EVALUATION OF SEWAGE SYSTEM MAINTENANCE OF BUILDINGS AND ITS DISPOSAL : A CASE STUDY OF SENIOR STAFF QUARTERS AT UNIVERSITY OF JOS PERMANENT SITE

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ABSTRACT

Buildings consist of sewage systems which help to evacuate unwanted waste. This evacuation can also be referred to as sewage disposal. Sewage treatment also is the process of removing contaminants from wastewater, including household sewage and runoff (effluents). It includes physical, chemical and biological processes to remove physical, chemical and biological contaminants. Efficient sewage evacuation/disposal leads to effective sewage treatment. Its objective is to produce an environmentally safe fluid waste stream (or treated effluent) and a solid waste (or treated sludge) suitable for disposal or reuse (usually as farm fertilizer). With suitable technology, it is possible to re-use sewage effluent for drinking water, although this is usually only done in places with limited water supplies, such as Windhoek and Singapore. All these can only be achieved by adequate sewage system maintenance /disposal. Sewage and effluent can contain a variety of human disease-causing microorganisms and parasites. Disease can be spread to humans from this material by direct contact or indirectly by consumption of contaminated food or water. The safe disposal of sewage and effluent is therefore essential to protect the health of the community. The issue of sewage disposal assumed increasing importance in the early 1970s as a result of the general concern expressed in the united states and worldwide about the wider problem of pollution of the human environment, the contamination of the atmosphere, rivers, lakes, oceans and groundwater by domestic, municipal, agricultural and industrial waste.

Key Words : Building**,** Sewage system, Sewage disposal, System maintenance, Industrial waste

INTRODUCTION

Arun et al. described waste as something that has no value, useless and wants to be discarded by the owner.[1] The scope of sewage management has evolved throughout history with changes in socioeconomic conditions, city structures and the environment. Today, sewage infrastructure that is well planned and operated supports urban sanitation and related activities. Varne and Wagh mentioned that environment pollution is one of the serious problems that the world is facing in this era.[2] Effective sewage management is essential for nutrient recycling and for maintaining ecosystem integrity.[3] Sewage systems are of different types/forms. The nature of sewage system used is highly dependent on the nature and amount of sewage to be disposed or treated. Divya et al., outlined that sewage system is an integral part of inhabited area which transports the effluents of the cities to the remote areas either for treatment or just to be dumped.[4] The main problem of waste management in an African context is however not only brought about by the amount of waste accumulated in our homes but also the incapability of the Government and waste management authorities to keep with the scope of the problem itself.[5] It is clearly understood that could be regarded as waste can as well be valuable to another person and trading opportunity may arise if the cost of transportation of such items does not

exceed the worth as perceived by the intending owner.[6] It has been a theme of interest to many researchers due to the associated hazards resulting from indiscriminate disposal of raw waste and its threats to the health of every community. In general, problems of solid waste management and their solutions are different in Africa and the rest of developing countries as compared to those in developed nations not only on the various differences in their waste composition but also on the standards of waste management services.[7] Couth and Trois further emphasized that integrated solid waste management is one of the most recommended and compatible approach for waste management which provides a framework for the development of a sustainable municipal solid waste service.[8] Moreover it presents a use of various collection, transport and treatment options.[9] Sewage management and waste is one of the three major environmental problems, other major environmental issues include flooding and desertification in Nigeria and many other developing and even developed countries are threatened by this.[10] Domestic sewage results from peoples day-to-day activities, such as bathing, body elimination, food preparation and recreation, average about 227 litres (about 60 gallons) per person daily. Al-Salem and Lettieri outlined that for sewage management system to work effectively there is a need to employ a more strategic, participatory approach that can address social, financial, environmental and also technical issues.[11] Sewage management includes collection, treatment and its final disposal (sewage) so as not to constitute environmental hazards. It embraces all the necessary steps in managing sewage as well as recycling it before disposal. Sewage is generated by residential, institutional, commercial and industrial establishments. It includes household waste liquid from toilets, baths, showers, kitchens, sinks and so forth that is disposed of via sewers. The separation and draining of household waste into grey water and black water is becoming more common in the developed world, with grey water being permitted to be used for watering plants or recycled for flushing toilets, sewage may include storm water runoff. Sewerage systems capable of handling storm water are known as combined sewer systems. This design was common when urban sewerage systems were first developed, in the late 19th and early 20th centuries.[12] Disease can be spread through contact with rodents or insects that receive primary exposure and in turn harbour the pathogens part of these living organisms have through the use of science and technology so altered its life support systems. Bathing in polluted seas causes some 250 million cases of gastroenteritis and upper respiratory diseases every year and many studies shows that respiratory and infections among bathers rise as a direct consequence of increasing amounts of sewage pollution in the water. Anderson explained that solid wastes are discarded or unwanted materials that are generated by house-holds and other sectors like industrial, agriculture, commercial and construction institutions which are dangerous to the people and its environments.[13] The types of wastes generated by human activities are municipal wastes, industrial wastes, agricultural wastes, construction and demolition and commercial and institutional waste. Lastly, Bohra et al. indicated that waste can be seen as items that people discard or throw away because it has hazardous properties and it is of no value.[14]

