WATER LOSS MANAGEMENT STRATEGIES IN KAYSERI, TURKEY

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Abstract

Water losses from distribution systems can be grouped as either real losses or apparent losses. The IWA water balance indicates how these fit into the larger water balance perspective. Currently 99% of the potable water consumption in Kayseri is based on ground water. This study is intended to provide guidance for water service provider and their consultants on the processes involved in establishing and implementing effective water loss management strategies and procedures and developing associated documentation in Kayseri. Kayseri Water and Sewerage Administration (KASKI) is getting well staffed and equipped for proper water demand management and active leakage control in Kayseri. Generally leakage control programmes are included among the various actions that government and local authorities are taking. These actions include putting pressure on their limited water resources or when the cost of water is high, thus providing a powerful financial incentive to reduce costs through lower losses. There are financial, environmental and social benefits to be gained by improving the management of water distribution systems, especially in the reduction of underground leaks and unaccounted for water. For these reasons, recently KASKI formulated an active leakage detection and prevention policy which has resulted in the reduction of unaccounted for water from the initial 54% to 35%. Further, the entire distribution network of Kayseri was subdivided into 7 subsections. In addition, old pipes were replaced with ductile pipes in distribution systems, and home connection of galvanized pipes was replaced with polyethylene pipes.

Key words: water supply, distribution system, water loss

Introduction

Drinking water demand of Kayseri City is supplied from ground water without any treatment. After chlorination step, water is directly distributed to city with water network systems. In current situation some of the old font and galvanize pipes needs to be replaced. With these old pipes, clean water which is given to city is exposed to some chemical changes. On the other hand, the amount of water loss is thought to be approximately 54 %. Several past studies reported that as drinking water distribution networks get older, their performance tends to decline. Further, bursts and leakage increase with the age of the pipelines, water quality problems arise from internal pipe corrosion, and additional pumping energy is required to overcome bottlenecks and to compensate for head losses due to incrustation situations (1). Therefore, measures of pipeline rehabilitation have to be performed in order to maintain the standards of network performance.

In this context, in order to use the drinking water efficiently and reduce the high level water losses, Kayseri Water and Sewerage Administration (KASKI) decided to replace the old pipes with ductil pipes and polyethylene pipes. In this study, Kayseri city was divided into 7 zones for effective management of drinking water supply and for reducing water loss significantly. Moreover, one of the most important duties of a local water authority is to supply drinking water to consumers.

Present situation

The water supply system of Kayseri serves about 600,000 people. Water consumption of households plus industry is about 75,000 m^3 per day. About half of the water fed into the system is non-revenue water, amounting to water losses of 54%. Recently the water loss was reduced to 35%. Probably about two thirds of these water losses are due to bursts and leakage at cracks, corrosion holes, joints, valves and hydrants (2,3). Further, almost half of the leakage may occur on service pipes. The future need of network rehabilitation depends on the aging behavior of the existing stock. The water is distributed to city with SCADA system.

Factors Affecting System Leakage

Some of the major factors affecting the current level of leakage in a distribution system are (2,3,4):

- length, diameter, age, material and construction method of water pipes;
- service connections density;
- service connections length;
- density of joints, valves and fittings;
- operational pressure;
- water utilities policies and practices for the detection and repair of bursts and leaks;
- water utilities mains replacement strategy; and
- water utilities pressure management strategy.

While some of the above factors are related to the efficiency of management and operational arrangements of the system, others are associated with the difficulty of the operating environment. A system with high operating pressures and high density of connections will tend to leak more than those of connections even though management practices are similar in both (4,5). A fair comparison must take into account this difference in operating environment. It was reported that there is a level of water loss generally accepted as unavoidable and this is strongly dependent on the characteristics of the system. Simplistic indicators however, tend to make no differences between avoidable and unavoidable water loss and, hence, can present a distorted picture of the situation.

Water Balance

An accurate water balance is fundamental to establishing a reliable estimate of real water losses and hence leakage. The IWA has done some great work in establishing a standard approach to the water balance. Fundamental to a reliable water balance is accurate bulk and customer metering. This standard approach has provided a more rigorous definition for elements of the water balance including Non Revenue Water

(NRW) which comprises apparent losses (ie unauthorised consumption and customer metering inaccuracies) and real losses (ie background leakage and losses from water main bursts and reservoir overflows). The IWA Water Balance of Kayseri City is depicted in Table 1. Unless there is sufficient metering to measure night flows, real losses are normally estimated as a balancing component after all other components of total system input have been evaluated, including apparent losses such as customer metering inaccuracies and data handling errors, theft of water and illegal connections. These items can be inflated so as to reduce the inferred quantity of real losses. Although the IWA has set guidelines for default values in the absence of concrete data, the use of too many defaults can result in a final figure for real losses that bears little relation to reality.

Table 1. The 2005 Annual Water Balance for Kayseri

<table>
<tr><td rowspan="7">48,593,298
m^3/year

100%</td><td rowspan="4">48,583,298
m^3/year

99.08%</td><td rowspan="2">8,861,109
m^3/year

18%</td><td>18,861,109
m^3/year
38.83%</td><td rowspan="2">28,861,109
m^3/year

59.39%</td></tr>
<tr><td>0
m^3/year
0.00%</td></tr>
<tr><td rowspan="2">2,538,811
m^3/year

5%</td><td>411,720
m^3/year
0.85%</td><td rowspan="5">19,732,189
m^3/year

40.61%</td></tr>
<tr><td>10,000
m^3/year
0.02%</td></tr>
<tr><td rowspan="3">10,000
m^3/year

0.02%</td><td rowspan="2">8,091,689
m^3/year

16.65%</td><td>208,780
m^3/year
0.43%</td></tr>
<tr><td>0
m^3/year
0.00%</td></tr>
<tr><td colspan="2">29,101,689
m^3/year

59.88%</td></tr>
</table>

Conclusion

In this study, Kayseri city was divided into 7 zones for effective management of drinking water supply and for reducing water loss significantly. In Kayseri, recently the water loss was reduced to 35%. Probably about two thirds of these water losses are due to bursts and leakage at cracks, corrosion holes, joints, valves and hydrants. Further, almost half of the leakage may occur on service pipes. The future need of network rehabilitation depends on the aging behavior of the existing stock. Besides, the amount of water loss will be reduced more by using new constructed SCADA system.

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