport distance and time for transporting sludge to the treatment facility.
- May reduce the illegal dumping of faecal sludge.
- May reduce accidents and spillage.
- Moderate capital and operation costs.
- Latrine desludgers can receive a payment from the utility/operator per load delivered to the transfer station, thereby ensuring safe disposal of the septage.
- May encourage more community-level emptying solutions.
- Potential for local job creation and income generation.

Disadvantages of transfer stations

- Fixed stations require expert design, location and construction supervision.
- May cause blockages and disrupt sewer flow in the case of sewer discharge stations.
- The sludge still requires secondary treatment and/or appropriate disposal.
- Requires an institutional and regulatory framework for taking care of access fees, connection
- to sewers or regular emptying and maintenance.
- Can lead to bad odours and vermin if not properly maintained.
- May inconvenience a few locally for the benefit of the whole community.

Septage transfer stations are facilities for holding emptied septage at close proximity to densely populated areas, with the objective of creating a two-step process for handling the waste matter. Septage and/or faecal sludge can be safely offloaded at the transfer station by local operators (primary transport) and temporarily stored. When the holding tank is full a larger vacuum tanker transports it (secondary transport) to a regulated disposal site or wastewater treatment facility.

Why use a transfer station?

Localised transfer stations shorten the time required for local operators to collect and transport septage, and they can therefore do more trips in a day and will be able to use smaller vacuum tanks that can navigate the densely populated residential areas.

A transfer station allows septage to be brought to a local point near to the latrines that are being emptied, using a short haul vacuum tank or manual labour (primary transport). From this point it can be collected and transported to the eventual disposal site using a suitable long haul vehicle (secondary transport). If possible, separating the liquid from the sludge before carrying out long haul transport will increase efficiencies and reduce costs.

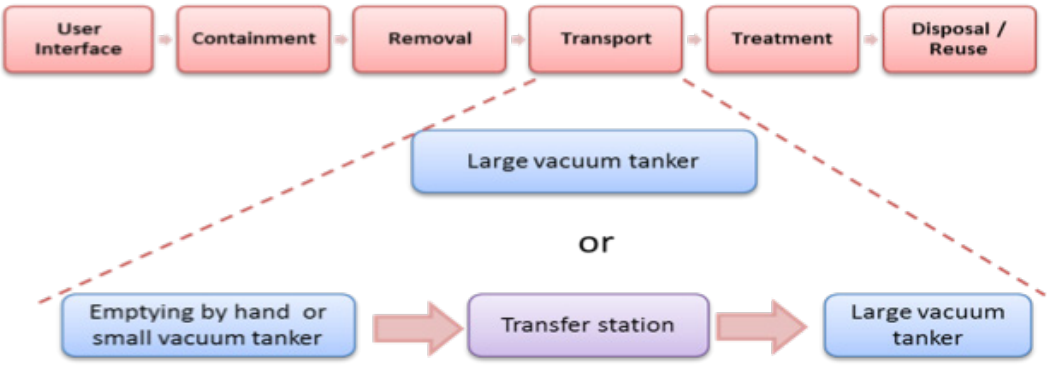

Figure 1. Sanitation service chain indicating a transfer station

What are the options?

In basic terms, a transfer station needs to provide a parking place for vacuum trucks or sludge carts, and, in the case of a fixed facility, connection points for discharge and extraction hoses, and a storage tank. However, the configuration of these elements could differ depending on local conditions and practices.

The following options are presented in this paper to provide a range of approaches that could be adopted, or key elements that could be used in other appropriate combinations:

- ***Mobile temporary transfer stations*** can be set up on temporary basis using easily transportable containers, while pits in the nearby area are being emptied. While cheaper than permanent facilities, the main advantage of these stations is that they sidestep the complex and often lengthy procedures and approvals required for siting permanent stations in high-density settlements. However, in densely populated informal settlements, securing the necessary space and access can be challenging.
- ***Simple permanent transfer stations*** consist of a water tight holding tank to contain the septage, a disposal point for hand disposal, an inlet pipe for coupling to a vacuum tanker, and an outlet pipe for coupling to a large vacuum tanker for carting away.

