ON-SITE WASTEWATER MANAGEMENT, TREATMENT AND DISPOSAL IN FOUR PACIFIC COUNTRIES

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Abstract

The paper summarises the policies, regulations and guidelines governing the implementation of on-site wastewater treatment in Fiji, Kingdom of Tonga, Niue and the Marshall Islands. It analyses the administration structure as well as the current situation of implemented projects. It identifies appropriate on-site technologies and their implementation requirements. One striking result is that no straightforward responsibilities exist and that wastewater treatment in Pacific Island Countries has a very low profile and is widely neglected by Government agencies. New projects facing difficulties with finding the correct authority to address and face a very little skilled people to implement solutions. The same lack of technical skills lead to the deterioration of existing problems producing severe health risks to the public. The paper identifies that through careful community assessments implementation strategies can be obtained. However, the lack administrating and technical skills within formally responsible authorities impedes a widespread possible improvement of the sanitation issue in those four Pacific Island Countries.

Keywords

Sanitation, Pacific Islands, Appropriate Technology

1 Introduction

In the past, the sanitation sector has been neglected in most Pacific Island Countries (PIC). In many cases this important sector of public health has been left aside when major upgrading projects improved the water supply systems in many countries and provinces. Basically, ignoring the downstream effect, that an improved water supply results in increased discharges into rivers or aquifers.

The past neglect of sanitation reflects specific challenges to the PIC. Water has always commanded a central role in peoples' cultures and value systems. Immediately accepted as a factor of survival and of human dignity, the sanctity and importance of water are reflected in the priority attached to its supply in most societies. Sanitation is a far more difficult issue, surrounded by taboos and the disgust associated with handling human excreta. Politicians are often seen in the proximity of handpumps and pipelines, never at latrines or septic tanks. The cost of poor sanitation in development terms is rarely understood, nor is its particular impact on women given adequate attention. Rapid urbanisation can accelerate this burden enormously in the absence of a quick regional response.

Broadening the technological options and choices is, therefore the essential strategy for the Small Scale Wastewater Treatment Plant Project (SSWWTPP).

2 SOPAC Role in the Sanitation Sector

2.1 Institutional change and integrated management

The awareness that finances are limited, but can go much farther than they presently do, reinforces the case for a more integrated approach to planning in the sanitation sector. Recognition is also needed that quicker progress in the sector is a precondition for more rapid economic growth through better health and higher productivity, as well as protection of the aquatic ecosystem in PIC.

The international community, and in this case SOPAC, assists PIC through guidance on such an approach to integrated planning and action. This will have wide-ranging implications on such issues as land management, agricultural practices, biodiversity and the use of the hydrographic basin concept as an appropriate management unit.

Improved financial performance also requires that concepts of decentralisation are backed by institutional reform. As the role of governments shifts from service delivery to facilitation and regulation, public utilities will need autonomy and the power to fix their charges and enter into new alliances and partnerships.

2.2 A question of will

Sustainability requires political will to recognise sanitation as a human right, an economic necessity and resource, and a key to human wellbeing and dignity. Sustainability requires also that people be managers and not merely participants. Political will requires advocacy for changed attitudes and actions.

Considering the described situation, on-site sanitation has the potential to provide a sufficient effluent quality in terms of health and environmental quality with systems that can be managed and sustained at community level.

3 The Small Scale Wastewater Treatment Plant Project (SSWTPP)

Within the framework of regional organisations in the South Pacific, SOPAC has the mandate to promote and implement sanitation throughout the region. In August 1998, New Zealand Overseas Development Assistance (NZODA) requested SOPAC to undertake a study that integrated the above mentioned guiding principles. The more detailed objectives of the study were:

- Appropriate wastewater treatment technologies for selected villages in Fiji, Marshall Islands, Niue and Tonga be identified (e.g. treatment by plants, high-loaded treatment lagoons, community septic tanks);
- The conditions under which a certain number of toilets can be connected to a single small scale wastewater treatment plant be identified (economic, technical and social viability);
- The participating countries have formulated specific project proposals for further implementation.

The project looked at on-and off-site options for wastewater treatment. Off-site in this context, means that some houses could be clustered together instead of each house having its own treatment system.

4 The Technology Options

The preliminary criteria of the small-scale wastewater project were determined by careful consideration of what was important when making wastewater technological choices with the project objectives in mind. These criteria were then prioritised, and existing and proven technologies were rated against these criteria.

4.1 Effluent quality

The technology chosen should produce effluent quality that meets the standard with regards to the various quality measurements such as BOD, suspended solids, nitrogen, phosphates concentrations. Different technologies provide different levels of wastewater treatment, removing contaminants by various methods.

