# WATER AND SANITATION IN HOSPITALS INTEGRATED ENVIRONMENTAL MANAGEMENT A SERIOUS FORGOTTEN ISSUE

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## **ABSTRACT**

Water and sanitation in hospitals are a serious forgotten issue. Water quality impacts the performance of the hospitals and its deterioration leads to drastic health service deterioration affecting infection control programs, occupational health and safety of the workers as well as the safety of the hospital buildings and its anticipated life service. The integrated environmental management in hospitals is a tool to secure controlling all indoor and outdoor environmental conditions where water and sanitation is one of the pivotal issues to be addressed by the system. Water quality monitoring and set of treatment methodologies will improve the service quality. The paper is addressing the system components starting with top management commitment and its extended benefits to the serviced community and their participatory role. The system is a mechanism of radiating environmental health awareness including water quality and proper sanitation for the community.

#### INTRODUCTION

Integration of the environmental health dimension in managing hospitals and health care centers in developing countries is getting to be a must for them to achieve efficient infection control measures, occupational health and safety of their working staff, proper disposal of their infectious wastes, and optimize their use of water, energy and medical supplies to insure sustainability of their services.

In Egypt the Environmental Law was imposed for actions by different ministries starting in 1999. The law mandates all industries and large establishments dealing with people to implement the law through adoption of integrated environmental management schemes to be set up in collaboration with those establishments.

Water resources and wastewater generated from any community centered activity is an important integer of its role in integrated environmental management. In Egypt as well as many developing countries, the quality of water used in hospitals is one of the

most forgotten issues and it is always taken for granted as pure and suitable for use once received from municipalities. Deteriorated water quality often makes water treated by the conventional methods unsuitable for use in hospitals. The quality of water used for doctors scrubbing their hands before medical operations may not be suitable but on the contrary can cause infection to patients because of unacceptable levels of bacterial contamination and the presence of infective stages of parasites. Water contamination can take place when it passes through un-maintained pipe networks and storage in roof tanks.

Contaminated water used in the kitchen for washing and preparing freshly served foods can be a cause of serious gastrointestinal ailments. Water with high hardness and with iron and manganese content creates scale formation in autoclaves used in central infection control units leading to low efficiency in disinfection of operating theatre tools and equipment. It can also create a problem for the laundry operations leading to unacceptable levels of whiteness and as a result the laundry operators may need to use high cost chemicals to remove stains and obtain proper texture for the sheets, towels and surgery cloths.

Badly designed water distribution system with many dead ends can enhance the growth of legion Ella bacteria, which can lead to the death of patients especially immunosupressed patients with organs transplants.

Insanitary discharge of the wastewater generated in medical health care centres through the use of a poorly designed collection system is usually one of the serious contamination sources in those centres. Uncovered drains in bathrooms, central sterilization units, small-scale surgical operation rooms, nurseries for immaturely born children, haemodialysis rooms and kitchens can be the source of cockroaches which emerge during the night, ruining all efforts of infection control in those critical areas. Badly maintained collection system can cause cross contamination for the water distribution system in the hospital.

In Egypt, public as well as private owned hospitals are seeking to improve their health care services. The Ministry of Environmental Affairs in collaboration with the other ministries in the government has started to develop environmental management schemes designed to ensure proper quality control. As a consultant to the Minister of Environment the author was able to develop the integrated environmental health management (IEHM) scheme in collaboration with the Ministry of Health and Population. The scheme is now adopted by the general organization for hospitals and research center as a leading organization responsible for medical research in the Ministry of Health. In order to achieve this goal the environmental dimension was seriously considered in upgrading all the 17 affiliated hospitals and medical research centers. Water and sanitation upgrading is one of the issues seriously considered in order to achieve the anticipated improvement. The general organization did have a department for infection and environmental sanitation control. The IEHM was introduced to the unit members as a scheme to ensure health care quality through the control of indoor and outdoor environmental factors affecting the quality of personnel performance, equipment and supplies consumption. The system has been introduced three years ago and it is now receiving increasing interest from hospitals not affiliated to the organization.

## **COMPONENTS OF IEHM SCHEMES**

Components of the system are shown in Figure (1). It also shows the sequence of events to be carried out by the hospital management to ensure minimal negative impacts on the environment especially in metropolitan areas where air and water pollution is causing a financial burden on hospital budgets that have to cope with the proper sanitation and infection control measures.



