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PROCEEDINGS

OF THE

ROUND TABLE MEETING

ON

MANUAL PIT EMPTYING

GOUDA

7 - 9 DECEMBER 1988

MANUAL PIT LATRINE EMPTYING TECHNOLOGY (MAPET) PROJECT

PROGRESS REPORT NO 3

place:

WASTE CONSULANTS, Crabethstraat 38F, Gouda, The Netherlands.

participants:

(KM) Kundaeli Mfwangavo (sewerage division DSSD),
(JM) Jasper Kirango Mwanga (low-cost sanitation division DSSD),
(PH) Peter Hawkins (low-cost sanitation division DSSD),
(RS) Roland Schertenleib (IRCWD),
(MC) Manus Coffey (MCA),
(JR) Jaap Rijnsburger (teamleader WASTE),
(JU) Jan van Uden (technician WASTE),
(HC) Heleen Claringbould (sociologist WASTE).

programme:

Wednesday 7th December: organizational and management aspects

1. The place of manual pit emptying in the overall urban sanitation management (disposal in sewers, substations, transport to sewage treatment, treatment).
2. Manual pit emptying: when private, when DSSD.
3. The conditions under which burying in the yard is acceptable, when will transportation out of the area have to be introduced.
4. Who is to decide on burial or transport, how is this to be influenced:
   - through renters/houseowners (information, legislation),
   - through private emptyers (legislation, licencing),
   - through DSSD (provision of services).
5. Licencing private latrine emptyers: which conditions should be put onto them and will licencing be an effective instrument.
6. State of the art DSSD in relation to the Dar es Salaam Sewerage and Sanitation Project.
7. International documentation and experience on small scale and manual pit emptying.
8. Funding and funding parties.

Thursday 8th December: technical and infrastructural aspects

1. The establishment of substations in the unplanned areas near a trunk road, where the pit contents can be disposed off temporarily for later collection, in order to cut down on the volume/driving-distance ratio.
2. The operating conditions and design demands for substations.
3. The type of vehicles to be used for haulage.
4. The conditions under which sewers for can be used for disposal of pit contents.
5. Methods for fluidization of pit contents.
6. The costing of sanitation equipment.
7. Ideas and suggestions for an international seminar on low cost sanitation and pit emptying in unplanned (peri)urban areas, to be held in Dar es Salaam end of 1989, beginning 1990.

Friday 9th December: demonstration manual pit emptying equipment

The proceedings have been summarized under the most appropriate headings, which only roughly correspond with the headings of the programme.

contents

1. Manual pit emptying and urban sanitation

Manual pit latrine emptying in Tanzania is generally seen as awkward and very dirty. Some people who already work in the sanitation environment (DSSD, City Cleansing) are used to the work and willing to do it privately as well. Private pit emptying is not organized. The private emptyers often empty in the same neighbourhood they live in, where they are known with customers. When hired by DSSD or City Cleansing they work all over town.

There is no official link between DSSD and private emptyers. When upgrading latrines DSSD sometimes pays the owner of the latrine to bargain for an emptyer, when the sludge is too thick for the tanker, or when the vacuum tankers are too strong and can demolish the pit lining.

Summary of relationships between manual emptying and the City Council Departments:
- some private emptyers are (former) employees of City Cleansing or DSSD,
- when upgrading latrines (low cost sanitation programme) DSSD sometimes contracts private emptyers,
- City Cleansing employees sometimes empty manually when desludging septic tanks.

Illegal connections to the sewerage system (Kariakoo) or stormwater sewers do exist for waste water but pit latrines are never connected in this way. There are no reports of private emptyers disposing sludge illegally. It might occur is in creeks, near locations where the groundwater table is too high for burial (pit latrines have a built up superstructure in those cases). Illegal disposal in ditches apparently is only practised by vacuum tankers.

Based on a tariff study the Ministry of Water (MAJI) decided to double the prices of latrine emptying nationally to Tsh 1,200 per tanker load. This new fee is accepted by the City Council. DSSD still charges Tsh 600, trying to keep the cost for the public low. The improved capability of the DSSD vacuum tankers (pumping solids upto 30 meters from the vehicle) is not well known by the public. They say to have more confidence in the traditional emptyers, who empty both liquids and sludge (burial in the yard).

Manual emptyers charge Tsh 4,000 to 6,000 for a service that may take 6 days. People choose for manual emptying because it is reliable, they take the nuisance for granted. People also stick to what they are used to. Ignorance about City Council services and charges might play a role. Advertising of the rehabilitated services has not yet taken place because of political sensibilities. Promotion however is essential, the whole (future) package has to be advertised by DSSD.

In Dar es Salaam pit emptying is a political issue for 3 reasons:
- the lack of facilities which is considered to be a major problem,
- the problematic transfer of vacuum tankers to the newly established DSSD,
- the private exploitation of City Council tankers.