- ***Modular transfer stations*** avoid having to manually remove compacted sludge by hand, and when the tanker is full, it is replaced with an empty one, and the full one is transported for emptying at a legal dumping site.
- ***Sewer discharge stations*** are much the same as the simple transfer stations, but are directly connected to a conventional gravity sewer main so that the septage can be transported to a semi-centralised secondary treatment system out of peak sewage flow times.
- ***Solid-liquid separation transfer stations*** only allow the liquid to be discharged to the sewer, and the sludge is transported by tanker. This reduces the volume of sludge to be carted to the disposal site.
- ***Modular solid-liquid transfer stations*** are a variation on the solid-liquid separation transfer station, but use a detachable tanker instead of a submerged holding tank. The detachable tanker allows the excess liquid to be discharged via a small bore pipe to a nearby sewer.

The table at the end of this document provides a comparison of the main features of each transfer station option, as well as the key issues associated with each option.

It would seem from consultation with sanitation practitioners, that mobile transfer stations are the preferred option since they are viewed as less contentious by the local community, they are not viewed as a permanent solution locking out further improvements down the track, are better suited to very dense settlements, and allow a level of flexibility for the operator.

General considerations when planning a transfer station

The most important considerations when planning a transfer station are where to locate the transfer station and whether it will be mobile or fixed. The provisional use of mobile stations may assist in optimising the operations by evaluating the suitability of potential locations over a period of time without committing to the construction of a fixed station.

The following sub-sections set out the planning and design considerations for temporary and fixed transfer stations, where applicable.

Siting a transfer station

Regardless of whether the transfer station is permanent or mobile, the siting of the transfer station requires careful planning.

Geographic location

The general location of the transfer station must comply with any relevant municipal regulations and should be located in an optimal location which depends on balancing three key factors:

- Minimising the time taken to transport the septage from the latrines to the transfer station;
- Maximising the coverage area to meet the demand generated by sludge collection using small-scale equipment (primary transport);
- The optimum size of the transfer station holding tank to match the collection volumes, based on the:
  - frequency that the holding tank will be emptied;
  - holding capacity of the larger secondary transport vehicles; and
  - distance that the larger will need to travel and the number of trips they will need to make in a day.

Figure 2. Geographic location

Access and spatial requirements
The physical location of the transfer station needs to meet a number of requirements:

- Easy access for both primary and secondary transport vehicles – this can be challenging to find in densely populated areas.
- Parking areas for both small discharging vacuum vehicles and carts, as well as large vacuum trucks that will be emptying the holding tank.

Community engagement
It is not uncommon for residents to reject the siting of a transfer station near to their homes. Community consultation prior to the location and construction of any transfer station is vital to ensure the success of the facility and sanitation approach. To overcome the resistance to a permanent facility, a mobile transfer station could be deployed that would minimise the constant inconvenience experienced by those living near to the facility.

Design considerations for fixed options

Fixed holding tanks can take various forms, from large plastic containers to more expensive concrete chambers, and can be located above or below ground. The structural components of a fixed facility must comply with all relevant municipal building codes. A number of key technical considerations for a holding tank are presented.

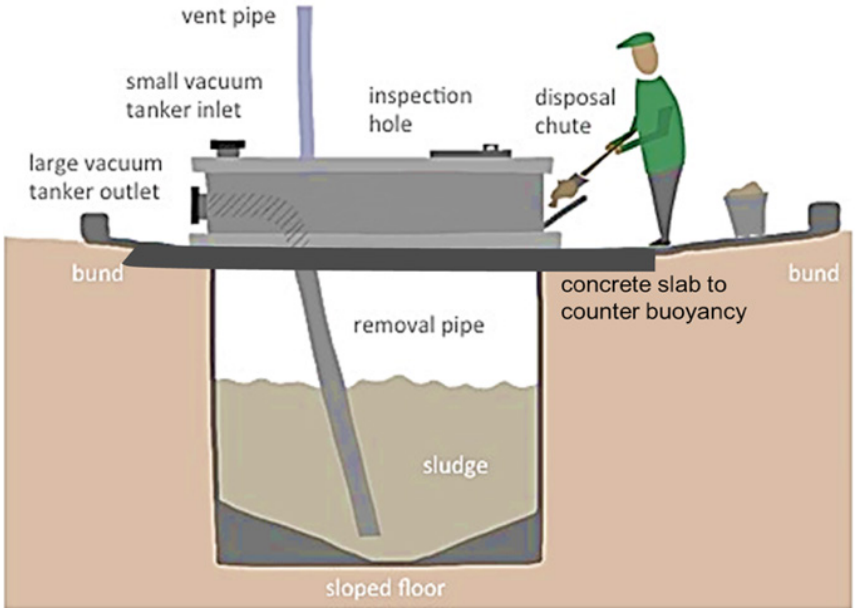

Figure 3. A simple transfer station (modified from SSWM 2014)

