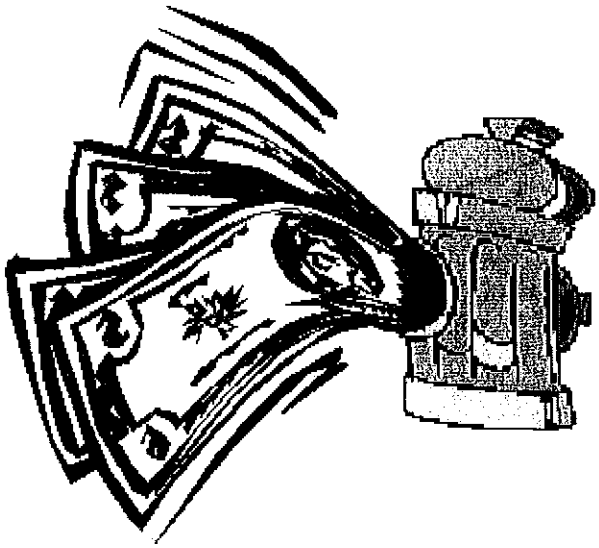
vf

National Drinking Water Cleari
West Virginia University
P.O. Box 6064
Morgantown, WV
26506-6064

The Economics of Water Lo$$
What is unaccounted for water?

by **Steve Wyatt**
MTAS Utility Operations Consultant, University of Tennessee



No drinking water system can avoid water loss. It comes with the territory. And let's face it: old or poorly constructed distribution systems are the main culprits. No matter where the fault lies, though, water loss is more than a nuisance—it's an economic menace. But small drinking water systems can rest assured that good news does exist. These systems can minimize revenue loss just by calculating unaccounted for water (UAFW).

Drinking water utilities can describe UAFW as the difference between the amount of water that they produce or purchase versus the amount that they sell or are able to account for within their systems. UAFW is usually expressed as a percentage.

Surprisingly, across the U.S the water industry seems to accept an UAFW loss of 10–12 percent as normal. Unfortunately, UAFW of greater than 30 percent is not uncommon. As water resources become more limited throughout the U.S., we must emphasis reducing UAFW volumes. Besides conserving precious water resources, low UAFW also indicates a well-managed operation.

The example on the following page illustrates how to calculate UAFW. This example looks at a 30-day cycle. Thirty days is not long enough for a legitimate study, but that amount of time effectively illustrates how most systems calculate UAFW:
Here, the water system cannot account for almost 20 percent of the water it produced in the 30-day period. If the cost of production for each 1,000 gallons is $2.25, then this system spends about $10,000 to produce 4,445,248 gallons of UAFW. In addition, the system has no idea who used the water or what it was used for.

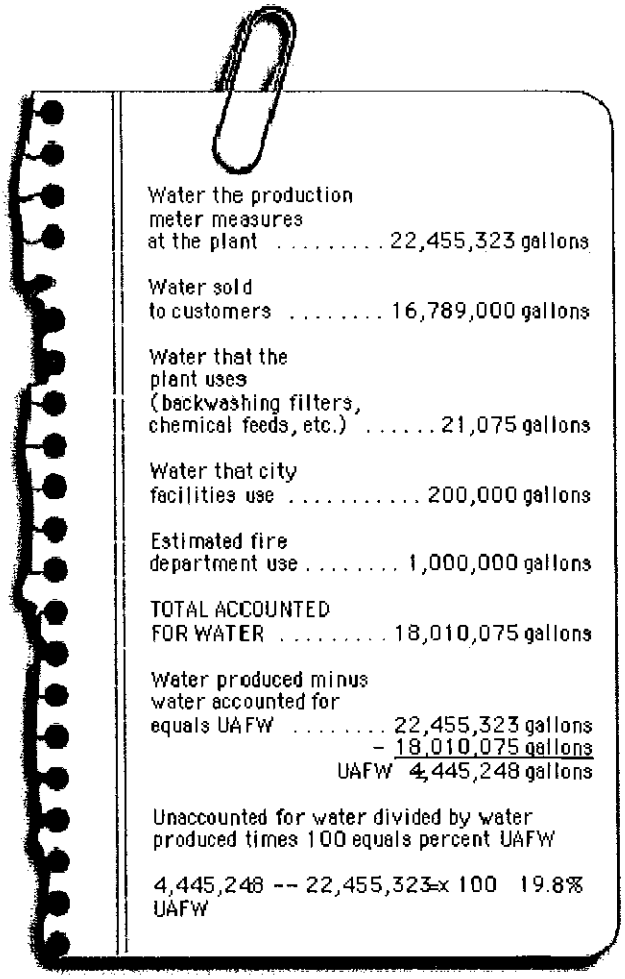
Another method of finding water-loss rates uses how much water a system loses per mile of distribution line instead of the UAFW formula. Either method works to find a system's overall water-loss rates. The real point to remember when calculating water-loss rates is that if a system has high volumes of unaccounted for water, it can negatively affect the system's physical capacity and financial health.