2. Pit construction and emptying

Since 1972 there is no more demolition of unplanned settlements in Dar es Salaam. Donors funded the improvement of existing neighbourhoods and the Government started site and service schemes. Now these projects stopped, the unplanned areas are getting dense because of the population growth and rural-urban migration. The densification has taken place in all areas up to Port Access Road. The unplanned areas have no sewage and little piped water. Water is many times bought from tankers. For defeacation the majority has a pit latrine on the compound.

Pit latrines that cannot be serviced by the City Council Tankers are always emptied in the traditional way: manually with burial of the sludge in the yard. For a second emptying the same place in the yard can be used to bury the sludge. The sludge of the first burial will have been composted after two years (minimum because of the worm eggs). A soil cover of 1 ft (30 cm) on top of the sludge will be sufficient.

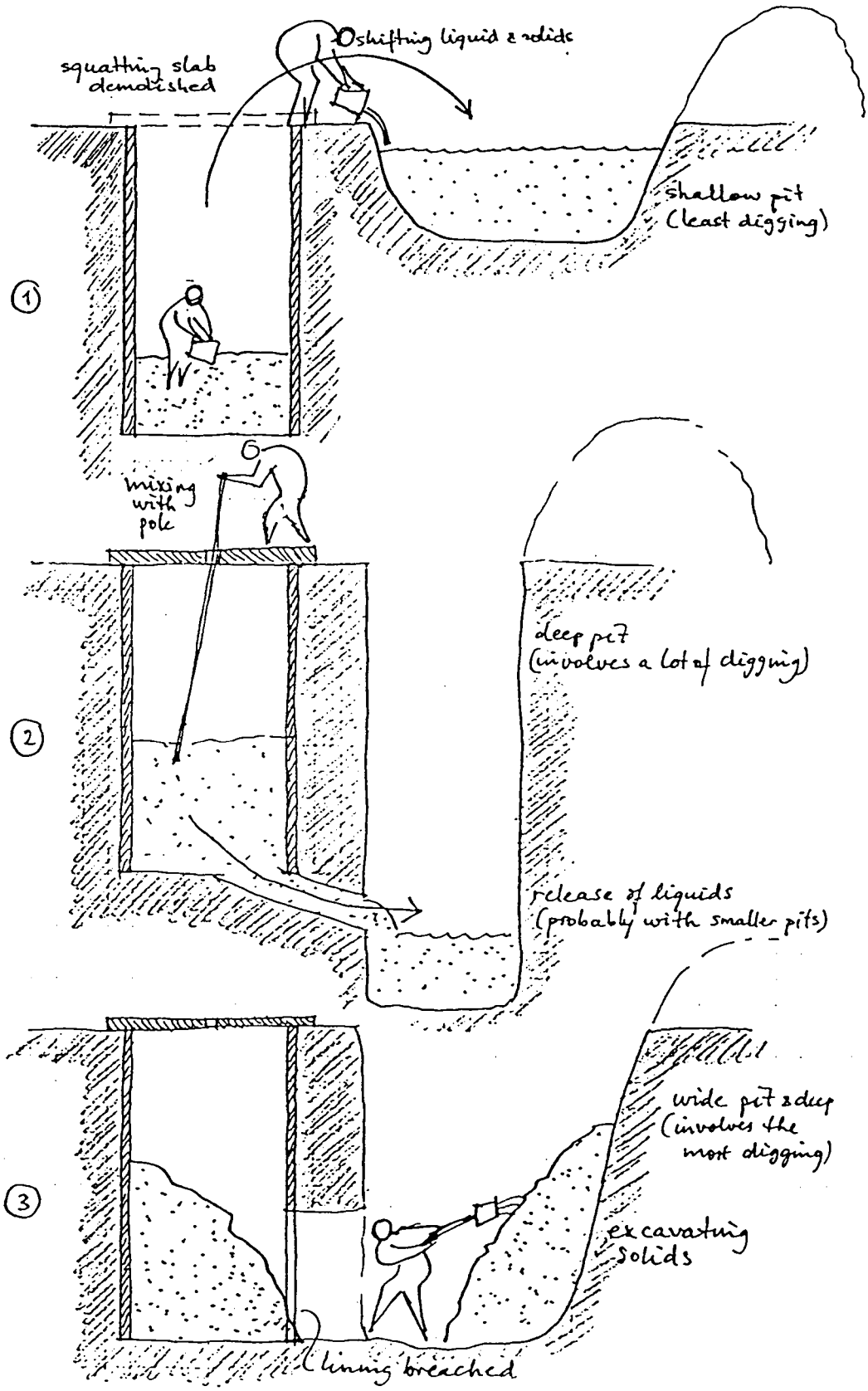
Constructing a second latrine instead of digging a dump pit is no alternative in most cases. Burial may take place in the middle of the yard but that is not the convenient location for a permanent latrine. Another reason for not building a new latrine is purely economic. A pit latrine in Dar es Salaam needs proper lining because of the sandy soil. Lining makes a pit costly. Pits are therefore traditionally constructed with a large volume (3 m deep, 6 m3 contents), to make them last longer. Only about 2 percent of the pits has no lining. The only area with rock is Msasani where no pit latrines will be found.