Structural arrangements for storage

- Size the volume of the holding tank must match the emptying regime and the number of houses that it is servicing, together with the fill-up rate of their pit latrines (which is a function of the average number of people per house, their diet and whether the pit is sealed or allows dewatering of the septage). This should be considered in conjunction with the rate at which the large vacuum trucks can empty the transfer stations – which is a function of the number of large vacuum tanks in operation, their sizes, and the distances they have to travel.
- Ensure the holding tank is well constructed and water-tight to prevent leaching and groundwater infiltration.
- Counter buoyancy forces by anchoring the tank down with cables or with a heavy concrete slab, especially where the underground tank is located in a high water-table and there is a risk of upliftment due to groundwater pressure.
- Slope the floor of the holding tank to allow the septage to drain to one point to ensure all the septage can be vacuumed up.
- Fit the holding tank with a simple level gauge to alert the operator when the tank needs emptying.

- Erect a vent pipe at least 9 metres high to discharge and disperse any foul air above the roofs of surrounding buildings, and fit the end with a fly-screen.
- Fit the roof of the holding tank with a lockable inspection hole to allow inspection of the inside of the holding tank, and to insert water hoses for loosening any sludge if it becomes too compacted to vacuum pump out.

Discharge access to the storage tank

- Provide a connection point for discharge hoses which are easily accessible by a small vacuum tanker.
- Build the disposal chute for hand delivered septage low enough to minimize spills when labourers are manually emptying their sludge carts. It should be lockable when not in use (to avoid garbage being thrown in when unattended).
- Install a screen/grate on the disposal chute to restrict the disposal of large items of garbage into the holding tank, and also to avoid anyone falling in. Designated containers should be provided to hold the screened garbage.
- Contain any accidental spills that might occur using a bund around the whole facility, and channel any spillage and wash-down water via a drain into the holding tank.

Emptying the storage tank

- Provide an easily accessible connection point for a large vacuum tanker.
- Locate the removal pipe just above the deepest point of the holding tank and ensure it is long enough to allow the sludge on the holding tank floor to be sucked up.
- The sludge from transfer stations must be transported to and treated in an appropriate secondary treatment facility (e.g. in sludge drying beds, anaerobic digestion or large scale composting) and not illegally dumped.
- If the transfer station discharges to a nearby sewer main, the discharge pipe should be fitted with a non-return foot valve (or check-valve) to avoid sewage from the sewer entering the holding tank during high flows or blockages downstream in the sewer.

Security and safety

- Erect appropriate signage about safety for both the public and the operators.
- Erect temporary barriers to ensure the safety of the public moving in the vicinity of mobile transfer stations.
- Restrict general access to fixed transfer stations by fencing in the facility and regulating who has access.
- Provide facilities for operations staff to wash their hands and to wash down any spills around the facility. Water for washing should be provided either from the water mains, or supplied by container.

Operation and maintenance considerations

The roles and responsibilities of the public and private institutions charged with the operation and maintenance of the facility must be clearly outlined. These include the security of the facility from vandalism and illegal use, controlling access, maintaining the functionality of the facility and ensuring that the facility is maintained in an hygienic state. To avoid indiscriminate dumping of toxic waste in the facility, only registered emptying contractors should be permitted to use the facilities.

Regular maintenance activities would include:

- Cleaning of garbage screens to ensure a constant flow and prevent blockages, flies and odours.
- The screenings should be stored in proper containers and transported to a designated landfill.
- Washing down and cleaning of the discharge chute.
- Cleaning of the general loading area to minimise odours, flies and other vectors from becoming public nuisances.

Compacted sludge

In many cases, the sludge in the holding tank can become dense and compacted while being stored, making removal by vacuum pump difficult. In these instances a high pressure water hose can be used to loosen the sludge to make it fluid again.

