Sanitation Now: What is Good Practice and What is Poor Practice?

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Abstract To meet the 2015 Millennium Development Goals sanitation target or the 2025 universal sanitation coverage target it is essential that it is properly understood where the available sanitation options are applicable. In high-density low-income urban areas conventional sewerage and ecological sanitation systems are inapplicable solely on grounds of cost. In these areas the options are simplified sewerage, low-cost combined sewerage and community-managed sanitation blocks. In medium-density urban areas on-site systems are also applicable (alternating twin-pit VIP latrines and pour-flush toilets, urine-diverting alternating twin-vault ventilated improved vault latrines, biogas toilets and ecological sanitation systems, all with greywater disposal or use). In medium- to low-density rural areas the options are the same as those in medium-density urban areas, with single-pit VIP latrines and pour-flush toilets, rather than alternating twin-pit systems. The level of water supply service (public or community-managed standpipes, yard taps, multiple-tap in-house supplies) also influences the choice of sanitation option.
Keywords Rural sanitation; sanitation technology selection; urban sanitation; water supply service level

INTRODUCTION

If we are to have any chance at all of meeting the sanitation target of the Millennium Development Goals (~2.3 billion people to be provided with improved sanitation by 31 December 2015) and/or the WHO/UNICEF target of 'Sanitation for All' (~4.4 billions by 31 December 2025) (WHO & UNICEF, 2000, 2006), then we must understand how to choose the appropriate sanitation system for any given low-income community, and also how to implement this solution at large scale for there are hundreds of thousands of similar communities in need of sanitation provision. It may be convenient to think of solutions for (a) high-density urban areas, (b) medium- to high-density small towns and large villages, and (c) low- to medium-density rural areas. We must also know which sanitation systems are inappropriate in these settings. So we have one group of solutions which represent 'Good Practice' and another that represents 'Poor Practice'.

SANITATION SOLUTIONS FOR HIGH-DENSITY URBAN AREAS

'Poor Practice'

It is simpler to decide on the 'Poor Practice' group first. In this group are conventional sewerage and periurban ecological sanitation ('EcoSan') systems. Why? Because Kalbermatten told us in the mid-1970s that conventional sewerage was simply too expensive for poor and very poor urban households (Kalbermatten et al., 1982a). This is also the case with urban EcoSan: the Stockholm Environment Institute (Rockström et al., 2005) quotes the capital costs given in Table 1 and there are indications that these are underestimates (Rosemarin, 2007). Such costs are, quite simply, wholly unaffordable (unless massively subsidized, but subsidies should not be considered as the world cannot, certainly will not,

Table 1. Urban EcoSan costs per household[a]

UN region	Unit cost (USD per household)[b]
Sub-Saharan Africa	350
Southern Asia	440
East Asia	650
Eurasia	725
Southeast Asia	800
Oceania	875
North Africa	900
Latin America & Caribbean	1000
West Asia	1200

[a]Rockström et al. (2005).
[b]Average exchange rates in 2005 (from http://www.oanda.com/convert/fxhistory): USD 100 = EUR 80 = GBP 55.

provide subsidies for all the periurban EcoSan systems required to meet the sanitation targets we are trying to achieve). In Europe multi-sewer urban EcoSan systems were found to be more expensive than conventional sewerage (Oldenburg et al., 2007). Therefore to promote urban EcoSan as a realistic sanitation option for low-income communities does not seem to be helpful at present, nor will it be helpful until costs have been substantially reduced.

'Good Practice'

So which urban sanitation systems are 'good practice'? For high-density urban areas simplified ('condominial') sewerage is usually the most appropriate option (Sinnatamby, 1986; Guimarães, 1986; Bakalian et al., 1994; Neder and Nazareth, 1998; Mara et al., 2001; Melo, 2005) as it is normally less expensive than on-site systems - Sinnatamby (1986) found that in Natal, northeast Brazil, simplified sewerage was cheaper than on-site sanitation above the relatively low population density of ~160 people per ha. However, in low-lying areas subject to regular flooding low-cost combined sewerage is more appropriate (Guimarães and Pereira de Souza, 2004).

If communities are very poor and cannot afford either simplified or low-cost combined sewerage, then the only option (given that in these areas on-site sanitation is more expensive than these two sewerage options) is community-owned and managed sanitation blocks (Burra et al., 2003; Maji na Ufanisi, 2008; see also Mara, 2008). These sanitation blocks are better designed and managed than conventional government-funded and contractor-built communal toilet blocks and they cost less. They are only used by the community that owns them: they are not public facilities, although a community can decide to allow non-community members to use their sanitation block for a per-use fee. Generally help from a local NGO is required initially to catalyze community activity and then to interact, on behalf of the community, with and obtain financial support from the local city or town council, which may not at the beginning take the views of poor communities seriously.