It is technically easier and more economic to empty a latrine every 2 years (liquid sludge) than once in 10 years (compacted solids). In Trinidad they have for that reason annual emptying per area. In Dar es Salaam the people do not want frequent emptying and still prefer a traditional deep latrine that lasts a long time (experience of VIP construction programme). It is even (an illegal) common practise to dispose off bath water seperately in the gutter to make the latrine last longer (resulting in more solids). Only when the public gaines confidence in the emptying service they may in the long run accept more frequent emptying.

3. Manual pit emptying routines

Three traditional routines have been identified for manual pit emptying and burial in the yard (see drawing).

Traditional emptyers throw parafin and salt into the pit before emptying. Parafin is lit to kill the smell. The purpose of salt is not clear. People may think it kills germs, it may act as a floculant to seperate liquid and solids.


squatting slab demolished
shifting liquid & solids
shallow pit (least digging)
1
mixing with pole
deep pit (involves a lot of digging)
2
release of liquids (probably with smaller pits)
wide pit & deep (involves the most digging)
3
excavating solids
lining breached

4. DSSD and improvement of manual emptying

The objectives to improve manual pit emptying are:
- do away with unhygienic routines,
- the sanitation authority must be able to service anyone.

To involve the traditional emptyers is not such a bad solution. They know the work, the public knows how to find them. There are between 500 and 1000 private emptyers in Dar es Salaam.

The cost of handpump equipment will be about Tsh 250,000 per unit. Capital investment is impossible for casual labourers like the traditional emtyers. Existing entrepreneurs will appear as middlemen, which role can also be played by DSSD. Funding of equipment has to be through official bodies anyway. If DSSD is the owner the emptyer can lease the equipment for the time it is needed by the private emptyers on conditions set by DSSD. It will be difficult to stimulate the privatization of manual emptying because it is not a priority of the City Council.

5. Licencing

The Head of the Health Department suggested to WASTE that permits for emptying could be given directly by the Medical Officer of Health. At present Vinyud, an entrepreneur who has 2 private vacuum tankers, operates under an arrangement signed by the City Director. DSSD has put forward proposals for licensing tanker disposal, which will become effective with the commissioning of the 5 new dumping stations.

Proper licencing and conditioning of private pit emptyers can only be introduced under a new by-law, which has to go a long way:
- City Solicitor involved in draft,
- approval Sewerage and Sanitation Committee,
- approval Finance and Administration Committee,
- approval full City Council,
- approval Ministry of Local Government.

DSSD already has the experience that proposed amendmends of the township ordnance bounced back.

Conditions to be included in licencing:
- emptying and burial up to certain standards (no spillage, minimum soil cover of 30 cm),
- haulage and dumping up to certain standards (no spillage, disposal only at approved dumping stations),
- operation area for emptying and haulage restricted around a fixed dumping place or transfer station (emptying and burial not restricted),
- inspection by DSSD to safeguard a minimum standard.

Inspection could be introduced without licencing when the equipment is leased out by DSSD, giving the right to inspect the equipment. Reporting performed emptyings back to DSSD is not a useful condition in this instance. For data recording and processing a computerized system is necessary. The only use at present would be the general record of performances (which is not even kept for tankers). To build up a record of locations where burial cannot take place direct inspection will be more effective.

6. Social involvement

Vacuum pumps can brake down because of a piece of cloth. Rags are a major cause for blockages when emptying pits. This is an example of the necessity to make people aware that proper latrine use may result in cheap and easy emptying. Otherwise the involvement of pit latrine users can make planners aware of facts that have to be taken in account like use of water or garbage disposal.

Women are responsible for the cleaning of the latrine and the hygiene education of the children. Therefore they should be asked about common practice in cleaning and use of the latrine. They may have an important informant role directly to their children and indirectly to the neighbourhood where they live and work. During the WASTE fieldtesting UWT will be asked for support.

Much has to be learned still about the traditional pit emptyers. The technical innovations are not satisfactory if no improvements can be realized in the working conditions of the traditional emptyers. Therefore it remains necessary to contact these emptyers and involve them in improvements for their work. It must be tried to arrange meetings to discuss their working methods and ask for their needs. A communicative DSSD employee could be used as intermediate to approach the (rather secretive) traditional emptyers.

7. Cases of small scale pit emptying

A lot of experiences must exist, but not much seems to be documented. Places with experiences:

- Jakarta: it was tried to motorize 1,000 liter tankers for desludging septic tanks,
- Douala, Senegal: Motocolumbus (?),
- Recife: trials, no further proceedings,
- Nairobi: trials with MCA mini tankers,
- Japan: small motorized tankers,
- India: transfer tanks in which the nightsoil buckets are emptied,
- Iran: small tankers,
- China: very small tanker vehicles (spotted by RS),
- Afghanistan: donkey carts.

