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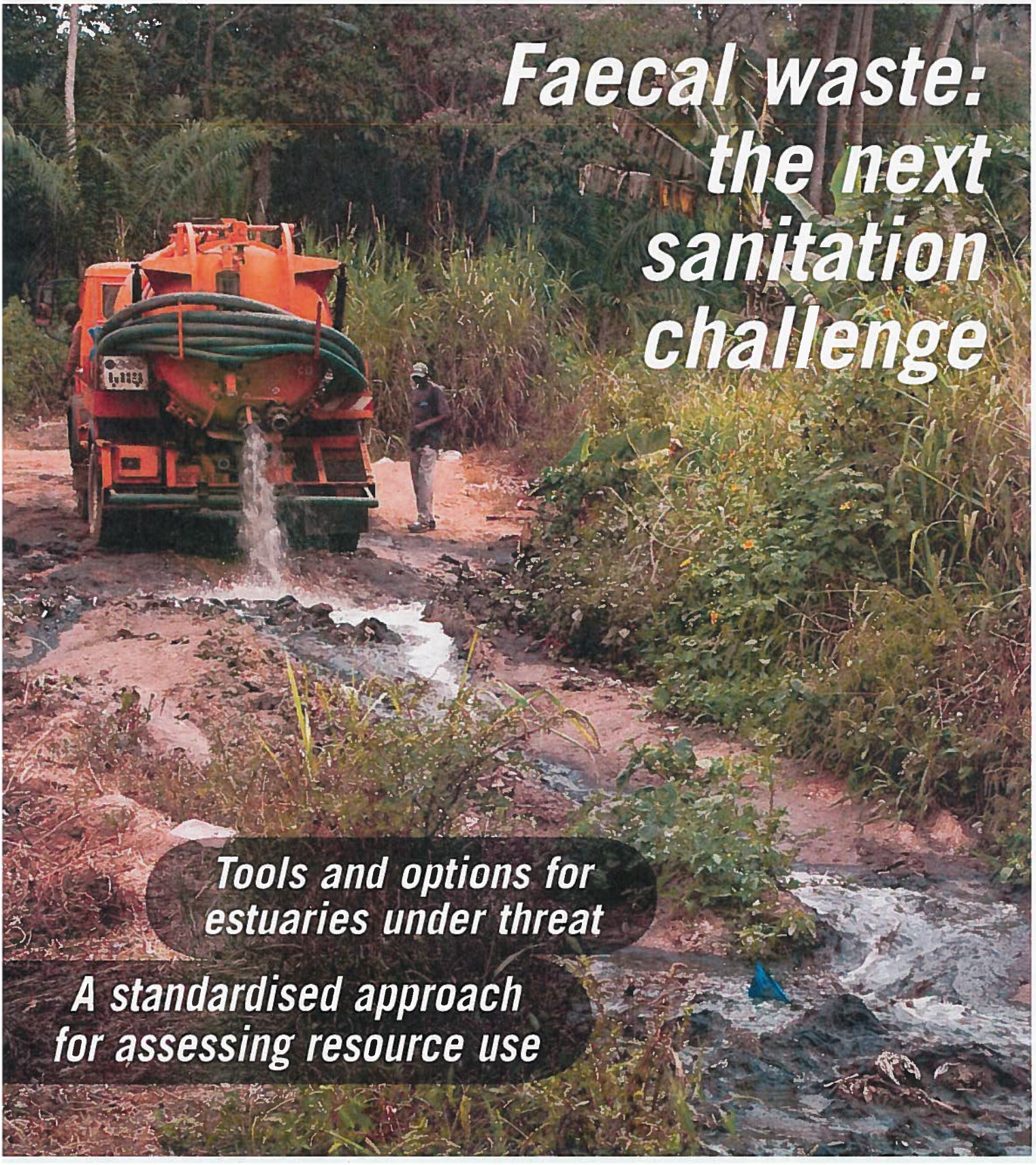


Faecal waste: the next sanitation challenge

Tools and options for estuaries under threat

A standardised approach for assessing resource use

COVER STORY

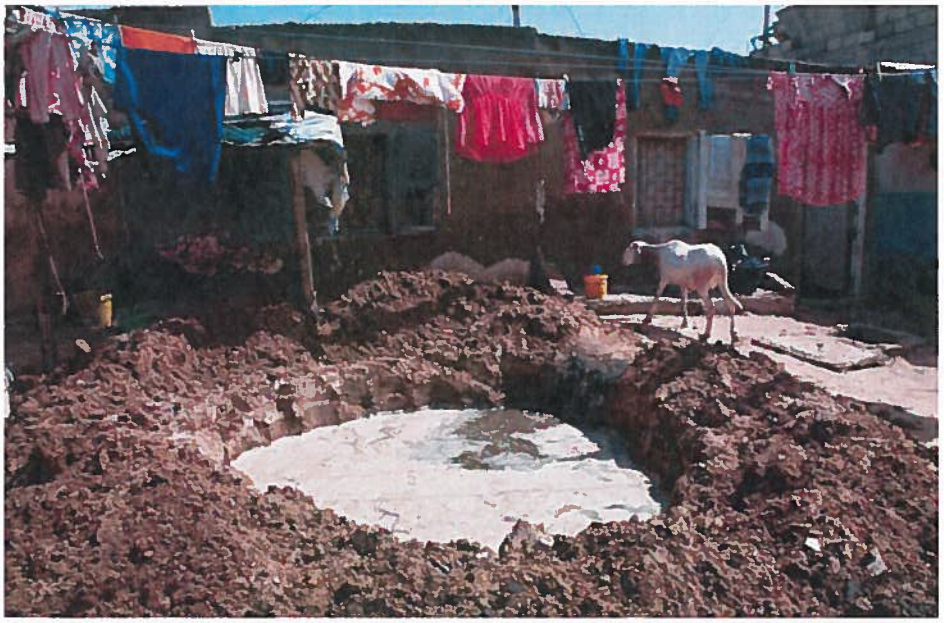
Faecal waste: the next sanitation challenge

