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Water and Waste Water Management of a Hospital- A Review

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Abstract: ***Water management in hospital can be easily examined as consuming water productively without freezing the functions of the user department. Healthcare facilities are one of the dominant types of facilities which consume an enormous amount of water for their regular operations. Therefore, water management in hospital; should be given an individual consideration in order to withdraw the viable cost of the user facility while contributing to renewable development of the nation. Various policies can be exercised for water management in healthcare facilities to understand on current water management practices which is vital for hospitals to take crucial measures to improve on the current practices. The purpose of this research is that to interrogate on the present water management activities which are carried out in healthcare facilities. The identified actions could be categorised in to as general water management plan and strategies which are distinct to healthcare facilities. Application of this blue print enables the management of hospitals to minimize the defect of their current water management practices and cut down the water consumption of their facilities by an appreciable amount. Wastewater management in hospital can be easily examined as wastewater discharged from hospitals has been suspected to contribute significant loads of contaminants pathogens such as antibiotic resistant bacteria in municipal wastewater.***

Keywords: Water management, healthcare facilities, enormous, user facility, renewable, blue print, wastewater management, antibiotic resistant bacteria.

1. Introduction

Water is a critical utility in a hospital. Water supply to hospital has to be properly planned, executed and operation and maintenance has to be assured. In a semi arid zone such as Nagpur, water quantity also becomes critical. Hospitals require relatively large quantity of water and also quality of water is equally critical CPHEEO Manual prescribes the following quantity of water.

Hospital (including laundry) per bed:-
1. Number of beds exceeding 100 = 450 litres per head per day.
2. Nurses/ staff quarters = 135 litres per head per day.
3. Minimum hot water requirements = 45 litres per head per day.

So far as quality is concerned water supply should meet drinking water quality criteria prescribed by IS 10500:2012 because it is this water which enters the distribution system till it is used for dialysis or surgical or any section which requires more stringent water quality.

All Hospital or Residential Complexes requires assured water quality. Also domestic water supply should need water to meet drinking water quality as per IS 10500:2012.However Hospital needs a part of its water supply to meet standards for drinking, Dialysis or for operation theatres. The latter two have to meet standards laid down by **Medical Council of India.** It was decided to examine prevailing water supply system in a hospital in Nagpur.

Reliability of water supply to hospital will depend on incoming water quality, equipment and system design and operation & maintenance. Uses of water in a hospital will be for drinking, dialysis and operation theatres. Therefore, microbial quality, chemical acceptability especially hardness & iron are typical parameters. Equally important will be the management of waste.

Water Management Plan: By acquiring following water management practices, we can reduce the water load of campus:

1) Water Conservation: Water conservation needs to be addressed through the 3 environmental R's:
   - Reduce:-Reduction in water usage is the first step in water conservation as it is the most important factor in using water more efficiently.
   - Reuse:-We can also reuse water that has already been used once. It has be done by reuse of less contaminated water like shower water.
2) Recycle:-The treated /recycled effluent from STP can be used for gardening, toilet, road washing etc.
3) Meter /Measure/Manage: - Metering and gauging helps us in evaluate the facility water usage and appropriate management of mechanical equipments which outcomes in higher water efficiency.
4) Enhance sanitary appurtenances (moisture less urinals, less flow toilets, spout flow control).
5) Use of waste water generated from the hospital shall be treated and reuse.

2. Literature Review

1. Wagner JM, Shamir U and Marks DH. (1988): Water distribution reliability: Analytical methods. This study emphasizes and examines the water management practices of health care facilities. Health care facilities are the major facilities which consume gallons amount of water in their daily operations. Hence, water management facilities in the health care centre should be given the special attention to

minimize the operation cost so as to obtain the sustainability development of the country so that to treat and reuse the waste water in a very eco friendly way so not to dispose the waste water into an open environment or end recipients so as to approach towards sustainability of the nation.

2. Morris Israel and Jay R. Lund (1995): Recent California Water Transfers Implications for Water Management: - This research study emphasize about the 1991 and 1992 California Drought Emergency Water Banks which were the first big water transfer programs in the nation in which the State provided as the leading broker for water trades. Despite the State-sponsored Water Banks have drawn across the board attention, there have been a high figure of water transfers and exchanges taking place in California individually of the State. This paper throw spotlight on California's recent experiences with water transfers, and pitch a series of potential lessons for federal, state, and local managers for integrating water transfers in divisionally water resource systems.

3. Jonathan Parkinson and Kevin Taylor (2003): Decentralized waste water management in peri-urban areas in low-income countries: - This study outline the work on peri-urban areas in low-income countries, traditional integrated approaches to wastewater management have generally failed to address the demands of communities for the collection and disposal of domestic wastewater and faecal sludge from on-site sanitation. There are favourable circumstances to perform wastewater management systems based on a separate approach that may offer good fortune for wastewater re-use and resource recovery as well as improvements in divisional environmental health conditions.

