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WATER LOSS REDUCTION THROUGH ON-LINE MONITORING OF PHYSICAL AND CHEMICAL PARAMETERS

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Abstract: *The water distribution network is the most expensive water supply system of populated centers (50-70% of the total cost of installation), due both to its large length (1-2 m / inhabitant) and the fact that currently, the networks have been made largely of steel tubes and azbo-cement. Intermittent operation is not recommended in drinking water system due to the danger of water contamination, due to lower atmospheric pressure in the pipes under pressure during their discharge with the entrance of the dirt from outside the pipe.*
The cabinets are installed in distribution network nodes. The devices supervise continuously and transmit to the central dispatch, on-line the following parameters: pressure, pH, conductivity, temperature, turbidity, water flow.
All information is stored and generates reports and charts with the evolution of the parameters registered.

Key words: *Water Distribution Network, Network Nodes, Physical and chemical parameters*

1. Introduction

The format of the bulletin will be A4. The article, inclusively the tables and the figures, should be of 6-8 pages, an even number of pages being compulsorily. The last page will be filled at least 70%.

A water distribution network, that operates for populated centres or for industries, includes all the pipes, fittings, measuring instruments and accessories constructions needed for the conveying of water from the storage tanks (or from the pumping facilities) towards the consumers' taps. The distribution network must provide the required maximum delivery service pressure.

The water distribution network is the most expensive element that constitutes a water supply system (50-70% of the systems' total cost). This is due both to its large length (1-2 m/capita) and to the fact that currently, networks are made largely of steel and asbestos-cement pipes. The distribution network must operate in a safe manner and without interruptions.

Intermittent operation of a drinking water system is not recommended, due to the

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danger of water contamination in cases when pressure within pipes decreases below atmospheric pressure (during their draining), event that absorbs inside polluting substances from outside the pipes.

In networks where the dominant materials are steel and gray cast, and pipes are joined by lead sealed connectors, there is the risk that when pipes are drained, contaminants from soil might enter the pipes through cracks or joining connectors.

The physico-chemical tests performed by our laboratory, in accordance with the laws in force and operating license, are conducted at well-established intervals, the samples being taken from the same locations. Thus, given the fact that tests are performed in laboratory, in case when non-compliances are discovered, the reaction time is reduced, and the implementation of measures are delayed. In this regard, a monitoring system for the chemical and physical parameters which are crucial for the water system's operation, and the transmission of information towards the central dispatch centre, shall offer the possibility of swift and effective interventions.

2. Description of equipment

The installed on-line analysis equipment is manufactured by Endress-Hauser and delivers the water's parameters as real-time data.

The sampling devices, the sensors and the electromagnetic flow meters are installed in the distribution network's nodes, via special mounting parts, installed on pipes, and transmit data to the analysers. For these devices special manholes have been built (figure 1). These manholes are protected against groundwater infiltrations and are fitted with water tight frames and lids (equipped with special rubber gaskets).

Fig. 1.

In order to obtain accurate results the analysers have been calibrated by means of precise measurements in parallel with the laboratory tests which have been conducted on basis of standard methods. After the units' calibration and after comparing the results with those from the laboratory, it has been seen that the gap between values has reached ± 3%, this degree of accuracy being sufficient for the purpose of the project.

The analysers are grouped by test and parameters classes and are mounted in metal cabinets connected to the power grid and equipped with local heating (Figure 2 and Figure 3).

2. Operating mode

The cabinets are installed in protected locations, inside fenced sites belonging to certain institutions with which the company has signed cooperation agreements. The data received from the measuring probes are stored in a memory buffer type electronic block. From the memory buffer data are sent to a data compressing device (logger type), which is able to create data packs that are sent via a GPRS communication transponder towards a dispatch point.

The monitored parameters are:

- turbidity;
-conductivity,

Fig. 2.

- concentration of free residual chlorine;
- temperature;
- ammonium ion concentration.

Apart from these parameters are also sent data related to:

- Pressure;
- Flow.

Depending on the location of the network's node three types of cabinets (Figure 4) have been mounted:

- Type I: ammonia, chlorine, pressure, turbidity, conductivity;
- Type II: flow, pressure, chlorine, conductivity;
- Type III: pressure, chlorine, conductivity
- Type III: pressure, chlorine, conductivity;

Given the nature of information and their

Fig. 3.

