# Water Loss Control: An Emerging Issue

## The ABCs of the Water Loss Control Committee Report

Patti Godwin
American Leak Detection

PNWS-AWWA Spokane Conference
Distribution Committee - Water Loss Control FG
Inland Empire Sub Section PreCon
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# Why We Need to Manage Water Loss

- It's big and getting bigger—USGS estimates 6 Billion gallons/day
- It's Overlooked—Out of Sight, Out of Mind
- It's Costly—1987 study estimates $800 Million/year
  - Excess supply costs: energy, treatment
  - Uncaptured revenue: poor accounting, unauthorized use
  - Indirect social, political, economic costs
- Wastes our Valuable Natural Resource

# The Water Accounting Void

**Water Supplier Testimonials:**

- 1996 AWWA WATER:\STATS Survey found losses ranging from 1% to 99%
- "We know we have leakage-so there-it's all accounted for!"
- "If the state has a 10% trigger level, we set our numbers so that we come in just under 10%."

# "Unaccounted for Water Percentage" Does Not Tell the Whole Story

- No consistent definitions for the various components of use or loss have been employed
- Worldwide, no standard definition has been found to exist for the term "unaccounted for" water
- Percentage indicators have been found to be suspect in measuring technical performance
- Percentage indicators translate nothing about water volumes and costs

# The Good News Is

**Efforts are underway to:**

- Properly assess current conditions
  - AWWA TEC "States Survey" Project
  - Alliance of Water Efficiency SCORECARD

    Washington State: B+

    allianceforwaterefficiency.org
- Raise Awareness
  - Publications & presentations, outreach
  - Water Loss Control Committee Report

# Water Loss Issue Is More Than Leakage

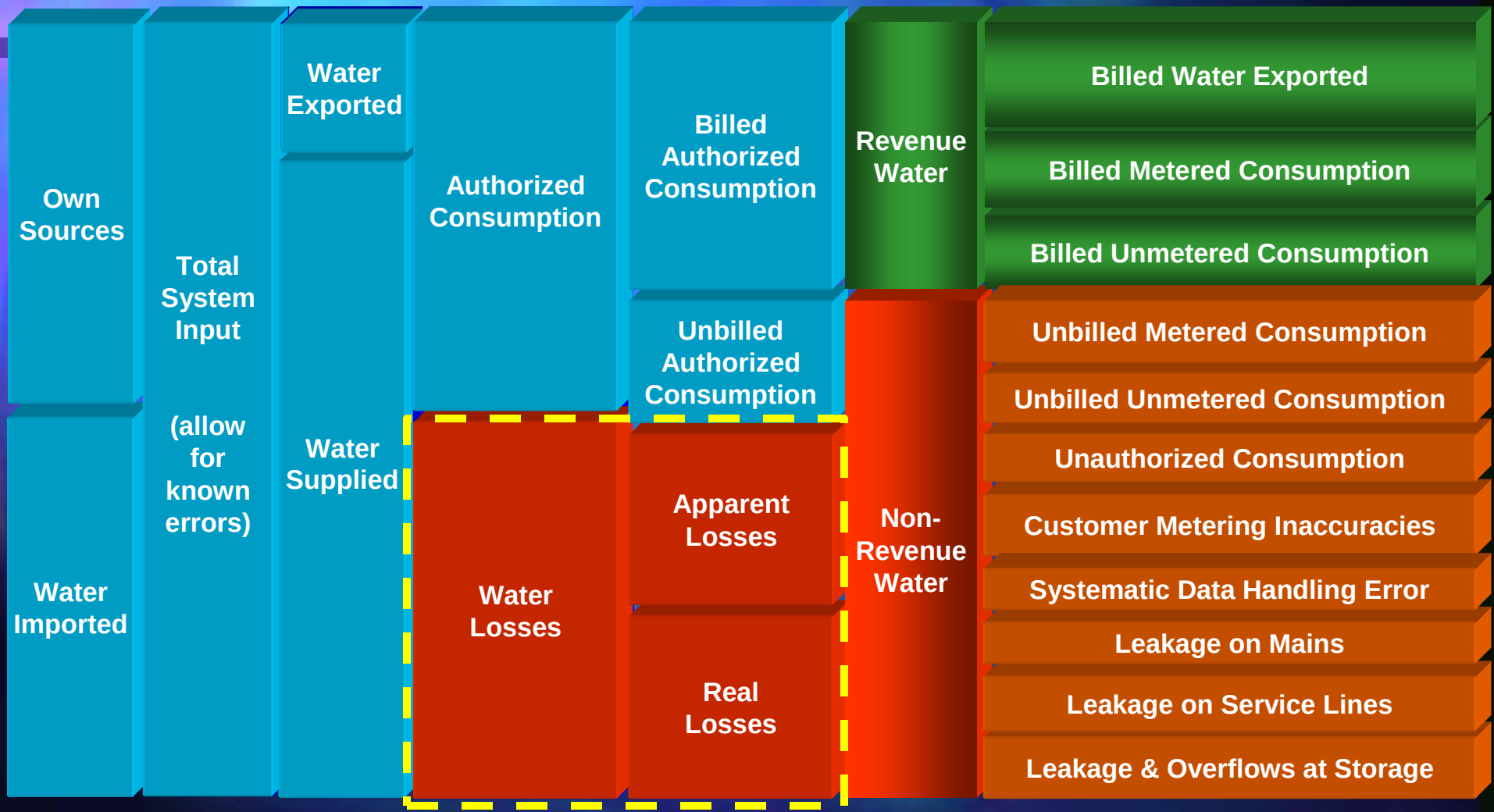
- Terminology; Lack of standardized definitions of water and revenue losses
- Technical; Not all water supplied by a water utility reaches the customer
- Financial; Not all of the water that reaches the customer is properly measured or paid for