Figure (1) Steps of Adopting IEHM

# APPROACH TO WATER AND SANITATION IMPROVEMENT:

Integrated environmental health management schemes call for top management commitment to adopting the system. It needs a highly supportive mechanism for securing proper infection control, resources conservation, and occupational health and safety of the medical and non-medical supporting staff such as those working in the central sterilization unit, food preparation areas, laundry and engineering sector handling the operation and maintenance of new diagnostic equipment. Training programmes were therefore conducted for top management personnel to achieve their support. Specially tailored programmes for the different categories of working staff

were also conducted to gain their support for the system as a protective system for themselves first as well as for the patients served.

Water and sanitation issues were an important focus among the issues considered for infection control and hazardous waste management to ensure their protection. Increasing levels of infectious Hepatitis A and gastro-enteric diseases in hospital staff made the advocacy for better operating water and sanitation systems easily accepted.

The IEHM scheme calls for frequent auditing of several hot spots in the hospitals and research institutes by means of a high calibre personnel in the hospital with the help of well-trained environmental health officers. This group is required to prepare an environmental register for the hospital as mandated by the law. The group has to be led by the general manager of the hospital and the environmental officers have to report directly to him between meetings of the group in case of urgently needed corrective interventions.

An environmental auditing group needs to be formed in each hospital. It should comprise the hospital department heads, a senior nurse, the operation and maintenance senior engineer, an appointed environmental health officer (with advanced degree in hospital environmental sanitation or equivalent), the financial and purchase departments heads and the occupational health and safety officer.

Water treatment in the hospital using filtration followed by ultraviolet disinfection is a recommended technique for upgrading the quality of the water flowing in the distribution system. Starting with better quality water reduces the operating and maintenance cost of kidney dialysis units, water softening for boilers, central sterilization units, laundry equipment and large-scale cooking equipment.

The infection and environmental health control department of the general organization for hospitals and research centres is responsible for checking on the performance of hospitals affiliated to it every month. It also follows up on the hospital performance while adopting the scheme and pin points any apparent deficiencies in the system. Reports on each hospital are prepared and sent to the general director of the organization to issue decrees for corrective measures. The author in collaboration with the general organization was able to examine the hospital records and made calculations based on the collected data for the economic benefits of adopting the system. Table (1) gives an overview of the anticipated and achieved savings from upgrading water quality of the Egyptian hospitals

Re-modeling and engineering changes were conducted with the financial support given by the general organization for hospitals. Every hospital was able on a planned period of time to prepare a plan of action based on the audit activities and secure their needed funs.

Table (1) Hospital operational problems created by deteriorated water qualities

Hospitals location	Water problems to be solved	Adopted solutions to the problems	Period of pay back and financial resources generated to cover the cost of investment.*
Metropolitan area utilizing city water system	<ul> <li>Increasing levels of water contamination due to deteriorated city water distribution system</li> <li>Un-maintained and infrequently cleaned and disinfected water roof tanks</li> <li>Deteriorated water distribution system in the hospital</li> </ul>	<ul> <li>Install water treatment unit at the outlet of the roof storage tanks</li> <li>Install mobile washing and disinfecting unit to frequently clean roof tanks</li> <li>Install proper sealing and closure of the tanks.</li> </ul>	Two years from savings in patients drug use, reduced medical treatment cost, reduced paid working sick leaves of workers due to gastro-enteric troubles**, reduced biological filter consumption rate in hemodialysis units
Suburbs of metropolitan area utilizing both ground water sources to supplement encountered deficiencies in city water supply	<ul> <li>High concentrations of calcium and magnesium hardness 500- 700 mg/litre as CaCO3, high concentration of iron and manganese (triple the permissible allowed concentrations) in addition to the above mentioned problems</li> <li>High concentrations of total dissolved solids in the range of 1000mg/L creating problems in all boilers, sterilization autoclaves, washing machines, ironing machines, increasing rates of regeneration cost of water dialysis units,</li> </ul>	Installing cation exchange unit with pressure pre-filtration and UV disinfecting unit	About 3 years by the savings from reduction in cost of scale removal from boilers***, central sterilization units, laundry equipment frequent maintenance, reduction in cost of dialysis units regeneration, cost of washing chemicals added to remove iron and manganese spotting and those used to improve laundry quality because of water hardness.
Rural area where the main source of water was underground wells	<ul> <li>High concentrations of total dissolved solids due to salt water intrusion 700 – 800 mg/L.</li> <li>Biological contamination due to mixing of effluent from surrounding residential area latrines with the withdrawn water</li> </ul>	A water filtration unit followed by UV disinfection. The treated source of water was softened to reduce its hardness content before feeding the boilers, central autoclaving sterilization system, the water distribution system was totally renovated to remove biological contamination of the old piping.	The system is newly installed so the payback period is not yet estimated; savings as in the previous case are anticipated.