To be viable, a water system must monitor and manage UAFW. A number of different elements contribute to UAFW, including:

- leaks,
- inaccurate or broken meters,
- unmetered use, and
- errors in the billing process.

Leaks Account for Much UAFW

Leaks can account for a large portion of UAFW, or they may be a relatively small portion of the problem. Water systems will always have leaks and line loss, but the trick is to keep water loss as low as possible. Leak detection is a chronic chore for water systems. A system may choose to purchase detection equipment and train staff to check for leaks, or they may hire an outside firm to perform a leak detection survey. Some systems use a combination of internal checks and contracting. Both practices have pros and cons.



Leak detection equipment ranges from simple, inexpensive sonoscopes/stethoscopes to mid-priced acoustic amplifiers to expensive leak correlators. All of these require some level of experience and training to obtain consistent results. Water system personnel use sonoscopes/stethoscopes to detect leaks at meters, valves, or hydrants. They are easy to use and require minimal training and experience.

As equipment becomes more complicated, though, workers will need more experience and may require additional training. Also, if a system purchases expensive leak detection equipment that it will not use very often, it is not necessarily money well spent. Most water systems can get by with inexpensive, simple equipment to find leaks at valves, meters, and hydrants, which is a good value for any water system.

Outside leak detection firms rely on experienced staff trained to use sophisticated equipment. Their services are not as easy on the pocket as simple devices, such as sonoscopes or stethoscopes. Some water facilities limit the survey to a portion of the system to reduce the cost. The facility then contracts for another portion of the system in the next budget. After three to four years, the whole system has been surveyed.

Investing in more elaborate, expensive equipment is justified if trained, experienced staff frequently use it. Medium to large water systems purchase leak detection equipment and train their staff to operate it. As these trained individuals gain

experience, they produce good results for their systems.

Most small to medium water systems could get a better return on their money if they contracted with an outside firm to conduct a leak detection survey. In addition, small and medium systems can use less sophisticated equipment to locate leaks prior to using an outside firm. Thus, system personnel find and repair easy leaks prior to the arrival of the experts, and save the system a lot of time and money. The experts can then concentrate on more difficult leaks.

Inaccurate or Broken Meters
Meters supply the data that generate revenue for your water and wastewater system. Basically, water meters are the cash registers for the system. If the cash registers are inaccurate or inoperable, the system loses money. Over time, meters age and lose accuracy. Missed volumes tend to occur during periods when the flow through the meter is low.

Every water system should have a written meter calibration and replacement policy. A written policy provides a tool to manage the meters.

Listed here are at least three essentials to a meter calibration/replacement policy:

1. Check and certify production meters and large customer meters on an annual basis. System personnel can either take meters to a testing facility, or they can check them in place. Checking the meter in place is the best option because the testing facility cannot duplicate exact operating conditions in the field.

2. Install production and large customer meters to meet flow requirements, not pressure requirements.

3. Make sure smaller meters are on a written replacement rotation. Metersuppliers can provide an estimate of how long a meter is expected to work accurately. The policy can specify that the meter should be replaced after a certain number of years or after a certain volume of water flowsthrough the meter.

Unmetered Use
Typically, communities have legitimate uses for a portion of water that their water systems produce, and the systems never bill or meter for it. However, systems should record these volumes monthly, even if they only take an educated guess at how much water is used for:

