

## Chapter 14

# On-Site Sanitation Systems for Low-Income Countries: Technical Guidelines for Groundwater Pollution and Nuisance Control

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## ABSTRACT

*On-site sanitation systems, the commonest sanitation technologies in low-income countries, are central to the elimination of open defecation in such countries. Nevertheless, their selection and application in the physical and socio-economic environment of low-income settings could be a complex and challenging task. Poorly designed and constructed facilities could pollute groundwater resources and create nuisances to the user and the general public. Meanwhile, local authorities in these countries often lack the human resource with the requisite technical capacity to analyse situations and recommend appropriate solutions. This calls for guidance in the most crucial technical decisions that affect the safe usage and environmental sustainability of on-site sanitation technologies. This Chapter reviews salient standards and guidelines for the selection of appropriate technologies, prevention of groundwater pollution, control of odor and fly nuisance, structural stability and safety of the latrine user.*

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## **INTRODUCTION**

Improved sanitation technologies or latrines play a central role in public health management by serving as a barrier to the transmission of pathogenic agents (Mara et al., 2010). As a determinant of health, access to improved sanitation enhances poverty reduction and other Millennium Development Goals especially those related to gender and mortality (United Nations Department for Economic and Social Affairs [UNDESA], 2007). Nevertheless, some 2.5 billion people, mostly in low-income countries, lack access to improved sanitation (Joint Monitoring Program [JMP], 2014). This makes the sanitation MDG practically unachievable and exposes the health of these billions of people to the risks posed by open defecation (JMP, 2013).

In low-income countries, on-site sanitation systems are the most affordable and the most technically feasible for many households. When properly constructed, operated and maintained in accordance with appropriate technical standards and guidelines, they can offer most of the benefits of water-borne sewerage to their users. On the other hand, poorly constructed and maintained on-site sanitation systems could pose a major threat to groundwater resources. Groundwater happens to be a major source of drinking water for most households in these countries, especially those in peri-urban and rural areas that are often not connected to conventional water supply systems. Aside from groundwater pollution, poorly constructed and maintained on-site sanitation systems, especially simple pit latrines, tend to offer a very low level of hygiene that may be comparable to open defecation. Consequently, some prospective users of available facilities may avoid using them and resort to the practice of open defecation which is recognized as the riskiest sanitation practice (United Nations Children's Fund [UNICEF], 2010).

To serve their intended purpose, latrines should be constructed to fulfil basic scientific and engineering principles. Moreover, the choice of a technology should be such that its requirements for sustainable operation and maintenance could be met within a given environment or socio-economic context at an affordable cost. In view of this, various national and international institutions have developed standards and guidelines to assist technical practitioners and lay people in the choice of latrine technologies, their design and construction, as well as the best operation and maintenance practices. Such standards and guidelines are usually aimed at controlling the risks of pollution and nuisances to the general public, especially those of offensive odor and fly breeding.

Although rigid compliance to conservative design codes has been criticized as a setback to innovation in technology development and adaptation in resource-constraint settings (Jenkins & Sudgen, 2006), the availability of flexible standards and guidelines can enhance the technical judgment of sanitation professionals. This is especially imperative in low-income countries where governments are faced with challenges in developing or attracting adequate human resources with the required technical capacity for the sanitation sector. In Ghana, for instance, 2008 statistics indicated that out of 430 engineers and other professionals required in the various local authorities, only eight were available at post nationwide (Obeng & Filho, 2010). Consequently, the practice of environmental sanitation fell in the hands of sub-professionals and low-capacity technical officers. In such cases, the availability of technical guidelines and toolkits would make a significant contribution to the appropriateness of technical decision-making.

Furthermore, in low-income countries technical decisions are required to be taken within the boundaries of infrastructural and socio-economic limitations that make the technical decision-making process very complex and challenging (Katukiza et al., 2010). These challenges that are particularly more prevalent in peri-urban areas of low-income countries include poor physical planning, unreliable water supply and low income levels (Ministry of Water Resources Works and Housing [MWRWH], 2007; Ministry of Local

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