

# Smart-monitoring system of the water supply network and the quality of transported water

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**Abstract** – *The problem of water quality change in the distribution network of the centralized water supply system in the city of Lviv is considered. To prevent the deterioration of the drinking water quality the introduction of modern systems of monitoring and modeling of water quality change in the distribution network is recommended.*

Keywords – drinking water, quality, monitoring, modeling, distribution network

## Introduction

The sources of water supply in Lviv are underground aquifers. Previous research has been established - the quality of water entering the distribution network of centralized water supply in Lviv, at checkpoints (at the boundary of the city) and in pumping stations, meets the requirements of drinking water.

## Description of the problem

During the transport of water through the network of distribution pipelines to consumers, its quality may vary. Research of technological parameters of work of 8 plots of distribution network of water supply of the city testifies to the following [2]:

- Increasing the overall hardness and alkalinity of water is due to the mixing of water from different intakes in the distribution network.
- The increase in the value of water oxidation is due to possible emergency situations with the introduction of pollutants of organic origin into the pipeline.
- The increase in the concentration of total iron in water is due to the corrosion of districts of the distribution network, characterized by long service life (from 2 to over 50 years) and a large length (up to 10785 m).
- Reducing the content of free residual chlorine in water during its transportation to the consumer indicates its consumption for the oxidation of chemicals contained in water, as well as the destruction of pathogenic microorganisms of biofilms on the inner walls of the pipes.
- Increased values of water quality indicators (data of LCME «Lvivvodokanal») on the studied sites do not exceed the maximum permissible limits.

The results of the study of the accident rate of the Lviv city water supply network (7 plots) during 2006-2017 indicate the following:

- The total correlation of the material of pipes of the plumbing network in Lviv as of 01.11.2016 is: steel – 29,99%; cast iron – 60,62%; polyethylene – 9,39%.
- The main causes of pipe damage, causing leaks: steel: corrosion of the metal – 91,69%; cast iron: corrosion of metal – 41,05%; depressurization of tubular connections – 52,11%. During the period of observation, no leakage was observed on the investigated areas of polyethylene pipes.
- The parameter of the flow of failures of the pipelines (1/year·km) increases with a decrease

in the diameter for both steel and cast iron pipes.

- The average weighted value of the parameter of the flow of bounce steel pipes is 3 times more than for cast iron.

However, the poor condition of the water distribution network, in particular its accident rate, can provoke not only the deterioration of water quality. Large-scale leakages or accidents cause water loss, collisions of the road surface, flooding of facilities, etc. Elimination of leakage of water takes time for its inspection, repair of the water supply, restoration of the territory's improvement. In addition, there are hidden sources of water.

It is recommended to introduce modern (Smart) monitoring systems in real-time state of water supply and quality of transported water.

**Smart-system for monitoring the state of the water supply network** is a promising system for monitoring the hydraulic parameters of the operation of the water supply network in order to detect an accident at an early stage. Based on data on water supplied and paid by consumers, and the analysis of data on the flow and water pressure at the control points, the zones of the settlement with hidden sources are diagnosed.

With the help of noise sensors (background noise problem), the pressure or flow of water installed on the hydrants or latches on the water supply network, determine the zones of the previous localization of hidden leaks.

Finally, the sources are localized in the following ways:

- Acoustic (on the surface of the earth – fluctuations of the soil);
- Correlation (on both sides of the damaged area – fluctuations of the walls of the pipe). There are problems with plastic tubes;
- with robots (inside the pipeline) equipped with:
  - pressure sensors. There are problems associated with changing the diameter of the pipes in the areas of the network;
  - ultrasonic sensors. Advantage - on the basis of the collected data, the thickness of the pipe wall is calculated, and therefore the degree of its corrosion.

Information on the state of the water supply networks is transmitted in real time to the control service of the LCME "Lvivvodokanal" for making a decision. The development of a system for monitoring the quality of water in distribution water pipelines requires a comprehensive selection of appropriate water quality parameters and reliable sensors. The system should prevent consumers from rejecting water quality indicators from authorized values by e-mail or SMS.

### **Conclusion**

The introduction of online monitoring will protect the drinking water supply system from accidental or deliberate pollution (eg, terrorism).

### **References**

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