Fig. 4.

use, the transmission rate is a submittal at every 5 minutes. The dispatch service decodes the data packs and convert them into graphs that indicate the evolution in time of the analyzed parameters (Figures 5, 6 and 7).

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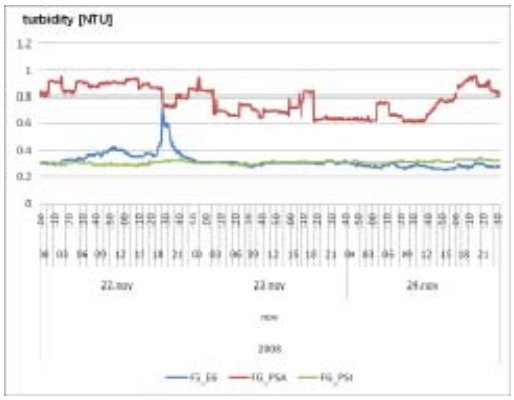

Fig. 5. *Evolution of water turbidity (green).*

All information is stored on a dedicated server with the possibility of data archiving

3. Conclusions

In areas with permeable terrain, which are actually draining the water lost through seepage from drinking water distribution networks and are also featuring a high groundwater level, it is very important to continuously know the evolution of studied parameters, along all the path: from storage tanks until the final consumer.

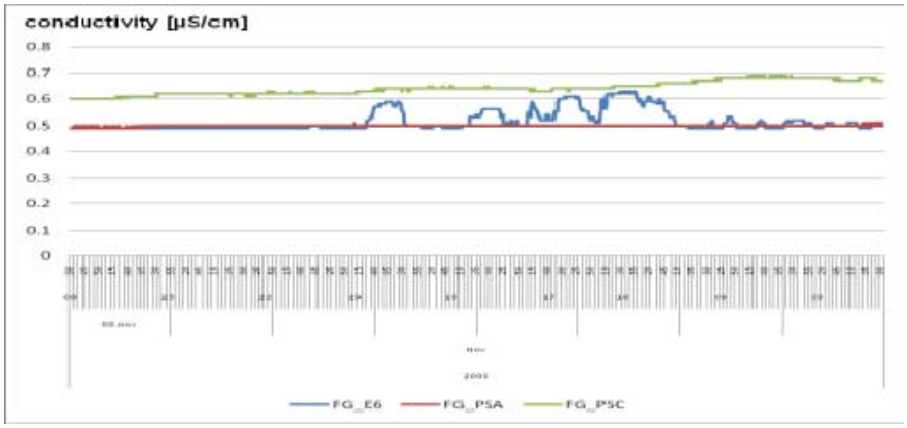

Fig. 6.

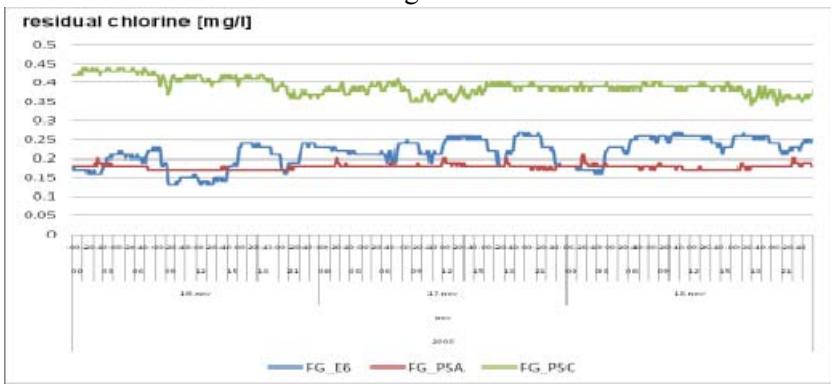

Fig. 7.

The water distribution systems in which the water losses are higher than 40% and in which more than half of pipelines have an expired normal lifetime, should be monitored by taking into account two elements:

- the physical losses;
- the quality of supplied water.

The data delivered by the monitoring cabinets allows an integrated approach for these two elements and allows the company to take all the optimal decisions in relation to a safe operation of the water system. The data are processed by a specialized personnel and, hence, a data base is established. Thus, the historical data collected from a measurement point will subsequently govern all the needed intervention procedures.