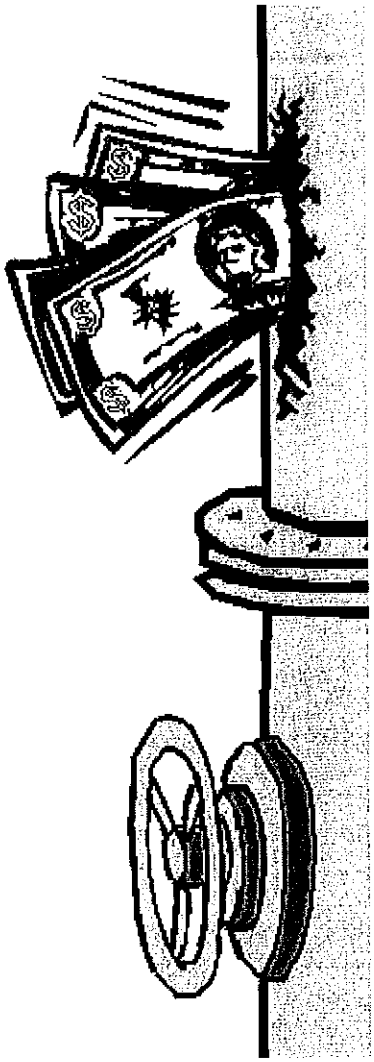
- fighting fires;
- flushing fire-hydrants;
- washing streets; or
- maintaining city parks, pools, or other facilities.

To keep up with how much water is used for these activities, encourage fire departments to provide monthly estimates of their water use. The same policy holds for the public works department. For example, street sweepers could carry portable meters that document water use. Further, meter any facility that uses water and record the reading monthly.

Occasionally, water theft occurs—generally from fire hydrants. The volume the thieves take is difficult to quantify, but the system should make a good faith effort to estimate the amount of water stolen. A spike in the UAFW level could be an indicator of water theft.

Billing-Process Errors

Another culprit that accounts for some UAFW is billing-process errors. Normally, these errors are a very small portion of UAFW. Here are some common errors:



- inaccurate meter reading—either a misread on the old-style dial meter or the meter reader errs as he or she records the reading;
- an incorrect factor is used to calculate the volume used;
- transcription error in the billing system;
- rounding error in the billing process; and
- estimates used are either totally unacceptable or estimates are used too frequently in the billing process.

Management and Tracking UAFW

A water system must have a management plan in operation so that it can monitor and reduce UAFW. Various technical publications are available to guide water system personnel in this process. To monitor water loss, system personnel should:

- walk the system and check for leaks and unmetered use,
- perform a review of all pumping records, billing, and accounted for water
- review meter histories and calibration records,
- produce and budget for a written meter program,
- determine whether the system needs a leak detection survey,
- clarify how the system will monitor for leaks in the future,
- track UAFW monthly, and
- stay on task, and work on UAFW regularly.

Tracking UAFW can be frustrating especially if a system looks at data over short time spans—billing and production volumes don't necessarily coincide. One approach is to use a running 12-month percentage for UAFW. This method identifies trends and does not falsely skew data. But remember, tracking UAFW is useless without accurate meters.

How a Small System Reduced UAFW

System A serves a population of less than 500 people and purchases water from neighboring System B. The master meter at the connection of the two systems was an early 1980s mechanical meter. System B historically billed volumes 50–76 percent higher than volumes that System A bills to its customers.

System A:

- did not have a meter change-out program
- had not performed an active leak detection program; and
- marginally accounted for volumes used in fire protection and other unmetered uses.

With outside assistance, System A reduced its UAFW to the 10–30 percent range. Here's how:

- It started a meter replacement program. In the first year, System A replaced 15 percent of the meters within the system. The system targeted these meters because of age and location.

- System A hired a leak detection company to survey a portion of the system.
- Office personnel found and corrected a rounding error in their billing software.
- System A persuaded the supplying system (B) to replace the old mechanical meter with a new ultrasonic meter.
- System A's water manager worked closely with the fire department to obtain reliable estimates of how much water was used in fire protection every month.
- Staff discovered and corrected other unmetered water uses within the system.

For a typical month, the decrease in UAFW has reduced the monthly payment to System B from about $2,300 to $1,270. System A has also realized a slight increase in revenue from more accurate meter readings in the replaced meters. System A still has work to do on reducing UAFW. They plan to complete the leak detection survey of the entire system and to continue the meter replacement program.

UAFW can be a financial drain on any water utility. How large a drain depends upon the system. Utilities must constantly monitor and maintain their systems and account for water volumes to maintain an acceptable level of UAFW. Each system must decide whether they want their UAFW drain to be 3/4 or 36 inches in diameter.

For more information about unaccounted for water, contact Wyatt at MTAS's Jackson Office, 605 Airways Boulevard, Suite 109, Jackson, Tennessee 38301. Or call him at (731) 423-3710.
To view MTAS's Web site, visit www.mtas.utk.edu.