AIM AND OBJECTIVES

To identify the recent and effective ways of maintaining sewage systems and its proper disposal from buildings with the following objectives. To identify sources of sewage in buildings. To investigate the means of collection, treatment and disposal. To suggest areas of correction that could be employed in buildings sewage system.

MATERIAL AND METHODS

The main instrument used for data collection was structured questionnaire targeted to various respondents. The respondents had been given ample time for completion of the necessary information needed in the questionnaire.[15] A sample size of 35 copies of questionnaire was administered on the facility users. A total of 30 copies of questionnaire retrieved were appropriate for analysis. A formal data collection process was necessitated

as it ensured that data gathered were both definite, accurate and that subsequent decisions based on arguments embodied in the findings were valid.[16]

Inspection and identification of problems

Inspection was done on some of the existing sanitary facilities such as the septic tanks, soak-away pits, drainage pipes, sewers, water closet suits, basins and sewage disposal systems.

The purpose of the inspection was to identify the various sanitary facilities and the sewerage systems as well as to determine their various functions. This would help in the identification of problems hindering the rate of performance of these facilities.[17] It would also help in assessment of the present workability of the disposal systems. As a result of this the problems identified were broken water steel pipes, mended sewage pipes, blockage of some of the sewage pipes, spillage of sewage from broken pipes, blockage of the open sewers, broken water closet suites, unmaintained inspection chambers, blockage of septic tanks, blockage of bathroom sewage pipes, foul odour around some buildings.[18]

Statistical method of analysis

The information from the questionnaires was presented in the form of tables. Pie charts were used for the purpose of the analysis and interpretations of results. The statistical methods used for analysis were the simple percentage and ranking method. These statistical methods were used to test the hypothesis and to develop relationship models.

Simple percentage

This is calculated using the formulae below :

$$\frac{n}{x} \quad x\ 100\%$$

Where n = Number of respondents

x = Total number of respondents

This method is used to analyse the various percentages of the different factors and characteristics of sewage systems maintenance. It also analyses how they are disposed of and how they affect the environment. The highest value is ranked as the first in each of the analysis and follows a descending order.[19-23]

RESULTS AND DISCUSSION

Some of the analysed results are as represented. The respondents living in bungalows had a total number of 13 with a 43% frequency rate, followed by single and multi-storey buildings which had a number of 5 respondents each with its corresponding percentage figure of 17% each. People living in mansions and others had a total of 4 and 3 responses with percentages, 13% and 10% respectively. **(Table 1)**

Table 1 : Types of building

S/N	Buildings	Respondents	Percentage
1	Bungalow	13	43
2	Single-storey	5	17
3	Multi-storey	5	17
4	Mansion	4	13
5	Others	3	10
	Total	**30**	**100**

From the **Table 2** and **Fig. 1**, the number of occupants (6 to 10) had a total of 12 respondents and a 40% frequency which was the highest. Number (0 to 5) had a respondents value of 11 and a percentage figure of 37%, while those in the range of (11 to 15) and (above 15) had 10% and 13% respectively.

Table 2 : Number of occupants

S/N	Numbers	Respondent	Percentage
1	0 to 5	11	37
2	6 to 10	12	40
3	11 to 15	3	10
4	Above 15	4	13
5	**Total**	**30**	**100**