4.2 Water supply

Water is used in waste disposal mainly for the transportation of sewage from one place to the next, although it is used in the biological degradation of organic matter to a certain degree as well. The assumption made by the project was that there had to be enough water for this use, as well as a sustained use into the future. Without this assumption the technology options would be restricted to the use of composting toilets and similar systems.

4.3 Land space

Land is a very complex and sensitive issue in PIC. In a PIC village, land may be owned by many families each claiming their own piece. This family ownership does not only include the immediate family but also continues down to the extended family as well, resulting in many people owning a piece of land. Land secured for wastewater treatment would be difficult to obtain.

4.4 Maintenance and operation

In case of the implementation of on-site systems, operation and maintenance of a wastewater treatment system would be left to the villagers. The proper maintenance of the chosen system is a limiting factor in terms of the sustainability of the project on a village level. It has been seen from past experiences that most often maintenance has not been satisfactory. In the case that mechanical equipment is imported, spare parts availability has to be secured at affordable costs.

4.5 Cost

Financial support may be supplied by many sources. At a village level, funding may be provided by the villagers themselves with the assistance of local government departments such as Department of Health. Apart from these sources financial service may also be provided from other sources like foreign aid programs. The financial capabilities of the project area under consideration play an important part for the technology selection.

4.6 Topography

Topographic conditions such as the slope of an area, each ahs an influence over the type of technology chosen and these conditions change from one village to the next village.

4.7 Electrical requirement

Electrical power may be used in many different ways in the waste treatment system. It may be used to power pumps to transport the sewage from one place to the next, and also may be used in technologies involving aeration. Those technologies that are dependent on electrical power for operation can sometimes become non-operational during power cuts that occur frequently in PIC. In some cases, power might not be available at all.

4.8 System selection

Taking into account these criteria, a rating of the technologies are listed in Table 1. As the most suitable technology for the village application, the project identified a combination of a common septic tank and baffled reactor with an upstream filter. The system requires minimal land, and semi-skilled workers to build and operate the system. The system provides a good to very good effluent quality at low costs. Furthermore, the basic technology, the septic tank, is very well know throughout the Pacific and existing systems can be simply upgraded instead of replacing them. All materials can be supplied locally and, if well sited, no pumps or moving parts are required.

However, within the project framework, this outcome has only 'guideline' value. The final decision rests with the community after they have been informed about the options and their accompanying costs and benefits. This project approach is in line with the commonly accepted 'participatory approach', leaving the major decision to the people targeted by the project.

ON-SITE TECHNOLOGY		1. Pit latrines
		2. Vip latrines
		3. Water seal latrines
		4. Biological waterless toilets/Rotaloo/ Carousel compost toilet/ Vera compost toilet/ Soltranii
	OFF-SITE TECHNOLOGY	5. Septic tank with upflow filter
		6. Intermittent sand filters
		7. Horizontal and vertical, small-scale wetlands.
		8. Small bore sewerage system & intensive type lagoon
		9. Advanced integrated pond system
		10. Reed beds system
		11. Rapid infiltration ponds
		12. Waste stabilization ponds
		13. Membrane bioreactor (MBR)
		14. Central treatment facility using grinder pumps
		15. Intermittent extended aeration plant
		16. Enviroflow biofilter treatment plant
		17. N-DN biofilter treatment plant
		18. Intermittent decanting extended aeration (IDEA)

Table 1: Wastewater disposal and treatment technologies and their possible application

5 Example: The Case of Tonga

5.1 Current sanitation situation

The Kingdom of Tonga consists of three main island groups and many smaller islands located between 15 and 23° 30' S latitude and 173 and 177°W longitude. Total land area is 679.7 sq km. There are about 150 islands of which about 36 are inhabited. The population is about 95,000, of which some 64,000 live on the main island Tongatapu. The country's capital is Nuku'alofa with about 45,000 inhabitants.(Pacific Island yearbook, 1994).

In general, each dwelling in Tonga has to have proper sanitation facilities as described in the Public Health Act, 1992, Part 7, pp. 25 - 26. The Public Health Act further states that those sanitation facilities require ministerial approval. It does not state specific standards but provides for the possibility of ministerial decrees to set such standards. No description of the current actual standards could be obtained. Simple one or two chamber septic tanks and pit latrines represent the principal sanitation facilities.

In theory, as already stated, the Public Health Ministry has to approve all sanitation facilities. However, in practice, the size of septic tanks is not based on specific key figures like household size, pollution, frequency of sludge removal Public Health, due to financial and technical constraints, retains a rather lax control over the design of any sanitation facilities. It is perceived that the department further lacks the human recourse and skills to fulfil its duties as stated in the Public Health Act, 1992.

