Annual Academic Sessions 2011
ISSN 2012-9912; ©2011 Open University of Sri Lanka

PERFORMANCE OF WASTE STABILIZATION POND IN DIGANA VICTORIA VILLAGE HOUSING SCHEME AND ASSOCIATED HEALTH & SANITATION ISSUES

M. I. Sudasinghe

Department of Mathematics and Philosophy of Engineering, Open University of Sri Lanka

INTRODUCTION

A shortage of wastewater treatment systems is observed in rural communities in developing countries. (Mahassen et al., 2008) In the developing countries, the unit costs of Waste stabilization ponds (WSP) are generally low (Marais, 1996) and they are suitable for both large and small populations. WSP are less expensive than other wastewater treatment technology like trickling filter and activated sludge process (Khan et al., 2007). WSP systems are commonly employed for municipal sewerage purification, due to its cost effectiveness and high potential of removing different pollutants. (Arar, 1998 and Cristian, 2003) Low operation and maintenance costs coupled with effective pathogens removal have made WSP technology widely employed all over the world (Mara & Pearson 1998; Alcalde et al., 2003; Khan and Ahmed 1992).

Digana village WSP is located in small communities in Digana Victoria village; Kandy was designed to serve 2000 persons. This facility was constructed in 1979 with Victoria dam project. Daily wastewater flow is about 2383 m^3/day mainly origin of domestic and hospital. The final effluent of WSP is discharged into Victoria Reservoir. The requirement for wastewater treatment is ever increasing due to connection of outsiders and new institutes. However, community is complaining on Operations & Maintenance (O & M) of WSP. Therefore, this study was conducted to evaluate the performance of WSP and to identify the issues related to the connection of WSP and their potential health and sanitation problems.

METHODOLOGY

During this study, transect walk, field observations and informal discussion with the office staff of the Mahaweli Authority of Sri Lanka and community were conducted to identify the existing situation. After preliminary investigation, a questionnaire was designed to investigate the issues and the potential health and sanitation problems of the community. Past studies and guidelines from reports of Central Pollution Control Board, Ministry of Environment & Forestry Board in India (2007) and China (Boller, 1997 & Mins, 1996), along with preliminary investigation and informal discussion with the officers who manage the selected STP was used to develop 109 performance criteria under five categories such as general, technical, physical, personal and operation and maintenance. A checklist was designed to evaluate the performances of WSP with 109 criteria. The general criteria shows whether the management is keen to maintain records of general information of STP including funding agency, cost, number of connection, water supply, wastewater generation, etc and produce annual report at regular intervals. The index provides an indication of the availability of above information with the management of the STP. Technical criteria show whether the design and functional characteristics of STP is adequate to treat the sewerage. A higher index value indicates that the STP has the capacity to treat the sewerage effectively from the respective community or organization. Physical criteria show the current physical status of the STP to carry out its technical functions to treat the sewerage effectively and efficiently. A higher value implies that the physical condition of the STP is in good condition and do not require repairs. Personal responsibility criteria provide and indication of whether personals have been recruited trained and provided responsibilities to carry out various functions of the STP. A higher value shows that there are adequate, trained personals who are given responsibilities to look after various activities in operating and maintaining the STP. O & M criteria show how the STP is operated and maintained in order to provide the services which are expected of it. This may be due to many reasons, such as a) structural and functional

defects of STP, b) lack of funds, and c) not willing to carry out the assigned tasks by the maintena nce staff. The observed status of the criteria was compared with the ideal status and combined score was used to decide whether the performance was good, satisfactory or poor. If WSP satisfy more than 70% of the criteria (or the index has > 70), the performance is considered as good. Index values of less than 50% and between 50%-70% are considered as poor and satisfactory respectively. The overall performance was determined by dividing the number of better performing criteria observed by the total number of criteria tested.

RESULTS AND DISCUSSION

General information of households

Digana housing scheme is a government housing scheme including 282 houses, a hospital, bank and a division of MASL. All the household in Digana village earn reasonable income as government employees and hence are above the official poverty line (National poverty line is Rs. 3087.00 per month as of February 2010) according to the Department of census and statistics of Sri Lanka, (2010). All the households have luxurious goods, such as a television (94%), a cassette radio (98%), a ceiling fan (92%), a refrigerator (90%) and a computer (40%). The use of firewood was prohibited by MASL as the houses are located close to each other and as a result neighbors would be inconvenienced by smoke produced from firewood. However 32% households are using firewood by violating the rules. Both men (48%) and women (52%) participate equally on wastewater management in Digana housing scheme.

Performance of WSP

As a result of lack of funds and skill labourer for daily O & M of WSP at present, a single unskilled labourer has been employed for the O & M of WSP. The WSP does not perform as expected. However there are no adequate facilities, such as health and sanitary equipment to handle the sewerage. Table 1 shows performance of Digana Village WSP

Status of performance criteria of WSP
Poor O & M of WSP
Bad odour
High Sludge production
High leakage conditions of sewerage drains
High damaged pipelines of WSP
No chemical treatment and analysis of effluent samples
De-sludgging has not been practiced
Tanks are under heavy repair
House keeping is not practiced
Inadequate number of labourers
No documentation on WSP
Poor personal responsibilities
High growth of algae and aquatic plants
Poor participation of labourers for O & M of WSP
Lack of funds for O & M
Beneficiaries do not aware of WSP

Table 1: Performance of Digana Village WSP

In spite of poor maintenance of WSP, wastewater is still sent daily to the treatment plant. Therefore primary treatment tank overflows regularly over the road disturbing neighboring community of Digana village. Pedestrian always make complains against the unpleasant situation in the area. Figure 1 show the performance criteria of Digana WSP which has values less than 50% and hence considered as poor.