Gert Jan de Kruijff (IHS) wrote a book titled: "500 years of illegal sanitation" covering cesspit emptying in Lamu.

8. Burial or transportation

If people are asked if they want the sludge buried on the plot or transported they will chose for transport. If the price for transport is much higher, people will probably agree with burial. There may be a difference between the houseowners not living on the compound and their tenants. The first are not involved in the living conditions and might base their decision purely on economic reasons. Only about 10% of the houses in unplanned areas are fully occupied by the owner and his family, 90% is let out (40% with owners and tenants in the same house, 50% fully let). The cost differences between burial and transport should be worked out. When people are confronted with different prices, their preference can be asked (fieldsurvey MAPET).
Burying is a solution with technical and economical advantages.
Transport becomes necessary under two conditions:

- Where proper burial is impossible: locations with a high groundwater table. These locations in valleys, near creeks, nearly always correspond with low accessibility, where vacuum tankers cannot reach. An additional form of small scale transport has to be worked out.
- When customers choose for transportation and are prepared to pay for it.

DSSD should be the authority to decide in which instances burial is not acceptable and should be able to provide transportation in those cases. DSSD cannot involve itself in burial because of the legislative restrictions (officially not permitted). Burial (traditional or improved with equipment) will remain the area of private pit emptyers, the demand for transport should be covered by DSSD.

Sludge will have to be transported to 5 dumping stations connected to anearobic ponds. There are no data on the present driving distances of City Council tankers (6 m3 volume). The driving distance break even point for mini-tankers (with 2 m3 volume) is about 5 km, which means they can perform most of their work when stationed at the 5 new dumping stations. The driving distance for manual haulage should preferably be not more than 500 m. Substations for transfer of pit contents and additional transport to the dumping stations will be necessary for most of the manual transportation and some of the mini-tankers.

A 1,000 liter tank can be filled with a handpump in less than half an hour but manual haulage is impossible under the prevailing road conditions. Animal traction (donkeys) is not feasible in Dar es Salaam where all cattle officially is banned from the road. A 200 liter drum takes five minutes to fill with a handpump, but in comparison to a 1,000 l tank you have to go five times for disposal. The balance between volume and transport distance has to be worked out.

The equipment for emptying and transportation to a (transfer) dumping station does not have to be transported to and from the DSSD depots every day. Arrangements can be made with the CCM offices in the unplanned areas. CCM offices already look after vehicles from Government and parastatals and could be involved for stationing manual emptying and transportation equipment.

9. Volumes for burial and transport

CCM in Dar es Salaam has 90 branches, of which 70 in unplanned areas. All branches have about 1,000 houses with in total 15,000 people. The sludge accumulation is 30 liter per capita per year. This roughly adds up to a maximum 500 m3 pitfill per ward per year. This volume could be handled by 1 improved manual team working with equipment and servicing a minimum of 2 full pits/week (100 pits/year). Maybe 2 teams is more realistic. The teams can be resident in their branche.

In about 10 branches the conditions are such that burial in the yard is not acceptable and transportation is necessary (5,000 m3 on fixed locations). In the remaining 60 branches about 20% of the pit contents will have to be transported (6,000 m3 spread all over town). The total volume to be transported out of unplanned settlements to (transfer) dumping stations is 11,000 m3/year. The volume for burial about 24,000 m3/year. Assumed that half of the transport can be done by mini-tankers and half by manual teams the break down is:

number of branches	transport or burial	m3 sludge	handled by	number of units
10	100%	2,500	mini-tanker	1
	transport	2,500	hand DSSD	5 (transport)
60	20%	3,000	mini-tanker	1
	transport	3,000	hand DSSD	6 (transport)
	80% burial	24,000	hand private	50 (burial)

10. Substations

At least 5 fixed substations will be necessary to serve the 10 CCM branches where burial is not acceptable. The scattered cases of transport in 60 CCM branches could be handled with mobile substations

10.1. Mobile substations

A trailer would be cheapest, moved by a tractor or a tanker passing by. A tractor could service 3 or 4 trailers daily. With DSSD (sewerage division) few tractors are in use, tractor technology in Dar still is complicated.

Tankers should be pressurized or tipped for disposal. Dumping into a tanker is difficult (loading height). For that reason a skipping system with a special container could be developed to be winched on to a trailer (a hand winch can be manufactured in Nairobi). The skipping system is thought to be promising for solid waste as well, the vehicle technology for solid waste and sludge collection could be integrated.

Collection of filled drums is not feasible. The drums all have to be able to hold vacuum (fragile connections). Having the drums near the road may be asking for trouble (robbery, demolishing).