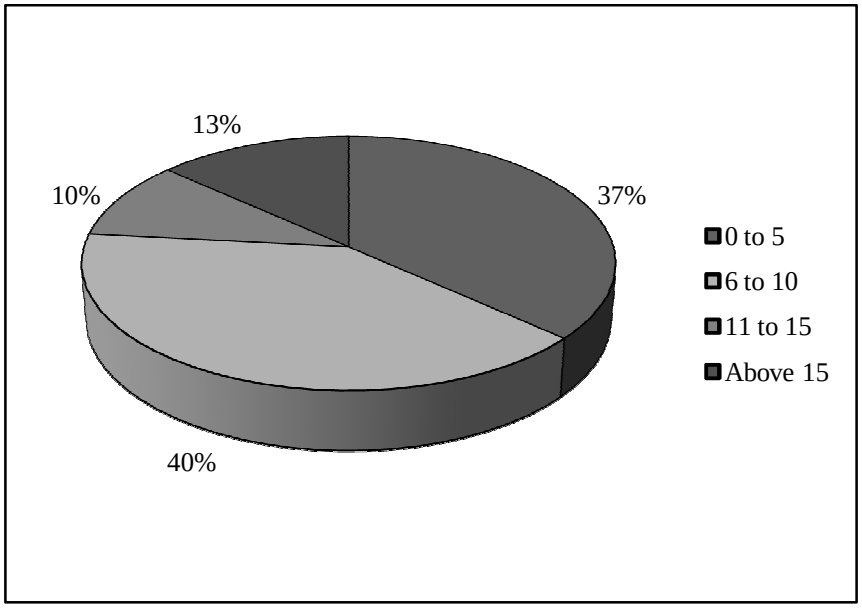

Fig. 1 : Number of occupants

From **Table 3**, with regards to routine maintenance (cleaning period) daily maintenance had the highest of 14 responses out of 30 respondents and a percentage figure of 70% followed by the monthly maintenance with a respondents value of 3 and a percentage value of 15%. Weekly and twice weekly had respondent values of 2 and 1 and equivalent percentages of 10% and 5% respectively.

Table 3 : Sewage system cleaning period

S/N	Cleaning period	Respondent	Percentage
1	Daily	14	70
2	Weekly	2	10
3	Twice weekly	1	5
4	Monthly	3	15
5	**Total**	**30**	**100**

Table 4 indicates that from the total respondents of 25 who have water closet installed, a sum of 11 respondents ranked highest with a percentage figure of 44% for a high level water closet. Low level had a total number of 8 respondents with a percentage figure of 32% and closed coupled with 4 respondents had a percentage figure of 16%. The category others had 2 responses and 8% percentage of the total responses.

Table 4 : Types of water closet installed

S/N	Water closet	Respondents	Percentage
1	High level	11	44
2	Low level	8	32
3	Closed coupled	4	16
4	Others	2	8
5	**Total**	**25**	**100**

Government organisations collects more of the waste with a sum of 13 and a percentage of 43% . Those without any collection had 9 responses with a 30%. The least is the private firm with 8 responses and a 27% figure. **(Table 5).**

Table 5 : Waste collection organisation

S/N	Organisation	Respondents	Percentage
1	Government	13	43
2	Private	8	27
3	Not at all	9	30
4	**Total**	**30**	**100**

From **Table 6** and **Fig. 2**, the frequency of sewage collection of 6months had the highest level of frequency in table 14 above with a sum of 8 respondents and a percentage figure of 27%. Above a year had 6 responses and its equivalent percentage figure of 20% .The least which is yearly had 2 responses and a 7% frequency. Those that had not disposed their sewage got a response of 14 and a percentage figure of 46%.

