



PREGLED NOVIH METODA ZA SMANJENJE GUBITAKA U VODOVODNIM MREŽAMA

REVIEW OF CONTEMPORARY APPROACHES IN WATER LOSS MANAGEMENT

REZIME

U radu je dat prikaz standardnih i nekih novih metoda za smanjenje realnih gubitaka vode u vodovodnim mrežama. U uvodu je dat teorijski osvrt na gubitke u vodovodnim sistemima u skladu sa IWA terminologijom i naglašena je njihova veza sa problemima u poslovanju JKP. Posebna pažnja posvećena je savremenim postupcima koji se zasnivaju na upotrebi matematičkih modela u otkrivanju gubitaka i kombinovanju sa direktnim metodama za lociranje gubitaka na terenu. Prikazana je jedna nova terenska metoda, iz klase akustičnih tehnika. Talas promene pritiska, izazvan hidrauličkim udarom, istaknut je kao efikasan alat za skeniranje mreže u potrazi za procurivanjima. Pri kraju rada, navode se i pojedini nestandardni postupci u lociranju procurivanja iz mreže, zajedno sa njihovim prednostima i manama. U zaključku se, kao osnovna poruka rada navodi, da pored potrebe da se definiše jedinstvena metodologija u lociranju i smanjenju gubitaka, problematika je toliko složena da svaki slučaj zahteva jedinstven pristup.

Ključne reči: gubici u vodovodnoj mreži, savremene metode, matematički modeli

ABSTRACT

This paper gives an overview of some standard and some new approaches in real water loss management in water supply networks. The introduction provides a theoretical overview of the losses in water supply systems in accordance with IWA terminology, emphasizing their relation with problems in PUC. Special attention is given to contemporary approaches based on the use of mathematical models for loss detection and their combining with direct methods in locating the losses in the field. New field method from the class of acoustic techniques is represented. Pressure wave, caused by hydraulic impact, was highlighted as an effective tool in scanning network leakage. At the end of the paper, there are some non-standard procedures in locating network leakage, along with their advantages and disadvantages. In conclusion, beside the need to define a unified methodology to locate and reduce losses, the problem is so complex that each case requires a unique approach.

Key words: network losses, contemporary approaches, mathematical models

1. UVOD

U praksi smanjenja gubitaka, najkompleksnijim delom posla smatra se lociranje gubitaka, dok je otklanjanje uzroka gubitka, uglavnom rutina. U načelu, postoje tri osnovna principa u lociranju i smanjenju gubitaka. U prvom slučaju, gubici se traže specijalizovanom opremom, direktno na terenu. U slučaju akustičnih metoda, mreža se „sluša“, gubici se detektuju i otklanjaju. Ovakav pristup je direktan, a detektovani gubitak se može u potpunosti otkloniti. Mana ovog pristupa je nasumičnost u pretrazi mreže i zahtev za angažovanjem velikog broja ljudi i skupe opreme, što je poseban problem u slučaju velikih mreža. Drugi pristup je indirektan i oslonja se na rad analitičara mreže. Ovom pristupu pripada čitav niz aktivnosti, a glavni su: a) Podela mreže na osnovne zone bilansiranja –OZB, (Fantozzi et al. 2009) i bilansiranje mreže, b) detektovanje verovatnih lokacija gubitaka na kalibrisanom matematičkom modelu. Ovaj pristup može biti osporen nedostatkom dovoljnog broja merenja

1. INTRODUCTION

In loss reduction practice, the most complex part of the job is considered to be the location of losses, while the elimination of the causes is mainly routine. There are three basic principles in locating and reducing losses. In the first case, the losses are sought by specialized equipment on the field. In the case of acoustic techniques, the network is being „listened“, losses are detected and removed. This approach is direct, and the detected loss may be completely removed. Disadvantage of this approach is the randomness of the network search and request to hire a large number of people and expensive equipment, which is a particular problem for large networks. The second approach is indirect and relies on a work of network analysts. This approach consists of a series of activities, the main are: a) The division of the network into basic balancing areas - BBA, (Fantozzi et al. 2009) and network balancing, b) detection of the probable locations of losses in a calibrated

¹ Dušan KOSTIĆ, Marko IVETIĆ, Univerzitet u Beogradu Građevinski fakultet, Bulevar kralja Aleksandra 73, 11000 Beograd
dkostic@hikom.grf.bg.ac.rs