10.2. Fixed substations

The DSSD tankers can empty the substations when they have spare capacity or once a day on the last trip to the dumping station. The substation should be situated along the road, not too close to the houses and public buildings. The location of a substation should be in the road reserve to be arranged with the Planning Department.

The location could be combined with a garbage collection point and must be fenced and locked to prevent garbage in the sludge. If the substation is provided with piped water this should be locked as well, because people will start using the water. Locations to be avoided: mosks, churches, schools, markets, shops.

10.3. Sewer use

Sewer use for sludge disposal is advantageous if it can be done: it saves the construction of transfer stations and additional transport. It depends on the systems flushing capacity and should only be applied in a gravity sewer without pumping station preferably feeding directly into the sea outfall. Only Kariakoo and City centre have this condition, but these can be serviced by tankers. The only applicable sewer system at present for unplanned settlements would be Vigunguti, after rehabilitation maybe Buguruni. Dumping points in sewers should have a 200 l trough with locked cover and piped water.

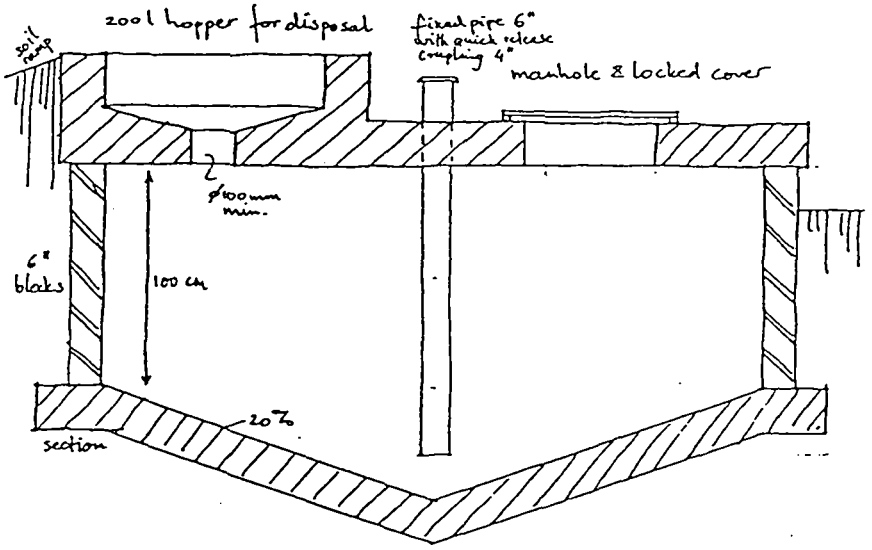
In general the use of sewers must be discouraged because of:
- risk of blocking sewers,
- disruption of the treatment (entry into the system after the anaerobic stage).

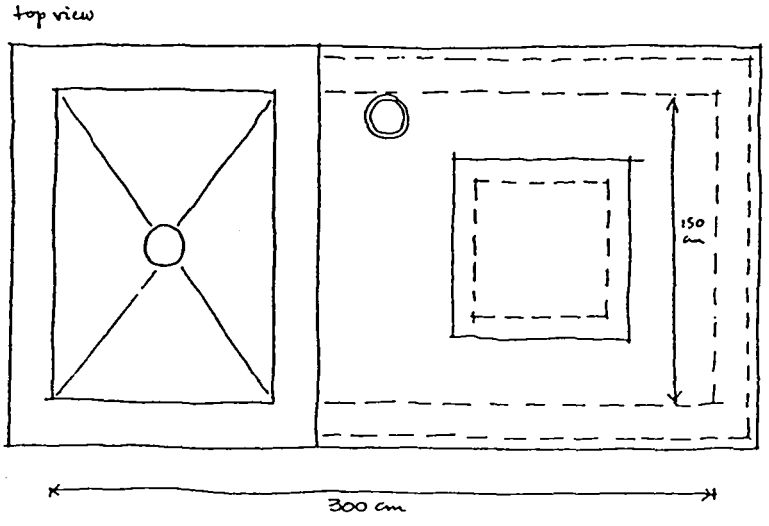
11. Design criteria for a fixed substation

The fixed substation could basically be a large sceptic tank of 5 m3. The volume will be sufficient when regular serviced. Costs are about 30.000 Tsh. To prevent floating a tank should be block lined, circular may be cheaper but builders are used to make the rectangular type. It could be one and a half meter deep, three meter wide and one meter deep, built up a bit above ground level. To protect children and animals from falling in the pit the manhole must be covered with a lockable lid.

The tank should have a permanent suction pipe from the bottom, starting with a diameter of 150 mm (6"), fitted with a (female) quick release coupling for the tankerhose of 100 mm (4").

Using old Health Department vacuumtanks as substations might be only a little cheaper. Officially they still have a book value, they have to be transported and adapted to the place. Floating and rusting may be other complications to this option.





