Promoting Non-revenue Water Management in the United States: A 30-year Journey

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Interdisciplinary Webinar
Reducing Leakage in a City’s Water Supply System

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Key Point: Reliable Data and Performance Indicators are essential to Successful Non-revenue Water Management

“For every complex problem, there is an answer that is clear, simple, and wrong”

H.L. Mencken
20th Century American Journalist

Source: Wikiquote

This applies to the use of Volumetric Percentage Performance Indicators

Unfortunately, many water US regulatory agencies use volumetric percentage indicators and regard them as:

- Simple to employ and track
- Straightforward to use to set targets, despite an inability to motivate measurable loss reductions in water utilities
The Problem with Percentages

Skewed “unaccounted-for” water percentage

An Example:

A large water-consuming industrial facility halts operations in 2007.

The UFW% (red line) increases dramatically, but...

Water losses by volume (black graph) continue to drop!

Thus, the UFW% misrepresents the water loss reduction that has occurred.

Courtesy of Will Jernigan, P.E. and Cavanaugh Solutions
American Water Works Association
2020 Committee Report*

- Recommends against use of any form of percentage indicator

- Offers two new indicators:
  - Loss cost rate: Important new indicator
  - Water losses rate: A helpful secondary indicator

*Companion research report was also published
**Loss Cost Rate: A New Financial Indicator**

- Expressed in **value/service connection/year**
- Marries the **rate of loss** (**real** and **apparent**) with
- The **unit cost of the loss** (variable production cost for real loss; retail cost for apparent loss)
  - Reveals the impact of changing annual loss and cost values
  - Good public relations value, by giving cost impact on a “per customer” level
  - Strong “out-of-bounds” indicator that flags utilities with very high values
  - Not appropriate to use to set optimally low loss targets in water utilities

Values shown in US dollars

Real (Leakage) Loss Cost Rate Performance Indicator for 437 Georgia and California Water Utilities with validated Water Audit Data for 2017
Best Approach

- **Seek an Economic Level of Loss:**
  Real (leakage) losses shown

- **Assessment is data intensive:** It needs reliable data on losses and costs

- **This could be an appropriate approach for large systems like Hong Kong**
USA NRW Reduction Target-setting: a different approach – for now

- Many systems: Widely ranging capabilities and limitations
- Status: Early in NRW Management, need focus on data gathering
- Targeting may best focus on system with the highest losses – possibly above 90th percentile – for now
- Loss control is likely to be economic for these systems given high losses and/or costs

Values shown in US dollars

Real (Leakage) Loss Cost Rate Performance Indicator for 437 Georgia and California Water Utilities with validated Water Audit Data for 2017

Minimum value = $0.01/conn/year   Maximum value = $224.34/conn/year
Water Losses Rate: a Good Trending Indicator

- Water Losses = real loss + apparent loss; expressed in volume/service connection/day
- High-level indicator for trending year-to-year losses
- Assists data validation; better insight to sharp changes in real or apparent losses
- Don’t use in “stand-alone” fashion; best to use in tandem with apparent and real loss rate indicators. WLR alone is not actionable; its components include water that is physically lost (real losses) and water not physically lost but under-billed (apparent losses)
- **Do not use for target-setting.** Instead, targets can be set using the Apparent Loss Rate and the Real Loss Rate
How to Assess Water Loss and Its Impacts?

Three Vs...

- **Volume**
  - Water Losses Rate
  - Volume/connection/day
  - Infrastructure Leakage Index

- **Value**
  - Loss Cost Rate
  - Annual costs
  - Economic Level of Loss

- **Validity**
  - Data Input Grading
  - Water Audit Data Validity Tier
### AWWA Recommended Water Loss Performance Indicators – Fit for Multiple Purposes and Users

<table>
<thead>
<tr>
<th>Type</th>
<th>Indicator</th>
<th>Description</th>
<th>Suitable Purposes</th>
<th>Limitations Needing Further Data Collection and Assessment</th>
<th>Principal Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td>Apparent losses (vol / conn / day)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Strong and understandable indicator for multiple users</td>
<td>✓</td>
<td>✓</td>
<td>Utilities, Regulators</td>
</tr>
<tr>
<td></td>
<td>Real losses (vol / conn / day)</td>
<td>Strong and understandable indicator for multiple users</td>
<td>✓</td>
<td>✓</td>
<td>Utilities, Regulators</td>
</tr>
<tr>
<td></td>
<td>Real losses (vol / pipeline length / day)</td>
<td>Strong and understandable indicator for use by utilities with low connection density</td>
<td>✓</td>
<td>✓</td>
<td>Data collection and assessment of the level of “low” connection density</td>
</tr>
<tr>
<td></td>
<td>Total Water losses (vol / conn / day)</td>
<td>Strong and understandable indicator; suitable for high-level performance measurement</td>
<td>✓</td>
<td>✓</td>
<td>Utilities, Regulators, Policy Makers</td>
</tr>
<tr>
<td></td>
<td>Real losses by pressure (vol / conn / day / pressure unit)</td>
<td>Robust but specialized indicator; technical rigor may be influenced by network materials.</td>
<td>✓</td>
<td>✓</td>
<td>Data collection and assessment of the use and applicable context(s) in NA</td>
</tr>
<tr>
<td></td>
<td>Infrastructure Leakage Index (ILI)</td>
<td>Robust but specialized ratio indicator, which can be influenced by pressure and connection density.</td>
<td>✓</td>
<td>✓</td>
<td>Data collection and assessment for guidance on wide use in NA</td>
</tr>
<tr>
<td>Value</td>
<td>Apparent Loss Cost Rate (value / conn / year)</td>
<td>Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is very useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs.</td>
<td>✓</td>
<td>✓</td>
<td>Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates</td>
</tr>
<tr>
<td></td>
<td>Real Loss Cost Rate (value / conn / year)</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Validity</td>
<td>Data Validity Tier (DVT)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity.</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1. Blue shading highlights real losses, green shading highlights apparent losses.  
2. Data Validity Tier is a band-type grouping of Data Validity Scores: Tier I: DVS=0-25; Tier II: DVS=26-50; Tier III: DVS=51-70; Tier IV: DVS=71-90; Tier V: DVS=91-100

**Best to employ several indicators – using a single number is limiting**
Implementing Improved Methods

- Improved regulatory structures in several states
  - Georgia & California are leaders
  - Annual water audits are required and are validated
  - Moving toward loss reduction targeting
Progressive Water Utilities: Success in Reducing NRW

Los Angeles Department of Water and Power
(Los Angeles, California)

One of the largest water supply systems in the United States supplying 1.63 million cubic metres per day to over 4 million people

Halifax Water
(Halifax, Nova Scotia, Canada)

Coastal city with varying elevations and topography similar to Hong Kong
Reliable Data and Strong Performance Indicators are key!

Looking ahead……….

• Drivers for improved water efficiency
  – Water shortages and scarcity: Climate change
  – Water supply infrastructure decline
  – Funding gaps: optimizing revenue capture

• The Way Forward
  – Additional regulatory requirements?
  – Further implementation of new technologies?

• The Future
  – Managed low levels of non-revenue water?
  – A struggling water future?

Source: PolicyMed.com