# Water Balance: Categorizing Use and Loss

# Non-Revenue Water

1. Water put into the system that does NOT return revenue to the Utility.
2. All Water Loss plus Unbilled Consumption.
3. “Unaccounted-for water” has been abandoned forever, as an “obsolete technology”.

# Water Balance: Categorizing Use and Loss



# Real vs Apparent Loss

1. Water Loss comes in 2 forms:
   Real and Apparent
2. Real Loss = Leakage. Cost is calculated as 'wholesale' rate.
3. Apparent Loss = Slow meters, billing issues and theft. Cost is calculated at 'retail' rate.

# AWWA Free Water Audit Software© - Version 4.2

## Data Grading for each input

**AWWA WLCC Free Water Audit Software: Reporting Worksheet**



WAS v4.2

Back to Instructions

? Click to access definition

Water Audit Report for:

Reporting Year:

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

**All volumes to be entered as: MILLION GALLONS (US) PER YEAR**

**WATER SUPPLIED**

| | | | |
|---|---|---|---|
| Volume from own sources: | ? | | |
| Master meter error adjustment (enter positive value): | ? | | |
| Water imported: | ? | | |
| Water exported: | ? | | |
| **WATER SUPPLIED:** | | | |

**AUTHORIZED CONSUMPTION**

| | | | |
|---|---|---|---|
| Billed metered: | ? | | |
| Billed unmetered: | ? | | |
| Unbilled metered: | ? | | |
| Unbilled unmetered: | ? | | |
| Default option selected for Unbilled unmetered - a gra | | | |
| **AUTHORIZED CONSUMPTION:** | ? | 0.000 | MG/Yr |

Use buttons to select percentage of water supplied **OR** value

**WATER LOSSES (Water Supplied - Authorized Consumption)** 0.000 MG/Yr

**n/a (not applicable).** Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)

**1.** Less than 25% of treated water production sources are metered, remaining sources are estimated. No regular meter accuracy testing.

**2.** 25% - 50% of treated water production sources are metered; other sources estimated. No regular meter accuracy testing.

**3.** Conditions between 2 and 4

**4.** 50% - 75% of treated water production sources are metered, other sources estimated. Occasional meter accuracy testing

**5.** Conditions between 4 and 6

**6.** At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources. Meter accuracy testing and/or electronic calibration conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.

**7.** Conditions between 6 and 8

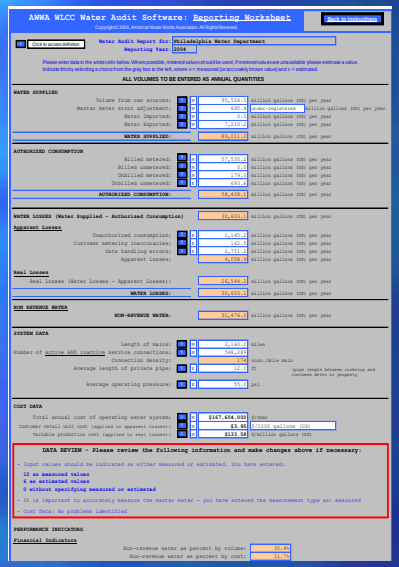
**8.** 100% of treated water production sources are metered, meter accuracy testing and electronic calibration conducted annually, less than 10% of meters are found outside of +/- 6% accuracy

