American Water Works Association
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Water Loss Control Terms Defined

Why the terms 'unaccounted-for' water and 'unaccounted-for percentage' just don't work!

Tracking water loss in drinking water utilities as the percentage of the estimated losses over the volume supplied is believed to have been first documented in the 1957 AWWA Committee Report "Revenue Producing vs. Unaccounted-for Water." In the ensuing decades after this paper was published many state and regional water regulatory agencies adopted statutes or regulations that attempted to gauge water loss based upon this loss/supplied percentage.

Unfortunately, there has been little verifiable reduction in losses by these agencies, largely because there are numerous shortcomings in this approach. Since the publication of its 2003 Committee Report "Applying Worldwide Best Management Practices in Water Loss Control,"

AWWA has recommended against the use of the terms "unaccounted-for" water and "unaccounted-for water percentage." Instead, water utilities should employ the term "Non-revenue" Water and the performance indicators in the IWA/AWWA Water Audit Method.

Problems with the term 'unaccounted-for' water

While the term "unaccounted-for" water appears to be self-explanatory, it suffers from inconsistent use and interpretation. The concept is to identify the collective volume of water that a water utility supplies to its distribution system that is not reflected in customer billing volumes.

The Water Loss Task Force of the International Water Association found that the definition of the term "unaccounted for" varied so much in different jurisdictions around the world that it was impossible to conduct reliable performance comparisons using the term.

Many water utilities and regulatory agencies have varying definitions for "accounted for" vs. "unaccounted for" water volumes. For instance, some definitions allow a certain volume of leakage – deemed "unavoidable" leakage – to be included as "accounted-for" water. Similarly, utility personnel have sometimes classified leaks that are known to exist in inaccessible locations (such as pipelines under streams or rivers) as "accounted-for" water. In the IWA/AWWA Water Audit Method, all types of leakage – regardless of size or difficulty of repair – are included under the heading of Real Losses.

The IWA/AWWA Water Audit Method states that all volumes of water supplied to distribution go to either beneficial consumption or wasteful loss. Hence, there is no "unaccounted-for" water since all of the water is "accounted for" in this method.

The term "Non-revenue" Water is defined to reflect the distributed volume of water that is not reflected in customer billings. Non-revenue Water however, is specifically defined as the sum of Unbilled Authorized Consumption (water for firefighting, flushing, etc.) plus Apparent Losses (customer meter inaccuracies, unauthorized consumption and systematic data handling errors) plus Real Losses (system leakage and storage tank overflows). In this way, the term "Non-revenue"

Water includes the sum of the varied and disparate types of losses and authorized unbilled consumption typically occurring in water utilities.

Problems with the performance indicator 'unaccounted-for percentage'

Some water utilities attempt to express their water loss standing by quoting their "unaccounted-for" percentage, which typically takes some form of:

(Volume of Water Supplied minus Volume of Customer Billed Water) / (Volume of Water Supplied)

Some will alternatively quote the inverse, referred to as the "metered water ratio," as

(Volume of Customer Billed Water) / (Volume of Water Supplied)

Using percentage indicators such as the above to assess water loss standing in water utilities gives misleading and unreliable measures of utility performance because:

- This type of performance indicator is mathematically skewed
- It is impossible to reliably represent multiple types of non-revenue water typically occurring in a water utility with a single simplistic percentage
- A simple percentage reveals nothing about water volumes and costs, the two most important factors in water loss assessments of water utilities

The mathematical flaws of the percentage indicator stem from the fact that the percentage is unduly affected by varying levels of customer consumption. This is demonstrated in the following two examples:

Example 1 (hypothetical)

A water utility supplies water to a small community. It supplies an average of 6 million gallons per day (mgd) from its water treatment plant. Over the course of a year, it bills the equivalent of 5 mgd. In this case, it is taken that the sum of unbilled authorized consumption, apparent losses and real losses in the water utility average 1 mgd (6 mgd – 5 mgd). The simple "unaccounted-for" percentage is calculated as:

UAF % = (6-5) / 6 = 16.67%

Assume that a beverage bottling plant is constructed in the community and launches operation as a very large water consumer that draws an average of 1.5 mgd form the water utility. The water utility now produces an additional 1.5 mgd and bills 1.5 mgd more than previously. The UF% is calculated as:

UAF % = (7.5-6.5) / 7.5 = 13.33%

Comparing the two percentage values, its appears that the water utility has improved its water loss standing by 3.34%

Improvement = 16.67% - 13.33% = 3.34%

However, the volume of non-revenue water remains the same at 1 mgd after the bottling plant is established. The volume of non-revenue water is unchanged, but the UAF% misleadingly suggests that the utility's water loss control has

improved. Because the volume of customer consumption has changed (increased) relative to the loss volume the percentage decreases, despite no change in the non-revenue water volume of 1 mgd.