12. Methods of extracting solids

12.1. Plug and gulp

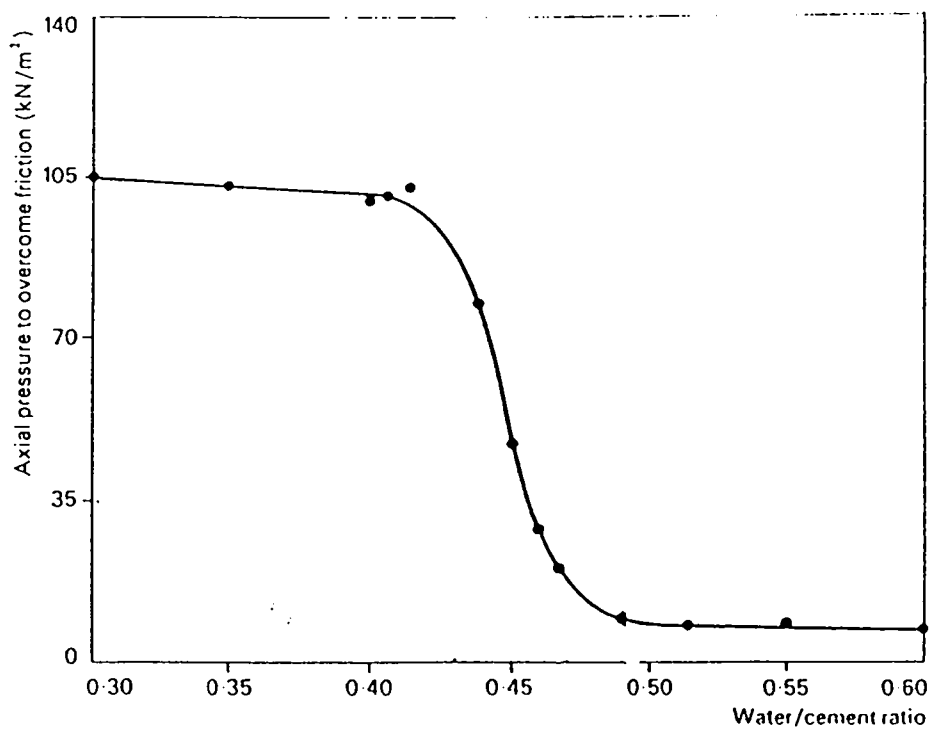
For sucking dense material gulping is necessary. The constant pulling of the hose (to let in the air) is very hard work, for which at least three men are necessary. MCA experimented with an automatic gulping attachment. For the Japanese tankers the re-establishment of vacuum takes two minutes, the Brevac type takes less. A mini-tanker asks 20 seconds.

12.2. Mixing

It is not necessary to mix the complete pit content, the problem is how to get water down, to break the hard stuff. One way is to use the liquid in the tanker by blowing it back. A high pressure water lance splashes (dangerous). PH experimented with an air lance, which seemed to help but there has been no time to work it out. In the Botswana tests an airbleed nozzle was used by Rolba to reduce the density. This could be an idea for the hand pump (feed back air from the outlet).

Rotating knives are no good because of stones. Agitators with sticking out parts get wrapped up with rags. A mixing device should function like an screw: pulling itself without too much resistance into the sludge and mixing while being pulled out (auger). Hand agitators should be sectional for use up to 3 m depth.

For the optimum water/solids ratio there might be an analogy with concrete (see diagram).



13. Costing of sanitation equipment

There is a great need of consistent figures. In development projects one tends to take the life span as long as the loan. Some figures can be used of Sandra Cointreau, based on averages; 7 years depreciation time for tractors and 5 years for trucks. The life time of Government vehicles in Tanzania is 3 to 5 years but they do not work with a depreciation account.

The average lifetime of the Heath Departments Mitshubishi vacuum tankers will be 3 years, the DSSD Leylands may last 4 years, maybe longer. The mini tankers resamble tractors. Manual equipment should have a longer life span. Apart from vehicle construction and road conditions the life time depends very much on spares back up, maintenance and driving.

With depreciation you can make any calculation you like. The commercial depreciation is different from the economical. Private entrepreneurs depreciate a vehicle in 1 year, otherwise they make not enough profit.

Comp rative estimates:

	depreciation period		maintenance
	commercial	economical	% per year
light tankers	2	3	20
heavy tankers	2	4	20
minitankers	3	6	15
manual	4	7	10
substations		20	
sewers		30	
sewage pumps		8	

MCA has put forward a proposal to UNCHS to make a computer programme with 20 specific parameters to compare refuse collection technology. This could be made applicable for sanitation technology as well.

