

Wastewater plants evaluation and optimization using radioactive tracers

L. E. B. Brandão¹; C. M. Salgado¹; A. C. H. Nascimento¹; R. C. Nunes¹
e-mail: brandao@ien.gov.br

¹ Division of Radiopharmaceuticals – IEN

Keywords: radioactive tracers, wastewater treatment

The basic purpose of a wastewater treatment plant (WWTP) is the removal of materials suspended or dissolved in liquid phase (floating and settleable solids, organic and inorganic contaminants and pathogens.). Numerous and equally important aspects must be considered when designing and operating a WWTP: degree of treatment and physical-chemical characteristics of the effluent; dilution and self-purification capacity in the point of releasing of treated effluent. Knowing the operating conditions of a typical unit has a fundamental importance.

Due to the large number of variables involved, the analytical solution of the hydrodynamic behavior in the various systems is extremely complex and leading to solutions that do not always describe the real situation, especially for units with longer usage, where the wear and tear, absence of periodic maintenance, all of this alter the conditions of the project and reduce the efficiency of wastewater treatment.

Using radioactive tracers is possible to obtain specific information about the behavior of the various units of a WWTP by stimulus/response methodology. Using a small amount of material marked with a specific radioactive isotope which was injected into the system (same main

characteristics of the population) and its displacement being monitored at specific points by radiation detectors is possible to study the behavior of the entire unit. In our laboratory, the following studies have been developing:

- The elaboration of the TRACERWATER program for analysis of the Residence time distribution curves (RTD) of sewage treatment plants;
- The design and the manufacture of submersible and waterproof unit detectors NaI scintillator made all in PVC;
- The development of methods for labeling compounds present in sewage (liquid and solid) with radioactive isotopes: $^{211\text{m}}\text{Ag}$ and ^{140}La for solid phase; ^{82}Br , ^{123}I aqueous phase and organic phase;
- Drawing up the program STATMOMENTS for the evaluation and identification of operational failures of a WWTP tank using the technique of injection a radioactive tracer and the Laplace's transform deconvolution technique for input and output functions registered by de NaI scintillator detectors;
- Development of methodology for assessing equalization tanks, sedimentation tanks and flocculation tanks using radioactive tracers and measuring characteristic parameters of these tanks. Applying this methods is possible the identification of operational problems such as dead volume, retention areas and channeling.