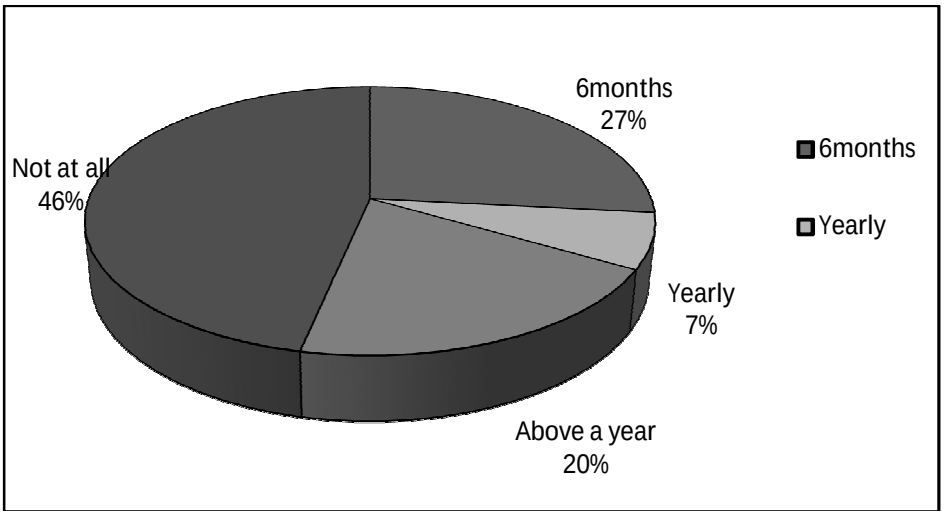

Fig. 2 : Sewage collection frequency

Table 6 : Sewage collection frequency

S/N	Period	Respondents	Percentage
1	6months	8	27
2	Yearly	2	7
3	Above a year	6	20
4	Not at all	14	46
5	**Total**	**30**	**100**

Table 7 shows the rate of problem/s encountered during usage of the sewage system Maintenance had the highest response of 15 and a 50% figure followed by blockage with 13respondents and a percentage figure of 43%. Collapse had the least of 2 and a 7% frequency.

Table 7 : The rate of problem/s encountered during usage

S/N	Problems	Respondents	Percentage
1	Maintenance	15	50
2	Blockage	13	43
3	Collapse	2	7
4	**Total**	**30**	**100**

Table 8 on the causes of problem/s encountered indicates that wrong installation had the highest respondent of 10 and percentage figure of 33%, followed by negligence with 9 respondents and 30% figure. Misuse and over population had a respondents numbers of 6 and 5 with its equivalent percentages of 20% and 17% respectively.

Table 8 : The causes of problem/s encountered

S/N	Causes	Respondents	Percentage
1	Misuse	6	20
2	Wrong installation	10	33
3	Negligence	9	30
4	Over population	5	17
5	**Total**	**30**	**100**

From **Table 9**, the major cause of collapse is mainly the type of soil with a respondent rate of 4 and frequency of 40%. Unknown causes of collapse had a response value of 4 each and its percentages of 40% each followed by improper location and inadequate capacity of 1 with a percentage figure of 10% each.

Table 9 : The causes of collapse

Causes	Respondents	Percentage
I don't know	4	40
Improper location	1	10
Inadequate capacity	1	10
Type of soil	4	40
Total	**10**	**100**

CONCLUSION

This research was carried out at the permanent site, Senior Staff Quarters of University of Jos with particular focus on the maintenance of sewage systems and liquid waste disposal. It also carries information on maintenance of the sanitary facilities and evaluation of sewage maintenance regularity. In the course of this work, it was gathered that the problems of maintenance was inadequate as reported by users and that they had carried out personal maintenance activities on their sewage systems at one time or the other in the past. Most of the residential buildings in the study area did not have maintenance manuals and maintenance standard in accordance with B. S. 3811. With regards to sewage disposal in accordance with B.S. 8005, either one or a combination of problems such as poor construction chambers/tanks, inadequate system operation, poor facility maintenance or irregular-/inadequate repairs should be arrested promptly. With the nature of the soil at University of Jos, erosion had been identified as a major cause of sewer exposure, collapse of septic tanks and soak away pits. It was identified from the data analysis that the existing sanitary facilities were not functioning satisfactorily and as a result of this some of the waste systems were renewed in order to satisfy the user's needs. The systems of sewage disposal in the area were also found to be poor and obsolete. Many reasons (as shown) were found to be responsible for the sewage disposal problems as they contribute to environmental pollution as well as unhealthy conditions for the inhabitants. If such reasons are addressed, the facility performance rate will improve drastically.

RECOMMENDATIONS

There should be a central sewage system plant for the quarters where all liquid waste will be collected to enable easy treatment and effective disposal. The rate of standard potable water supply should be increased to avoid staining and blockage of some sanitary facilities. A maintenance culture should be imbibed as a very important aspect of ensuring proper sewage collection and disposal. A sewage disposal system plan should be made available by the institutions physical facility department. New sanitary facilities should be made available and accessible to the residents to ease replacement of the broken and old ones. Sanitary inspection should be carried out on a frequent basis on both the sewerage systems and the environment to avoid sewer spillage. Standard pipe sizes of good quality should be used for the various drainage systems to achieve durability. All sewage pipes should be buried completely in the soil to prevent breakages. Site and soil investigation/s should precede the design and construction of sewage disposal systems. Soak away pits should be at least three metres away from buildings so that foundations are not affected. They should also be sloped away from buildings to avoid overflowing and flooding. For proper maintenance and maximum performance, sewage systems should be inspected every 3 to 6 months.

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