14. Prototype manual equipment

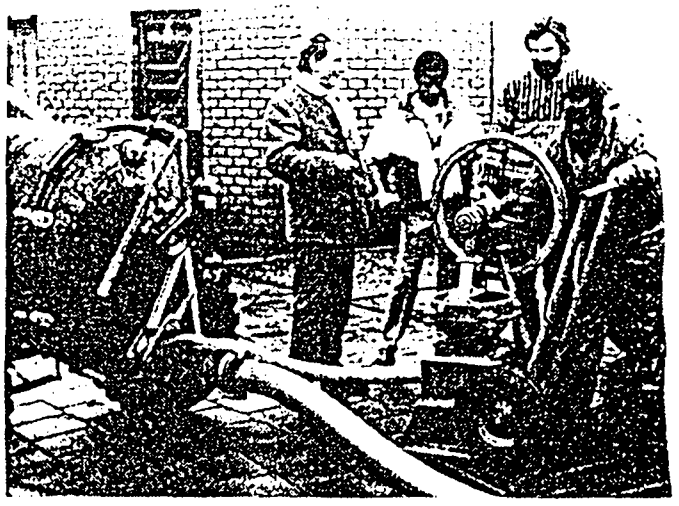
The newly developed 1,000 liter prototype tankcart has some disadvantages that must be changed before shipping it to Dar es Salaam:

- Volume reduced to 600 l (less weight),
- steel plate can be less than 5 mm,
- air outlet with ball valve and looking glass,
- 3" hose will do (more flexible),
- water tank not necessary,
- rear pushbar necessary.

- Cart wheels with spokes (grip for pushing by hand), size at least 100 cm,
- if tyres then regular size for Tanzania,
- axle a little more to the middle, front wheel weight should be not over 100 kg when full,
- front wheels regular size for Tanzania (R4 is about smallest), maybe the turntable can not be under the tank for that reason,
- turntable rocking,
- pull bar stronger,
- handle bar wider.

- Top valve and inlet pipe can be omitted,
- bottom valve with male coupling and cap against leakage,
- upright tall sight glasses,
- fixed rear panel with small door (30 cm) for cleaning, with simple hinge and guide.

The performance of the diaphragme handpump was very good, in combination with the 1,000 liter vacuum tank as well as the 200 liter oildrum. In combination with the oildrum it can be used well for plug and gulp because the vacuum builds up quickly (only 200 l). The stability of the pumpcart while turning the flywheel could be improved. The prototype will be shipped to Dar es Salaam for fieldtesting.



15. Funding the implementation

A lot of funding exists but not for low cost sanitation projects. Fashions with funding agencies at present are Small Scale Industries and NGO's.

If equipment is manufactured locally only local currency is involved. The capital input from development funding should be used to purchase 10 manual emptying units. Operation and maintenance should be covered locally. The rent for hiring out the equipment may enable the project to cover the operational costs and even expand the service slowly. For expansion a Tsh 400 per day will be necessary.

The enthousiasm of the City Council towards the project doesn't mean they will (be able to) pay for (a part of) it. We should look for bilaterals like the Swiss, the Dutch, the Germans or a multilateral like the Arab fund. Bilaterals presently start to move into poor (peri-)urban areas. Eventually the World Bank is an option. A donor will only fund if the project is supported by the (local) government. Local financing by DSSD might be possible during 1989. It is doubtful if an extra City Council grant will be politically feasible.

Implementation of manual and small scale equipment should be made part of a large package to be put forward as a (flexible and short term) research project, in which all levels of sanitation are compared under the same conditions. For a draft proposal see annex. Possible funding parties to be approached are the EEC, Irish Government, ODA, GTZ, SDA, DGIS and the Arab Fund (always complaining they have no good projects).

16. International presentation

A seminar on pit emptying will be more worthwhile if the MAPET results can be compared in a total package like proposed in the annex. The comparative research should be closed off with a second seminar. The first seminar then has the character of a preparatory workshop and should be focussed on the inputs for the research, to prevent discussions afterwards. The second seminar is the much larger international presentation of the final results.

<u>opening workshop</u>
- state of the art 3d world pit emptying, inventory of existing cases (Jim Wilson?)
- state of the art Dar es Salaam sanitation (DSSD)
- presentation MAPET fieldtesting (WASTE)
- presentation comparative research (Peter Hawkins?)

Parties to invite: WASTE, DSSD, round table participants, Duncan Mara, Ron Caroll, funding agencies, WEDC, ENSIC, IRCWD, IRC.

<u>closing seminar</u>
- conclusions of the comparison project
- relevance to the 3d world
- links with solid wastes

For the organization of the conferences, especially the logistic and administrative part, the Ardhi Institute and UNICEF should be approached.

Research Proposal

Comparative study of pit emptying technologies and their integration

Introduction

The use of on-site excreta disposal systems such as VIP latrines and related technologies, is now well-established as a viable, low-cost option for low-income urban and peri-urban areas in developing countries. Because of constraints on space, however, the pits have to be emptied of sludge from time to time as they cannot be re-located. Technology for providing this pit emptying service is still under development, but has now reached a stage where its thorough evaluation would provide a useful tool for project planners in the selection and application of pit emptying equipment.