Sludge removal from septic tanks is the responsibility of the owner of the dwelling who has to pay Public Works Department to dispose of the sludge. The sludge is then discharged into drying beds located close to the Nuku'alofa central rubbish dump. Though Public Health claims that all sludge is being disposed of in those drying beds it is, firstly hard to believe that sludge is being transferred from one side of the island to the other and secondly, that the few drying beds provide enough space to dispose of the sludge of about 45,000 people living on Tongatapu. Septic tanks and pit latrines discharge their effluent through simple soak pits into the underground. No particular attention is paid to the depth of the groundwater level or to the existence of drinking water wells nearby. Though no particular water quality samples were taken, major contamination of water bodies and soil definitely occur sometimes resulting in thick brow sludge immediately below the surface. Strong smells in the vicinity of septic tanks and pit latrines indicate malfunction of the system or direct discharge of wastewater and sludge into the soak pits. Apart from the very common septic tanks, more advanced wastewater treatment technologies exist in some resorts, the Nuku'alofa Hospital and at the Mormon Church settlement. The Sunset Resort has a package plant installed that suffers from irregular wastewater supply with high peak loads and very little average loads.

The Nuku'alofa Hospital discharges wastewater into an activated sludge plant that is currently operated by the Public Health Department. No particular operational control is applied, apart from supplying air. Stilling basin and pre-treatment are virtually non-existent. Operators have not been trained and have no skills to operate the plant and the pumps. The plant appears to be grossly under-sized. No plans of the plant are available and the responsible person can't even remember who designed and commissioned it. Though dealing with bacteriologically heavily contaminated water, no disinfection is applied before discharging the effluent into a drainage field nearby.

The Mormon Church settlement operates a two basin ponds plant. Though no figures could be obtained, the inspection suggests that both basin operate in an aerobic mode for their size and little wastewater loads. The system is in excellent conditions with operators well trained and motivated. Water quality samples are taken on a regular base and operation of the ponds adjusted accordingly. Public Health Department retains no control over that particular system.

5.2 Sanitation projects

Currently there is no major sanitation initiative in Tonga apart from a pilot composting toilet. This project is being implemented by the Tonga Water Board (TWB) through an AUSAID institutional strengthening project and as well as continuing WHO support to self-help initiatives in the Northern island of Vava'u. A European Union funded water supply upgrading project in Vava'u has a health awareness component. This may include the introduction of compost toilets as pilot projects. There seems to be no link between the two projects. This is particularly remarkable since the Hapaii-Project appears to be very successful with the target group extending the project at their own expenses.

6 Recommendations

6.1 Project implementation agency

The project recommends that TWB should be the implementation agency for all pilot projects that might eventuate from this project. The Public Health Department should retain all regulating powers but should not be involved in the operation of wastewater systems. Considering the lack of any related skills in the Department, it will not be in the position to come up to this important task. Major training efforts are inevitable to overcome the current lack of specific knowledge. In principle, the same is true for the TWB. To this moment there is no trained wastewater engineer in the institution nor is there any wastewater technology under the responsibility of TWB, apart from the already mentioned AusAid project. However, significant institutional capacity to deal with complex projects and technology has been accumulated through operation of a complex water supply system. It is anticipated that TWB could train one of their project engineers to become responsible for wastewater projects.

6.2 Project implementation area

As a possible project, areas have been identified by stakeholders according to the severity of the wastewater problem. According to the interviews carried out, the Popua area has the most pressing

problems and therefore the highest priority for any project implementation considerations. The area consists of mainly reclaimed land that lies below or at mean sea level. The groundwater table is at ground level. The area is subject to flooding, even during minor rainfall events, inundating existing pit latrines and septic tanks. The result is a significant higher rate of typhus and diarrhoea and other water borne diseases. The project is currently seeking funds for the feasibility study and the project implementation.

7 Conclusions

Similar arrangements have been devised and coordinated with other PIC that participated in the project. This paper does not provide sufficient space to describe them in detail. From our point of view, progress have been made in the sanitation sector by involving different agencies in the planning process and advising on institutional changes and the technology options have been widened.

One striking result of the project is that no country has straightforward administrative responsibilities for the implementation of a sanitation project. All sanitation projects face difficulties with finding the correct authority to address and face a shortage of skilled people to implement solutions. The same lack of technical skills leads to the deterioration of existing wastewater projects resulting in severe health risks to the public. The project found that through careful community assessments, sustainable implementation strategies can be obtained. However, the current lack of administrative and technical skills within formally responsible authorities impedes a widespread possible improvement of the sanitation issue in those four Pacific Island Countries.

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