

**THE REMOVAL OF WASTEWATER FROM HEALTHCARE UNITS –  
MONITORING STRATEGIES AND RISK ASSESSMENT**

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**Abstract:** This study aims at presenting both data on the biological, physical, chemical and ecotoxicological characterisation of the hospital wastewater before their discharge in the municipal sewage system and their effects as well as those of the pharmaceuticals and disinfectants on the urban wastewater system and on the environment. In addition the paper allows identifying some environmental stressors released by hospital activities. This knowledge is important both for risk assessment and risk management related to hospital effluents.

**Keywords:** wastewater, hospital, monitoring, risk

### **1. Introduction**

The hospitals generate hybrid wastewater, at the same moment domestic, industrial and effluents of care and medical research. While the domestic water consumption is an average of 100 l/person/day, the hospitals use a much greater volume of water, varying between 400 - 1200 l/bed/day, which is accompanied by a significant volume of wastewater loaded with microorganisms, heavy metals, toxic and radioactive elements [1, 3, 5].

### **2. The characteristics of hospital wastewater**

*The microbiological risk.* The concentration of bacterial flora in hospital wastewater varies between  $2.4 \times 10^3$  /100 ml and  $3 \times 10^5$  /100 ml, being smaller than those of the municipal sewage system [2]. Recent studies [6] emphasized the presence of germs having acquired the characters of resistance in antibiotics. The markers of viral contamination of surface water, such as enterovirus and adenovirus, were identified in hospital effluents also. The presence of high-quantities of enteroviruses is deeply correlated with other viruses. The viral and bacterial contamination of wastewater is variable upon the hospital activity prophyle (higher in infectious diseases units and tuberculosis sanatories), being heterogenous upon hour, day of prelevation and wastewater flow.

*The chemical risk* is generated by the pharmaceutical and disinfection substances daily used in medical activities. In hospital wastewater, high concentrations of chlorine compounds, even of heavy metals as mercury and silver, were found [1,2,4].

*Radioactive elements.*  $I^{131}$  administrated by oral way is rejected 60-70% in urine. The current doses for thyroid carcinoma may vary between 100  $\mu$ Ci in diagnosis and 100 mCi in treatment.  $Tcm^{99}$  and  $Tl^{201}$  were identified in hospital sewage system. Radioactive pollution studies of water ecosystems [4] have demonstrated for some radioelements the biomagnification phenomenon upon aquatic fauna and flora.

#### **4. Impact of hospital wastewater upon urban sewage system**

To prevent the overloading of treatment processes, the maximal efficiency threshold of the purification station must be established upon the following parameters: the flows of liquid effluents ( $m^3/s$ ) and their superficial charge or the pollutant charge on the surface unit ( $m^3/m^2/s$ ). The hospital effluents have generally a lower microbiological load due to the systematic use of the disinfectants [2,5]. These bactericides may have a negative influence upon the biological processes carried out at wastewater treatment plant. To prevent the overloading of processes carried out in wastewater treatment plant it seems important to consider upstream treatments of hospital wastewater before their discharge in the municipal sewage system. If the degradation of pollutants is not achieved, the risk of pollutant's persistence in the environment for a long period of time occurs, and can represent a risk in short, middle and long term for the living species of the ecosystems.

#### **5. Monitoring strategies**

As generating and removing of hospital liquid wastes represent a domain of increasing interest, the following monitoring strategies in the field are suggested:

- The hazard identification through a quantitative and qualitative assessment of all products used in a given time (e.g. one year) by all medical units. All departments will be involved including the pharmacy, the financial, the technical, the research service for a complete registering of chemicals, drugs, radioactive, cleaning, disinfection products.
- The assessment of existing risks using the classes of risk delivered by the labels (e.g. flammable, toxic, corrosive, irritating etc).
- The precise description of using conditions in every service (the quantities used yearly, the discharged quantities, the possibility/impossibility of recovery)
- The assessment of discharge circuit. Depending on the risks a pre-treatment of the wastes may be imposed. It may be physical (e.g. the electrolysis for silver salts recovering) or chemical (e.g. the neutralization of antimetabolites).
- The decision is taken depending on the informations gathered in the previous steps. The decision will state precisely the discharging methods, the control points, the frequency of sampling and the specific monitored indicators.

**6. Conclusion** The problem of the wastewater discharge represent a major concern for hospitals and a challenge for public health. A specific and rigorous monitoring and control program must be developed to avoid the risk for human health and to preserve the ecosystems' integrity.

#### **References**

1. Curşeu D., Popa S., Cristea C. (1999) "Cadmium levels in surface and ground water in Copsa Mică" - *Jurnal de Medicină Preventivă*, Iaşi, vol. 7, nr. 1, 34-44
2. Emmanuel E., Blanchard J-M. (2001) "Caractérisation chimique, biologique et écotoxicologique des effluents hospitaliers". *Rev. d'écologie industrielle*, 22, 31-33
3. Girard R., Monnet D., Fabry J. (1993) „Alimentation en eau à l'hôpital, les eaux usées à l'hôpital-Guide technique”, Edition Fondation Marcel Mérieux, 206 p.
4. Halling-Sorensen B. (2000) "Occurrence, fate and effects of pharmaceutical substances in the environment - A review", *Chemosphere*, vol. 36, 2, 257-266.
5. Leprat P. (1999) "Les rejets liquides hospitaliers, quels agents et quelles solutions techniques?"Troisième journée du Réseau Régional d'Hygiène de Basse-Normandie
6. Stelzer W., Ziegert E., Schneider E. (2001) „The occurrence of antibiotic resistant microorganisms in wastewater”, *Zentral Mikrobiol.* , vol. 240, 283 – 292.