Data reported in this table is based on recorded data in purchase documents, consumption records for drugs and medical supplies. Periods of pay back were calculated based on the reduced cost recorded for purchase of drugs, reduced cost

of needed spare parts and maintenance periodicity as well as costs previously paid for outside services of sister hospitals needed when major laundry problems occurred because of poor quality water.

- Reduction in sick leaves was estimated from personnel attendance records as gastrointestinal troubles was related to improved water conditions since all conditions did not change and water quality improvement was the only introduced variable.
- \*\*\* Yearly cost of renovating highly corroded and scale covered parts of the boiler house was very high and drastically reduced by improving the feed water quality

Monitoring is an important part of the IEHM to assess both the impact of the indoor and outdoor environment on the performance of the hospitals. Water quality was assessed before and after the interventions installed to improve the quality of water and continuing checks ensure quality is maintained and other preventive measures are carried out to protect both the staff and patients from most of the diseases previously suffered.

Wastewater monitoring was carried in gynecological hospitals to ensure placenta are not disposed of in the sewer system causing its frequent clogging and hence necessitating the entrance of sanitary workers with their highly contaminated equipment in the hospitals to fix the problem. Other hospitals discharges were also monitored to ensure frying oils from the kitchen are not disposed of in the hospital sewer network. Kitchen staff are requested to collect the used oils to be sold to soap manufacturing plants. Kitchen drains were all covered with small aperture screens to prevent food residues from going into the sewer and also to prevent cockroaches and insects from coming out of the drainage system during the night into the kitchen area.

According to auditing and monitoring results of different hospitals indoor and outdoors environments a valuable corrective action plan has been developed where corrective approaches are adopted. Prioritization within the proposed plans was decided based on the severity of the impact created by the source of infection and/or enhancing infection. Accordingly water and sanitation improvements were always considered among the first to be implemented after showing their serious impacts on spread of infection and stressing to management the incurred cost based on financial calculations.

Community participation within the management schemes of hospitals is a vital component to secure the sustainability of the system. Audio-visual TV presentations are prepared to show the patients' visitors and outpatient clinic users the importance of water quality as a source of escalating health problem. Some hospitals have closed circuit TV (cctv) which was used to show these presentations as they educate society, especially women, in their anticipated role in ensuring the cleaning of their house roof tanks to avoid deteriorated water quality impacting especially on children and

older people. Hospitals are acting as a source of knowledge dissemination, especially to poorer categories of society who may not have a good educational background.

# CONCLUSIONS AND RECOMMENDATIONS

Water quality is a vital factor to be monitored so closely in order to achieve best quality services in hospitals and health care centers. Infection control programs are controlled by the water quality supplied in hospitals. Sanitation systems also need serious consideration for appropriate design for operation. In order to implement an integrated environmental management system that is needed for achieving hospitals accreditation, water distribution system components should be under continuous monitoring and updating to overcome all potential problems emanating from system deterioration. Accordingly the following recommendations should be adopted:

- Monitoring the water supplying system and its suitability for the different water uses in the hospitals is a must to insure efficient infection control programs.
- In rehabilitating old hospitals the closed water system circulation should be applied if possible as this design will avoid the presence of dead ends and so minimize growth of bacteria specially Legionnaire bacteria.
- Water and sanitation systems operation, and problems arising from infrequent maintenance and monitoring should be an indispensable component in training programs about infection control and integrated environmental management offered to the staff.
- Cost of water treatment for improving its quality to match the different water uses in the hospital is always paid back from operational savings and cost reduction in the cost from lower cross infection rates which are translated into lower medical treatment cost and less paid sick leave for staff.
- Hospitals should offer the service of community participation and awareness with respect to relation of health problems and water quality and the role anticipated from the community to overcome those problems.

#### REFERENCES

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### Note/s

This paper data is based on unpublished financial data gathered at the General Organization for Hospitals and Research Institutes, Cairo, Egypt.