		Mobile temporary transfer station	Simple transfer station	Modular transfer station
Main features	Siting	Temporarily above ground	Below ground	Above ground
	Constructa-bility	None	Easy	Moderate • Split levels and retaining walls
	Sewer connection	Not necessary Could discharge liquid	No	No
	Security	Barriers to secure site	Lockable	Lockable and fencing
Operation	Septage discharge	By hand and small vacuum tanker	By hand and small vacuum tanker	By hand and small vacuum tanker
	Septage/ sludge removal	Septage/sludge towed away in a large (detachable) tanker or alternative container	Septage pumped out and removed by a large vacuum tanker	Septage towed away in a large detachable tanker or alternative container
Maintenance	Daily	Basic washing and cleaning	Basic washing and cleaning	Basic washing and cleaning
	Monthly		Remove compacted sludge by liquid agitation and vacuum pumping	
	As required	Mechanical maintenance of tanker and motorised vehicle		Mechanical maintenance of tanker and motorised vehicle

Table 1. Technical comparison of transfer station options

Concluding reflections

Septage transfer stations can play a vital role in facilitating safe faecal sludge management in dense urban areas where tank desludging can be undertaken only by small vacuum tugs or manually due to narrow or inaccessible roads and lanes. They offer an appropriate disposal site in close proximity to

Sewer discharge station	Sewer discharge station	Modular solid-liquid separation transfer station
Below ground	Below ground	Above ground
Moderate • Connection to sewer main	Moderate • Connection to sewer main • Holding tank requires separation baffles	Moderate • Split levels and retaining walls • Connection to sewer main
Yes Discharge of septage	Yes Discharge of liquid	Yes Discharge of liquid
Lockable	Lockable	Lockable and fencing
By hand and small vacuum tanker	By hand and small vacuum tanker	By hand and small vacuum tanker
Septage released to sewer	• Liquid released to sewer • Sludge pumped out and removed by a large vacuum tanker	• Liquid released to sewer • Sludge towed away in a large detachable tanker and alternative container
Basic washing and cleaning	Basic washing and cleaning	Basic washing and cleaning
• Remove compacted sludge • Remove any sewer blockages	Remove compacted sludge by liquid agitation and vacuum pumping	
Replace the non-return valve at regular intervals	Replace the non-retun valve at regular intervals	Replace the non-retun valve at regular intervals

where emptying takes place and removes the perverse incentives for illegal disposal when regulated disposal sites are located far out of town. Although the concept of septage transfer stations is simple, implementation can be complex as there are many issues that need careful consideration for success.

Besides technical issues, both social issues and management issues need careful consideration if the approach is to prove successful. Practice to date has shown that installing transfer stations can be challenging, based on their social acceptability in local urban contexts. This said, they remain an important element in solving the widespread urban sanitation crisis facing so many cities today.

Under **NO** circumstances should manual labour be permitted inside of the holding tank where there may be deadly gases present.

About us

SNV Netherlands Development Organisation

SNV Netherlands Development Organisation (SNV) is a not-for-profit international development organisation with a long-term, local presence in over 30 countries in Asia, Africa and Latin America. SNV's global team of local and international advisors works with local partners to equip communities, businesses and organisations with the tools, knowledge and connections they need to increase their incomes and gain access to basic services – empowering them to break the cycle of poverty and guide their own development.

SNV's Urban Sanitation & Hygiene for Health and Development (USHHD) programme works with municipal governments to develop safe, sustainable city-wide services. The programme integrates insights in WASH governance, investment and finance, behavioural change communication and management of the sanitation service chain. We engage private sector, civil society organisations, users and local authorities to improve public health and development opportunities in their city.

As part of our USHHD programme, we have a long term partnership with the Institute for Sustainable Futures, University of Technology Sydney (ISF-UTS) focused on research and learning to improve practice and contribute to the WASH sector knowledge and evidence.

For further information please visit: www.snv.org

Institute for Sustainable Futures, University of Technology Sydney

The Institute for Sustainable Futures at the University of Technology Sydney (ISF-UTS) works with industry, government and the community to develop sustainable futures through research and consultancy. ISF-UTS seeks to adopt an inter-disciplinary approach to its work and engage partner organisations in a collaborative process emphasizing strategic decision-making.

For further information please visit: www.isf.uts.edu.au

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This learning brief draws on the following learning paper:

Mukheibir P. (2015), Learning paper: *A guide to septage transfer stations.* Prepared for SNV Netherlands Development Organisation by Institute for Sustainable Futures, University of Technology Sydney. Available online at www.snv.org/explore-more and www.uts.edu.au.

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