Example 2 (actual)

The City of Philadelphia Water Department (PWD) has focused strongly on water accountability and efficiency over the past 15 years. By enacting a number of improvements to refine its water auditing and control both apparent and real losses, PWD has seen noticeable reductions in Non-revenue Water. However, over the same period of time, the aggregate volume of customer consumption in the PWD service area has also dropped notably due to a shrinking population, gradual implementation of low-flow toilets and customer conservation.

The graph shown in Figure 1 illustrates the weakness of the UAF% in assessing PWD's water loss standing. On a volume basis, PWD has achieved significant reductions in Non-revenue Water, which existed at levels well over 100 mgd for many years, but has been reduced to 74.9 mgd at the close of the 2008 fiscal year. Despite this success, PWD's calculation of a UAF% shows values consistently remaining between 30% and 40%. The two lines on the graph show the stark differences, with Non-revenue Water volume decreasing steadily, while the UAF% trend remains essentially flat. This occurs due to the fact that PWD's customer consumption continues to decrease relative to the decrease in its loss volume, resulting in a UAF% trend with little variation. Measuring PWD's water loss standing by the UAF% gives a completely unrealistic – and opposite – assessment of its water loss control success.

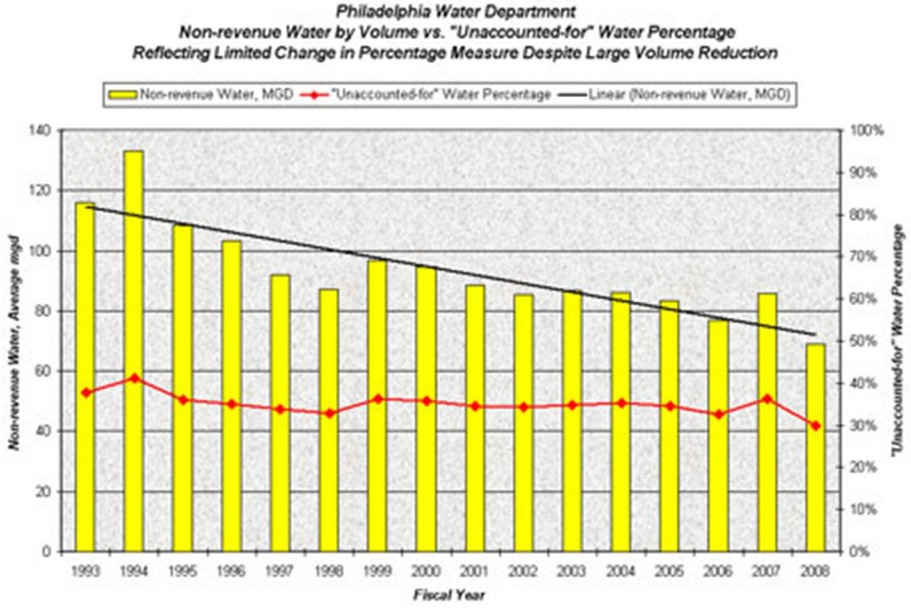

Figure 1. Over the past 15 years, the City of Philadelphia Water Department has made great reductions in non-revenue water.

The IWA/AWWA Water Audit Method relies upon the quantification of water volumes, costs and system characteristics as input to several performance indicators to reveal water loss standing. It does not rely on a single, simplistic percentage such as UAF%. Instead, it employs distinct performance indicators on global water supply, apparent losses, and real losses.

Having the use of several robust, detailed performance indicators instead of a single, simplistic indicator is a vastly superior means by which to assess water loss standing in water utilities.

AWWA recommends against use of the term "unaccounted-for" water and the "unaccounted-for water percentage." Instead, it recommends use of the term Non-revenue Water and the array of performance indicators included in the IWA/AWWA Water Audit Method.