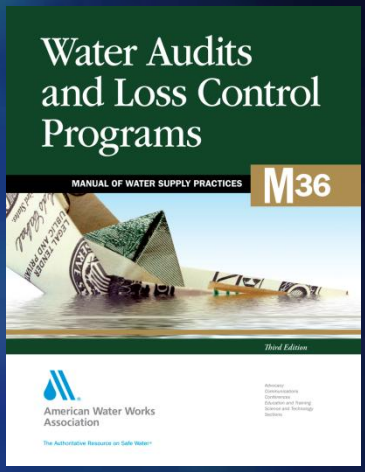
**9.** Conditions between 8 and 10

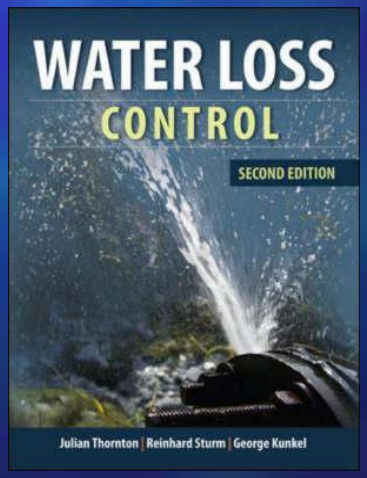
**10.** 100% of treated water production sources are metered, meter accuracy testing and electronic calibration conducted semi-annually, with less than 10% found outside of +/- 3% accuracy.

# AWWA Tools for Water Loss Control

- The "M" Series: Manuals of Practice
  - Guidance Manuals: widely recognized around the world as source of best practices in water utility operations and management
- AWWA Water Loss Control Committee's Free Water Audit Software©
  - Originally released 2006; current Version 4.2 software (2010)
- Water Research Foundation Research Reports
- Textbooks
- www.awwa.com - type "water loss control" in search box; select first item in list