In many low- and middle-income countries faecal sludge is untreated and if collected, disposed of directly into the environment. Credit: Linda Strande.

● The management of faecal sludge from onsite sanitation systems in many areas of the world has yet to be properly addressed, with subsequent impacts on human health and the environment. **LINDA STRANDE**, an editor and author of the new IWA Publishing book 'Faecal Sludge Management – Systems Approach to Implementation and Operation', explains how the importance of faecal sludge management is finally being acknowledged, introduces some of the unique challenges of working in the field, and looks at the steps required for sanitation to move forward.

The sanitation needs of 2.7 billion people worldwide are served by onsite sanitation technologies, one billion of these living in urban areas across Africa, Asia and Latin America. This total is expected to grow to five billion by 2030. In many cities, onsite technologies have much wider coverage than sewer systems. For example, in Sub-Saharan Africa, 65–100% of sanitation access in urban areas is provided through onsite technologies. However, in low- and middle-income countries there is typically no management system in place for the resulting faecal sludge (FS). Faecal sludge management (FSM) is therefore essential to the future development of global sanitation.

FS comes from onsite sanitation technologies and has not been transported through a sewer. It is raw or partially digested, a slurry or semi-solid, and results from the collection, storage or treatment of combinations of excreta and blackwater, with or without greywater. Examples of onsite technologies include pit latrines, unsewered public ablution blocks, septic tanks, aqua privies and dry toilets. FSM includes the storage, collection, transport, treatment and safe end use or disposal of FS. FS is highly variable in consistency, quantity, and concentration. Without an FSM structure in place, when onsite systems become full, the untreated FS typically ends up directly in the local environment. This results in the pervasive contamination of the environment with pathogens and does not provide a protective barrier to human contact and hence protection of public health. For example, in Dakar, Senegal only 25% of FS that accumulates in onsite facilities is being collected and transported to FS treatment plants. Frequently occurring problems in the service chain that prevent FS from being transported to designated treatment facilities for treatment and safe end use or disposal include: households not being able to afford professional emptying services; collection and transport trucks not being able to access narrow lanes and paths leading to houses; operators not able to afford the transport of FS over large distances to treatment facilities; and the lack of legitimate FS discharge locations or treatment facilities.



Manual emptying of cess pit in Dakar, Senegal. Credit: Linda Strande.

Looking beyond the household level

Progress towards the Millennium Development Goals (MDGs) has been successful in increasing access to improved sanitation facilities. However, providing adequate access to sanitation facilities does not end when onsite technologies are built – it is imperative to also take a longer-term focus which moves beyond the household level. A lack of funding for comprehensive FSM has resulted in the current sludge management crisis.

Onsite technologies can be a viable option, but only if the entire service

chain, including collection, transport, treatment and safe end use or disposal, is managed adequately. Thinking within the wastewater industry worldwide has started to shift, with onsite or decentralised technologies being considered long-term viable options and possibly the more sustainable alternative compared to sewer-based systems, which are prohibitively expensive and resource intensive. In urban areas it has been demonstrated that the cost of FSM can be five times less expensive than conventional sewer-based solutions (Dodane et al., 2012). In addition, sewer systems and FSM can be complementary, and frequently do exist side-by-side in low-income countries. A very successful example of this management model is in urban areas of Japan where the systems successfully co-exist, which allows for the onsite treatment and reclamation of wastewater in large buildings (Gaulke, 2006). The Japanese model is a success due to the strong enabling environment that includes regulation, enforcement and subsidies.

Systems approach to faecal sludge management

The solution to overcoming these problems requires a systems-level approach that addresses every step in the service chain and integrates technology, management and planning. From a technical perspective the first step in designing FSM systems is determining the final end use or disposal option of sludge and liquid streams, so systems can be designed to achieve the appropriate level of treatment for the desired end use. Resource recovery from treatment products should be a treatment goal whenever possible, but the number one goal is obviously the protection of public health. Once the final end use or disposal options are selected the treatment technologies that achieve the treatment objectives can then be chosen or designed. Similar to designations for Class A and Class B biosolids, FS is treated for levels of pathogen reduction that makes it appropriate for different end uses. For example, pathogen reduction and sludge dryness requirements are different for compost used on food crops versus as an industrial combustion fuel. These decisions are context specific, based on local regulations and market demand for end products. This approach is important to ensure that effluents and end products achieve adequate and appropriate levels of treatment, systems are not over-designed wasting financial resources, and that systems are not under-designed risking public and environmental health.