4. AR Mesdaghinia, K Naddafi, R Nabizadeh, R Saeedi and M Zamanzadeh (2009): Wastewater Characteristics and Appropriate Method for Wastewater Management in the Hospitals: - This research paper bare facts about hospitals generate relatively huge quantity of wastewater that may consists of several potentially hazardous materials; therefore the appropriate management of hospital wastewater is important. In this representation study, the quality and quantity of wastewater in the hospitals of Tehran, Iran, were examined and the suitable method for wastewater management in the hospitals was resolved. Monitoring of pH, TSS, BOD_5, COD and total coli forms marked that the quality of wastewater in the hospitals was identical to domestic wastewater. The study points about the wastewater treatment and disposal methods which release into the municipal wastewater collection system and is the leading alternative for wastewater management in the hospitals.

5. Kholoud Al-Ajlouni, Saleh Shakhatreh, Nuha AL-Ibraheem and Musa Jawarneh (2009): Evaluation of Wastewater Discharge from Hospitals in Amman – JORDAN: - This study gives out the framework of the hospital waste management which is a very pivotal function which is to be carried out as per environmental and public immunity issue. This paper also outlines that the release of water which is primarily dawn from groundwater and rivers leads to contamination if it is not treated properly. It also points out about the health care centres deplete a big volume of water each day and brings about numerous amounts of contagious and toxic water which is being liberated to the conduit. These contaminants should be given treatment in waste water treatment plant of each heath care centre before it is discharged to the municipal sewerage system.

6. Badejo A. A, Coker A. O. and Sridhar M. K. C. (2011): Tertiary Hospital Wastewater Treatment using Reed Bed Technology Planted with Vetiveria nigritana benth and Phragmites karka retz: -This research study emphasize about the Tertiary hospital wastewater in Nigeria which pose a risk to public health due to lack of treatment. Reed bed technology using regionally available macrophytes which restraint excellent potential for biological wastewater treatment. Taking account into Vetiveria nigritana and Phragmites karka in CW for the elimination of organic and inorganic pollutants from tertiary hospital was therefore investigated. Characteristics of wastewater such as pH, NO_3, PO_4 and NH_3 contents, SS, BOD, DO from the University College Hospital, Ibadan were evaluated using American Public Health Association's (APHA) methods.

7. Stephen Obekpa Abah and Elijah Ige Ohimain (2011): Healthcare waste management in Nigeria- A case study: - This research paper trace facts about the hospital waste consist a certain category of waste because they contain probably harmful materials. This study approach involved the estimation of the quantity of HCW achieved, estimation of the waste segregation practices and determination of the knowledge of hospital workers in relation to HCW management. Daily waste stock of each ward was estimated. A judgement status of the waste management practice in the hospital was created using the following norms: waste management; waste transport; waste recycling and reuse.

8. Jafrudeen and Naved Ahsan (2012): Study of widely used Treatment Technologies for Hospital Wastewater and their Comparative Analysis: - This paper summarize about the work carried on hospital wastewater which contains several potential hazardous materials. Certainly hospital wastewater may have a detrimental impact on environment and human health. Therefore, the selection for relevant treatment technology and appropriate analysis of hospital wastewater is necessary. This study points about an experimentation work which reveals that pH, BOD, COD, TSS and total coli forms indicated that the quality of hospital wastewater is parallel to medium values of the domestic wastewater. Effluent release or re-use after suitable treatment safeguard an environment and public health, ruling administration shall have to accustom integrated wastewater management approach, monitor and impose existing current standards and also if require can generates new guidelines or schemes or standards.

9. Md.Zafar Equbal and Chamundeeswari (2012): Wastewater Management by Root zone Technology: - This research work underline about Root Zone treatment is an engineered mechanism by filtering wastewater as it passes through synthetically constructed wetland area. It is expressed as an efficient and reliable secondary and tertiary treatment method. The contaminants are ejected by various physical, Chemical and biogeochemical processes like

sedimentation, absorption, and nitrification likewise through uptake by wetland plants. Root zone systems are proclaimed well enough for schools, hospitals, hotels, and for minor communities. The objective of this pilot research design is to study the performance of the wetland plant Phragmites Australis in the treatment of wastewater generated in the SRM University premises.

10. Dohare S, Garg V K and Sarkar B K (2013): A Study of Hospital Waste Management status in Health Facilities of an Urban Area: - The Purpose of this research paper is to highlight certain aspects about hospital waste management status in health facilities providing health care in an urban area. This study is focused on awareness of health facilities about CPCB rules, hospital waste management background status, maintenance records and accident reporting system and proper dumping of hospital waste. It was noticed that of the 71 hospitals under study, only 42.2% health care facilities were registered with State Pollution Board for biomedical waste management and 46.4% study units were awake of existence of Central Pollution Control Board Rules on Biomedical Waste Management. Hospital waste management affairs remain a challenge which yet to be mark as the current study which reveals total deficiency in most of the hospitals.

