



Potable water security assessment – a review on monitoring, modelling and optimization techniques, applied to water distribution networks

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ABSTRACT

The paper tries to investigate some of the most important issues that need to be addressed to provide an integrated system for potable water security, in developed countries. It can be understood that in developing countries both supplied water quantity and quality are important for water security. According to the US Environmental Protection Agency, “water security is defined as prevention and protection against contamination and terrorism.” Water quality safeguarding has been addressed by many researchers during the last decades trying to define ways to ensure water of proper quality for the public. As unexpected contamination events may occur in water distribution systems, early warning systems providing the water managers with enough time to act effectively need to be developed. These systems should include interconnected: (a) monitoring tools to monitor in real time at least the most crucial water quality characteristics; (b) modelling tools to simulate the transport of any harmful contaminant and calculate the variations of its concentration; and (c) optimization tools to define the optimal locations and density of the monitoring sensors and disinfection stations. The drinking water supply system addressed in this paper consists of the supply system after the water treatment plant and until the consumers’ taps, with special emphasis on the water distribution system. Drinking water security is addressed in cases other than normal operating conditions. Specifically, the paper examines contamination phenomena due to operational failures (e.g., during the disinfection process), natural disasters, pollution accidents and malicious actions. Contamination phenomena due to other factors, such as lead contamination are not included in this paper. It reviews the literature on monitoring, modelling and optimization techniques used in water distribution systems while at the same time proposes an integrated approach consisting of risk assessment methods and the use of “simheuristics” to deal with drinking water security.

Keywords: Potable water; Quality; Safety; Security; Disinfection; Optimization; Modelling

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