Inhibitors to sustainable development

The following bottlenecks at the crossroads of technology, management and planning are currently inhibiting the sustainable development of FSM systems:

- Acknowledging the importance of FSM: this includes governments taking responsibility, donor agencies providing funding and large intergovernmental organizations promoting FSM.
- Instituting frameworks and responsibilities: responsibilities should be streamlined with one entity of a city government taking on the responsibility and this can eliminate overlap or gaps in stakeholders roles.
- Increasing knowledge dissemination and capacity development: there is a lack of affordable and accessible reference materials, developing methods that increase local expertise is imperative.
- Creating sustainable business models and fee structures: different business models than the traditional municipality-driven for sanitation services need to be considered to reduce the financial burden at the household level.
- Implementing integrated planning methodologies: this is required for city-wide FSM systems that can address rapid growth rates, the heterogeneity of income level, sanitation technologies, and formal and informal settlements, and weak enabling environments.
- Developing appropriate technologies: key research areas include: characterization and quantification, collection and transport, semi-centralized treatment technologies, onsite treatment technologies and resource recovery.

Effective management will help to ensure the long-term success of FSM technologies, including institutionalisation, technical capacity, legal frameworks and cost recovery mechanisms. Even if environmental regulations are in place, they require adequate enforcement for them to be adhered to. Financial structures that can sustain the system ensure financial viability, including appropriate financial incentives and sanctions. Methods to ensure running costs and financial transfers are covered throughout the entire service chain are required for the system to function. Examples are management concerns being incorporated into technology decisions, such as locally available or reparable pumps being selected, or resource recovery from treatment products being an incentive to operate the treatment plant effectively.

An integrated planning approach helps to ensure vested participation and management, without which technologies in low-income countries tend to fail. Planning starts with the first phase of designing a system, but is necessary to ensure a continuum of success throughout the life of a project. Planning is essential to engage key stakeholders, including public authorities, entrepreneurial collection, transport and treatment service providers, and the serviced communities. Stakeholder engagement will help to ensure a long-term investment in the success of the system and continued feedback on future improved solutions. Planning covers organisational, institutional, financial, legal and technical aspects of the entire service chain, and is necessary to coordinate and ensure varied and complex levels of service among stakeholders with diverse interests. These interests need to be matched with an appropriate institutional framework, financial mechanisms and capacity. Planning can prevent failures, such as locating a FS treatment plant on the outskirts of a

Discharge of faecal sludge into the environment in Yaounde, Cameroon. Credit: Linda Strande.

Collection of dried sludge for reuse as fertilizer in Kampala, Uganda. Credit: Linda Strande.

city where land is available and relatively inexpensive, but which means that haulage time and distance for transport is prohibitive, ultimately resulting in direct dumping of FS to the environment and the treatment plant being unused.

The way forward

Bottlenecks at the crossroads of technology, management and planning that are currently inhibiting the sustainable development of FSM systems are listed in the accompanying box. Creativity will be key to developing innovative solutions for technology, management and planning that are globally transferable. Research in FSM is currently undergoing rapid developments, and examples of current research are included in the recently released book Faecal Sludge Management (see box).

Three projects that Sandec, the Department of Water and Sanitation in Developing Countries at the Swiss Federal Institute of Aquatic Science and Technology (Eawag), is currently working on include PURR (Partnership for Urban Resource Recovery), FAQ (Faecal Sludge Quantification and Characterization) and FaME (Faecal Management Enterprises). The goal of the PURR project is to identify effective co-management strategies for FS and wastewater sludge in urban areas in Vietnam and to train local stakeholders on methodologies for monitoring. The goal of the FAQ project is to develop a methodology to accurately quantify and characterize FS at a city-wide scale and is currently being field-tested in Hanoi and Kampala. The goal of the FaME project is to identify innovative end uses for FS, and to equip stakeholders with the capacity to sustainably implement and operate these. Conducted in Senegal, Ghana and Uganda, results from this research show that the energy content of FS is comparable to other biofuels (Murray Muspratt et al., 2014), combustion of FS in industrial kilns may create more revenue than use as a soil conditioner, and a model of financial flows throughout the service chain can be used to identify obstructions and policy requirements (Diener et al, in press). For more information about this research, FSM, and on the FSM book visit www.sandec.ch.

Developing solutions for FSM can close a 100-year gap in knowledge in comparison to wastewater management, and will lead to safer sanitation for billions of people around the world.●

Note

[1] Target 7C – reducing by half the number of people without access to 'improved' sanitation. Improved is defined as systems that hygienically separate human excreta from human contact, and includes; flush toilets, connection to a piped sewer system, connection to a septic system, flush / pour-flush to a pit latrine, ventilated improved pit (VIP) latrine, and composting toilet.

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