Main requirements of a pit emptying technology are as follows:

(i) Must be able to handle the range of liquids, compacted solids and rubbish found in latrine pits

(ii) Must be able to serve houses in all parts of the urban area, including densely packed unplanned settlements

(iii) Should allow for the movement of wastes to treatment/disposal points, possibly up to 20 km distant

(iv) Must be affordable and maintainable since if not used, residents will continue to empty pits themselves, unhygienically.

Up to about ten years ago no attempt had been made to address these problems, and pit emptying was carried out by hand, often a risky and unhygienic business, or using standard developed-world vacuum tankers which were not powerful enough to deal with some types of pit contents and too big to enter many unplanned areas.

In a first series of comparative tests coordinated by IRCWD and carried out in Botswana, prototype equipment was tested and specifications developed for a more powerful tanker capable of handling compacted wastes and able to operate at greater distance from the pits than previously. At the same time the need was identified for a small manouverable tanker vehicle to serve areas of difficult access. Such a vehicle has now been developed, and tested in Kenya.

All these are relatively high-cost solutions and rely on imported technology. A study is now under way in Tanzania to develop hand-powered equipment to render manual emptying simpler, cleaner and safer, and prototype development should be completed during 1989.

Experience gathered so far with these various systems suggests that the best solution is probably a combination of them, to be applied in different areas. For longer distances to dump, the standard and improved vacuum tankers can offer a fast and economic service, whilst for shorter distances and in more crowded areas the mini-tanker becomes practical and more economical. Where access is impossible for motorised traffic, manual emptying is the only remaining alternative. With manual emptying and possibly mini-tankers, arrangements for the transfer of wastes to other vehicles for transport to dump will also be necessary.

Given such a range of options, it is clearly necessary to test them individually whithin the same operating environment so as to evaluate their relative strengths and weaknesses. Operating all types of equipment together is also the only way of evaluating the parameters determining optimum division of services between the different technologies.

Description of Study

Objectives:

(i) To collect, evaluate and compare full range of pit emptying technology currently available
(ii) To identify and evaluate the major parameters of different technologies in a given situation
(iii) To develop and disseminate guidelines on the choice of pit emptying technology packages and their implementation.

Location: Dar Es Salaam, Tanzania has been selected since it is a low-income city with a large pit-emptying requirement and representative of many of the difficult operating conditions found in developing countries. It also has, in the recently formed Dar Es Salaam Sewerage and Sanitation Department (DSSD), a competent counterpart organisation already involved with pit emptying. Additionally, all types of pit emptying technology except for mini-tankers are (or will be) present.

Duration: One year

Main Activities:

1. Development of manual pit emptying technology

This will be carried out prior to the project under a programme already started by the Netherlands Development Agency (DGIS). Prototype locally manufactured equipment should be available by mid 1989 and final reporting will be done later in the year, as a basis for pilot-scale introduction of the technology.

2. Seminar on pit emptying

A small seminar for all local personnel and experts involved in the project, and one or two other experts with relevant experience, will be held in Dar Es Salaam at the end of 1989 or beginning of 1990. Data on the operation of existing systems and the manual pit emptying technology study will be presented, as well as relevant experience from other countries, and the proposed research programme discussed and finalised.

3. Procurement

It is proposed that two mini-tankers be procured for the trials, which will be handed over to DSSD on completion. Because of the need to study the social and organisational factors involved in the manual pit emptying technology, a minimum of ten sets of equipment should be procured for this pilot study.

If possible, orders should be placed in July or August 1989 to enable delivery for the beginning of 1990 so that the project follows on naturally from the manual emptying studies. Some technical assistance would be required for the local manufacture of the manual equipment.

4. Data collection and operation

This phase will run from January to December 1990. Work with large tankers will continue as usual, subject to detailed data recording. Because of limited capacity, the mini-tankers and manual systems will be used in selected representative areas initially, but after the first six months' data have been partially analysed it should be possible to develop an operational framework within which the different technologies complement each other. This will allow at least a few months' experience of the type of mixed systems that this study aims to optimise.

Detailed data will be recorded on service requirements/requests, organisation and utilisation of services and personnel, quantitative and qualitative performance and all aspects of cost.

Running costs and maintenance will be provided by DSSD, as will labourers, drivers etc.

5. Personnel

Two senior local staff will be recruited to manage the project. A technical background in engineering/public health engineering will be required, plus some practical organisational experience. Additionally, two technicians/mechanics will be employed so as to be able to ensure continuity of record-keeping in maintenance of the new machinery.

Expert personnel would consist of one engineer to supervise general coordination of the project and to assist in data analysis and reporting, whilst technical backup for the mini-tankers and especially the manual systems would be provided by those involved in their development.

6. Presentation of results

On completion of the final report in early 1991 a larger seminar/workshop will be held in Dar Es Salaam to present the results and guidelines for choosing and applying pit emptying technology. The final report will be combined with other contributions to the seminar and discussions into a document which will be edited, printed and distributed by IRCWD.