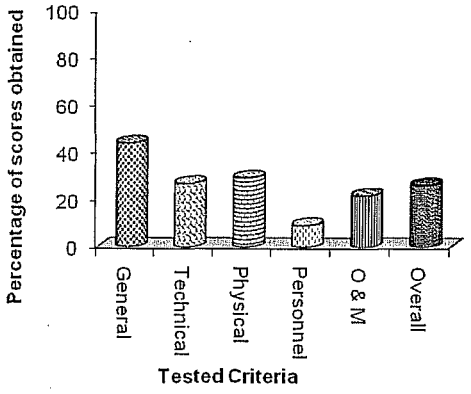

Figure 1: Percentage of evaluated performance criteria of Digana Village Sewerage Treatment Plant

Health and sanitation of households

All the households in the Digana village are provided with pipe born water and as a result, no significant impacts on disease outbreaks in housing schemes are found. However 4% of children were affected with diarrhea. Dengue is one of the major problems in area due to high density of breeding places, partly due to lack of maintenance of drainage systems in the housing scheme. Lack of ownerships and the expectations of a government institution to look after the maintenance of the surroundings, the people do not get organized into a group to repair their drainage system by themselves to protect their health. Majority (84%) of households in Digana village has sound knowledge on health and sanitation practices and health impacts.

Difficulties due to the connection to the WSP

Majority of households (94%) complained about the difficulties that they undergo as a result of bad smell experienced due to anaerobic conditions in the sewerage transport lines.

Description	Percentage
Over loading latrine	22%
Bad smell	94%
Flies problem	20%
Overflow latrine	10%
Mosquitoes problem	98%

Table 2: Difficulties experienced by people in Digana housing scheme as a result of the WSP

Acceptability of WSP within the community

The majority (86%) of household in Digana village accept WSP as good since they do not need to handle sewerage and wastewater problems. However the rest do not like the WSP mainly due to maintenance difficulties. It is very difficult to attend for repairing and maintenance of the system when the WSP is centralized with large number of household. However, the residents prefer individual onsite treatment system like septic tank and soakage pits than the centralized WSP.

CONCLUSIONS/RECOMMENDATIONS

The study shows that the waste water management system at the Digana Village is technically sound and performed very well during the initial stages. The system has deteriorated over the

years as a result of lack of funds for O & M and non availability of qualified personal. The most promising approach would be to handover such a system to a competent organization, such as NWSDB or a private operator to operate and maintain it. This would address the problem of non availability of competent staff to operate and maintain the system. However, the major problem of securing adequate funds remains. One of the long-term solutions is to charge the users. The other option is to allocate funds from the government, which is not a very viable option. However, it is unfortunate that government has overlooked these important issues without addressing them thus creating many environmental issues which affect not only the beneficiaries of the system, but many others, such as downstream users of polluted water resources. The sewerage leaking line of the WSP and stagnant drainage system provides very conducive environment for breeding of mosquitoes. There is a potential of disease outbreak if this situation continues without any intervention.

ACKNOWLEDGEMENT

The author wishes to acknowledge the Crossing Boundaries Project of the PGIA, University of Peradeniya Sri Lanka, SaciWATERs, Hyderabad, India and the Government of Netherlands for providing funds and facilities to undertake this research.

REFERENCES

Alcalde, L., G. Oron, L. Gillerman, M. Salgot and Y. Manor. (2003). Removal of faecal coliforms, somatic coliphages and F- specific bacteriophages in a stabilization pond and reservoir sytem in arid regions. *Wat. Sci. Tech. Water Supply*, 3(4): 177-184.

Arar, A., (1988). Background to treatment and use of sewage effluent. In: Treatment and use of Sewage Effluent for Irrigation (eds Pescod M.B. and Arar, A.) Butterworth, Sevenoaks, Kent.

Boller, M. (1997). Small wastewater treatment plants – A challenge to wastewater engineers, Wat. Sci. tech. 35: 1-12.

Christian, R., W. Sabine and M. Arnulf, (2003). Acombined system of lagoon and constructed wetland for an effective wastewater treatment. Wat. Res., 37: 2035-2042.

Khan, M.A. and S.I. Ahmad. (1992). Performance evaluation of pilot waste stabilization ponds in subtropical region. *Wat. Sci. Technol.*, 26(7-8): 1717-1718.

Khan M.A., and Khan M.A., (2007). The potential of waste stabilization ponds effluent as a liquid fertilizer, Pak. J. Bot., 39(3): 817-829.

Mahassen, M., Ghazy, E., El-Senousy, W. M., Aatty, A. M. A., and Kamel, M. (2008). Performance evaluation of a waste stabilization pond in a rural area in Egypt. Ame. J. of Env. Sci. 4 (4): 316 – 325.

Mins, K. (2007), Wastewater pollution in China, [online]. [Accessed on 23.09.2009]. Available at http://darwin.bio.uci.edu/~sustain/suscoasts/krismin.html

Mara, D.D. and H. Pearson. (1998). Design Manual for Waste Stabilization Ponds in Mediterranean Countries. European Investment Bank. Mediterranean Environmental Technical Assistance Programme. Lagoon Technology International, Leeds. UK.

Marais, G.V.R., (1996), New factor in the design, performance of waste-stabilization pond, Bull world health organ. 34(5), 737-763.

Sinha, A.K., and Nazimuddin, M. (2008), Evaluation of operation and maintenance of sewage treatment plants in India-2007, Central pollution control board, Ministry of Environment and Forestry, [on line], [Accessed on 20.05.2009], Available at: http://www.cpcb.nic.in.