SANITATION SOLUTIONS FOR MEDIUM-DENSITY URBAN AREAS

For medium-density urban areas (e.g., small towns) the choice is between simplified sewerage and on-site sanitation systems, with cost and user preference generally being the

two most important decision criteria, although the local soil conditions (shallow rock, high groundwater table) may exclude some options.

The on-site sanitation options are most commonly:

(a) Alternating twin-pit ventilated improved pit (VIP) latrines (Mara, 1985),
(b) Alternating twin-pit pour-flush (PF) toilets (Roy et al., 1984),
(c) Urine-diverting alternating twin-vault ventilated improved vault latrines (UD-VIV, also called 'eThekwini latrines') (WIN-SA, undated),
(d) Biogas toilets (Aggarwal, 2003; MNCES, undated), and
(e) EcoSan toilets (Winblad and Simpson-Hébert, 2004; Morgan, 2007).

UD-VIVs are easily convertible to operate as EcoSan toilets, but it may be sensible to promote their use as non-EcoSan units initially in order to familiarise the users with the use of a sanitation facility, with later conversion to EcoSan operation (perhaps after 2-3 years), if that is what the users want, rather than opting for nutrient recovery and use *ab initio* as this may prove to be too onerous and confusing for the users.

Options (a) – (d) need to be supplemented with a greywater (sullage) management system (Ridderstolpe, 2004; Morel and Diener, 2006). A choice normally has to be made from simple on-plot soakaways, greywater use to irrigate a 'greywater garden', or discharge into stormwater drains with a modified cross-section to permit a reasonable velocity of flow of the greywater in the dry season (Kalbermatten et al., 1982b). With option (e) greywater use is already part of the system.

SANITATION SOLUTIONS FOR LOW- TO MEDIUM-DENSITY RURAL AREAS

In low- to medium-density small- to medium-sized rural areas on-site systems are generally the appropriate choice, although simplified sewerage has been successfully used in small villages (~1000 persons) in the northeastern state of Ceará in Brazil (Sarmento, 2001). The onsite options are:

(a) Single-pit VIP latrines,
(b) Single-pit PF toilets,

and options (c) - (e) above, together with a simple greywater management system (soakaways or irrigation of greywater gardens). The sanitation system chosen has to be the least-cost of the various possible options - cost is the most important criterion as those requiring improved sanitation provision are the rural poor and very poor.

Table 2 summarizes the sanitation options that can be used in low-income high- and medium-density urban areas and medium- to low-density rural areas.

WATER SUPPLY - SANITATION SYSTEM COMBINATIONS

Often the level of water supply service influences the choice of sanitation system, as shown in Table 3.

CONCLUDING REMARKS

Without a proper understanding, including the design, of the available sanitation options and where they are applicable, the MDG sanitation target cannot be met. This knowledge has to

Table 2. Sanitation options in low-income urban and rural areas

Type of settlement	Sanitation options
High-density urban areas	Simplified sewerage Low-cost combined sewerage Community-managed sanitation blocks
Medium-density urban areas	Simplified sewerage Low-cost combined sewerage Alternating twin-pit VIP latrines Alternating twin-pit PF toilets UD alternating twin-vault VIV latrines Biogas toilets EcoSan toilets
Medium- to low-density rural areas	Simplified sewerage Single-pit VIP latrines Single-pit PF toilets UD alternating twin-vault VIV latrines Biogas toilets EcoSan toilets

Table 3. Feasible water supply and sanitation combinations

Water supply service level	Sanitation options	Notes
Public standpipes	Community-managed sanitation blocks	It is assumed that individual household sanitation facilities are unaffordable.
Community-managed standpipes	Community-managed sanitation blocks, on-site systems, condominial sewerage or low-cost combined sewerage	Choice depends on space availability and costs. *Note:* the combination of standpipes and condominial sewerage *is* feasible - see Sinnatamby (1986).
Yard-taps (one tap per household)	On-site systems, condominial sewerage or low-cost combined sewerage	Choice depends on space availability and costs.
Multiple-tap in-house supplies	Condominial sewerage or low-cost combined sewerage	In low-density non-poor areas on-site septic tank systems may be cheaper.

be transmitted to the local level (local government engineers and planners, local consulting engineers), as well as to the national level (ministries of water, health and finance). This is a major challenge, especially now in the International Year of Sanitation 2008, but actually the real sanitation challenges are not only to meet the 2015 MDG sanitation target and the 2025 universal coverage target, but also to then keep pace with the huge predicted urban population increase in developing countries of around 2 billion people by 2050 (UNFPA, 2007).

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