11. Mirat Ahmad and Dr. Gauhar Mehmood (2013): Resolving Seepage Problem and Ground Water Management at Kanshiram Multi speciality Hospital: - This article explore about the availability of groundwater which is neither extensive nor protected from deterioration, in most of the occurence the extraction of excessive quantities of ground water has resulted in drying up of wells, damaged ecosystem, land subsidence, saltwater intrusion and depletion of resources. This paper deals with the problem that was prevailing in Kanshiram hospital due to shallow ground water level. Therefore, this paper highlights the rectification of the seepage problem and proper groundwater management in terms of qualitative and quantitative potential of Kanshiram Multispecialty hospital.

12. Prayitno, Zaenal Kusuma, Bagyo Yanuwiadi and Rudy W Laksmono (2013): Study of Hospital Wastewater Characteristic in Malang City: - This work audit about the hospital wastewater which involves contagious, pathogens, toxic, biodegradable and radioactive foreign matter that can cause infection and pose health issues. The presence of the hospital adjoining to the residential potential to cause environmental problems as a result of waste released into the surroundings. The aim of study was to determine the waste water characteristics and adequacy of hospital wastewater treatment plant (WWTP) in Malang City. The samples seized at the WWTP influent and effluent and then calculated pollutant concentration using APHA method and compared with a standard. The study also mark out that the characteristics of the wastewater effluent at three hospitals in Malang City consist of contaminants which had out reach the quality standards.

13. Ablilash Rajendra and Ramu (2014): Bio-Medical Waste Management in the Local Planning Area of Mysore City: This work Investigates about the biomedical wastes which comes under the hazardous wastes. Such waste requires proper disposal subjected to composting, land filling etc. The current study accord with the methods of managing the medical wastes at the hospitals in the Mysore city so that without posing a serious threat on human health and environment. Persistent training should be in builted to the staffs revealing about the handling and disposing these wastes and forceful instructions should be followed by the management would help to manage these wastes.

14. Abolfazl Rahmani Sani and Fateme Dareini (2014): Treatment of Hospital Wastewater by Vetiver and Typical Reed Plants at Wetland Method: - This work interrogate about the lack of water crisis has been advised as a large problem in many countries. In this line, using the naturally or artificially refined wastewaters in agriculture and other related applications has been offered as an essential and practical result to solve the problem. The natural method of cleaning has been an appropriate method corresponding to other refinery methods. This method is applied naturally by means of artificial reed. This method has positive advantages such as low cost, easy management, low technology required, low energy consumption.

15. Asante OB, Yanful E (Prof.) and Yaokumah EB (2014): Healthcare Waste Management, Its Impact- A Case Study of the Greater Accra Region, Ghana: - This study explore about the hospital waste management which is an acute important environmental and public safety issue, due to the waste's contagious and toxic character. In later years, hospital waste management has become a newborn issue of concern with the rising evidence suggesting physical hazards related to health care waste expose upon the service providers, patients and the community as a whole. Ghana, a developing country, has insufficient data on the healthcare waste generated, how it is handle, and its disposal. The study involved about 120 healthcare centres in that sphere. Comparing the finding of the waste generation rate to other studies Greater Region of Ghana has a much greater generation rate of healthcare waste.

16. Maamar Yagoubi, Mohammed El Morhit, Kenza Dahani and Mimoun Zouhdi (2015):- The microbiological quality of water in IBN SINA Hospital of Rabat (Morocco):- This study outline the work on water is an important commodity for the functioning of hospitals, but it can be a source of serious infections in case of epidemic, especially for the most weak patients. This is an anticipated and diagonal study over an age of three months in the bacteriology laboratory of the IBN SINA Hospital in Rabat, which desire for bacteriological analysis of four types of water collected in the services in our study. In case of unusual results, effective corrective action must be carried out to develop water quality and guard from harm the feeblest patients.

17. N. O. Ahmed, A.O. Ahmed, G.A. Gasmelseed and A. A. Jalil (2015): Assessment of Wastewater Management in Khartoum State Hospitals: - This article delivers about the assessment of wastewater management extensively and in particular in Khartoum state hospitals, is of predominant concern due to its effects on surroundings and public health. The assessment is undertaken mainly to establish an efficient management system in Khartoum state hospitals. Samples

were seized from six hospitals, for analysis, inspection and assessment. Lean on wastewater quality parameters which are the total Suspended Solids, Chemical Oxygen Demand, Biochemical Oxygen Demand, Dissolved Oxygen, pH, Electric Conductivity and Total Coli form, high infection load of hospital wastewater were driven.

18. Umadevi V (2015): Fenton Process: A Pre-treatment Option for Hospital Waste Water: - This study outline the work on leading oxidation process which includes Fenton, Photo Fenton processes etc. Such Processes contribute to a assuring mechanics for the treatment of waste water. Such operation points out about the short reaction time amongst all the foremost Oxidation Processes. In above techniques Fe & H_2O_2 are the two basic chemicals have been incorporated. The above system leads to the isolation of the oxidant and the composition of the hydroxyl radicals which damage the organic pollutants to reliable compounds.

3. Conclusion

Healthcare facilities have a huge responsibility for properly monitoring their own water consumption and contributing to minimize the crisis for water. Therefore, water management strategies are required for healthcare facilities in order to ensure an effective and efficient usage of water

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