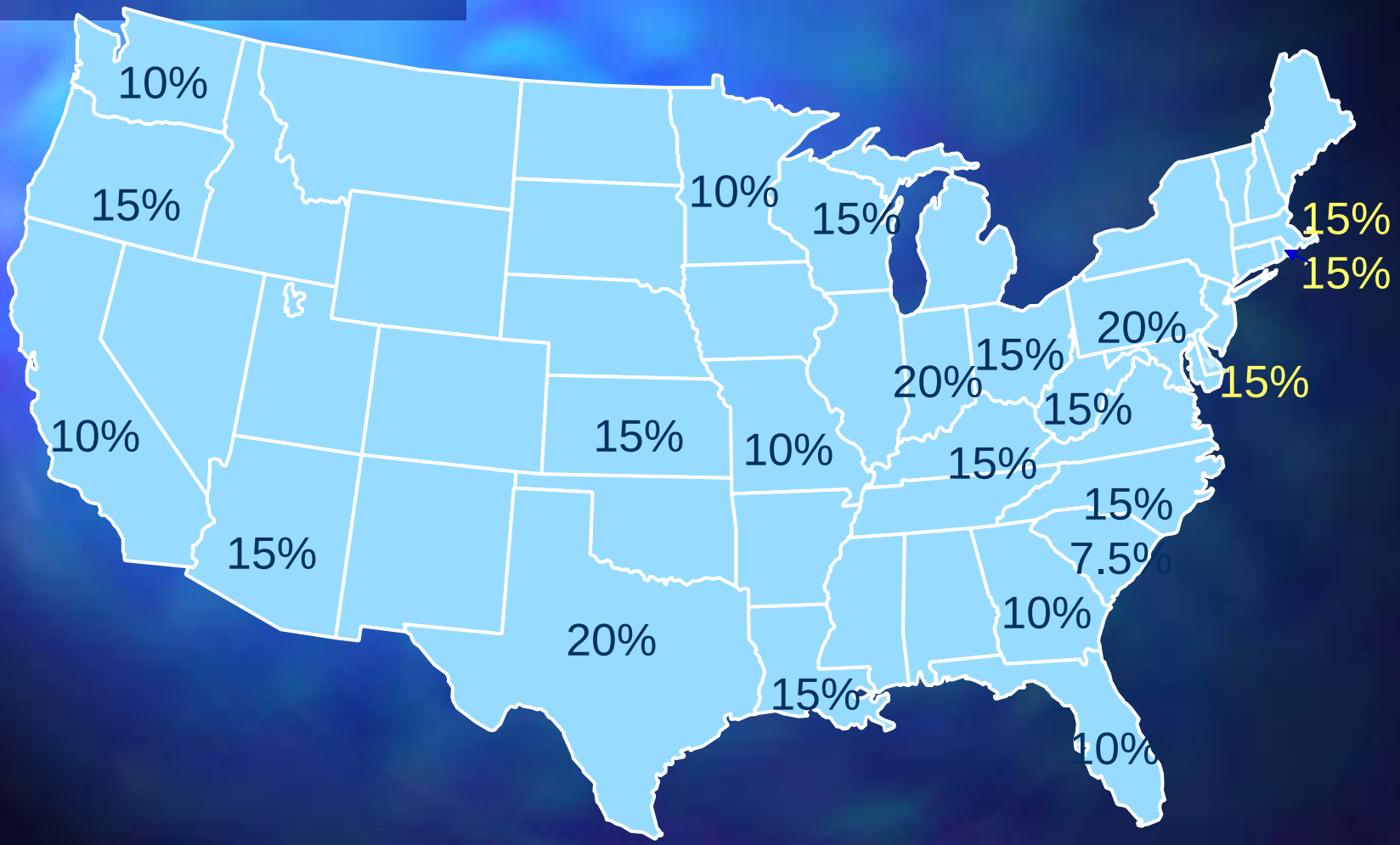




# Ten Practices Covered in the "States Survey" Project

- Water loss policy
- Definition of water loss
- Accounting and reporting
- Standards and benchmarks
- Goals and targets
- Planning requirements
- Compilation and publication
- Technical assistance
- Performance incentives
- Auditing and enforcement

# Selected State Standards for "Unaccounted-for" Water

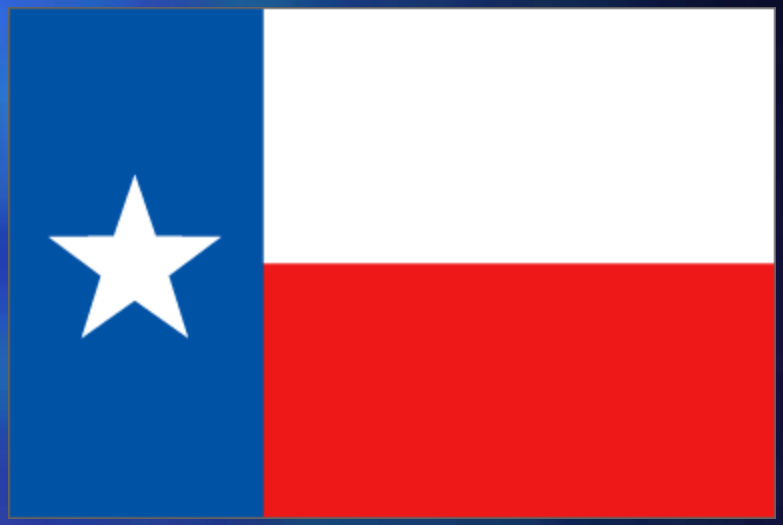


# States Survey Conclusions

- Fair amount of state and regional policy language exists, but with no imposed consequences through incentives or enforcement mechanisms
- Refined definitions, measures and standards for evaluating water losses are needed
- No established uniform method of accounting exists to collect valid and reliable data
- A better system of *accounting* is needed to instill *accountability* in drinking water supplies

# State of Texas

- *House Bill 3338 (2003) required water audits from water utilities for 2005 operations*
- *Texas Water Development Board selected IWA/AWWA Water Audit Method*
- *Over 2,000 water audits for 2005 collected in early 2006*
- *Findings confirmed that many water utilities have never tracked water efficiency data*
- *Audit data collection completed for 2010 year data; Texas manual exists – will they use AWWA Water Audit Software?*



*Report on evaluation of 2005 data can be found at: http://www.twdb.state.tx.us/RWPG/rpgm_rpts/0600010612_WaterLossinTexas.pdf*

# State of Georgia

- Decades long struggle for use of water from Lake Lanier; 2009 court ruling went against the City of Atlanta's continued level of withdrawals for water supply
- Landmark ***Water Stewardship Bill*** passed March 18, 2010: requires IWA/AWWA water audit by all water utilities by 2013
- Georgia Association of Water Professionals (GAWP) lead effort to implement a guidance manual
- State-wide water audit data collection underway in 2012
- Metropolitan North Georgia Water Planning District: part of Atlanta Regional Commission; oversees +60 water utilities in multi-county Atlanta area
  - Requires water utilities to submit water audits via AWWA Free Water Audit Software©
  - Developed training program around the software


http://www1.legis.ga.gov/legis/2009_10/pdf/sb370.pdf

http://gawp.org/audits.php

http://www.northgeorgiawater.com/

# Delaware River Basin Commission

- Intra-state agency encompassing Pennsylvania, New Jersey, New York, Delaware and US Army Corps of Engineers


- DRBC's revised Water Code requires mandatory water audit reporting using the IWA/AWWA Water Audit Method starting in 2013 for calendar year 2012
- Coordinating with PA PUC Pilot Program
- PA DEP – monitoring PA PUC, DRBC efforts

- http://www.state.nj.us/drbc/programs/supply/audits/

# *Pennsylvania Public Utility Commission*

- Regulates private water companies in Pennsylvania; approximately 130 systems
- Ran a two-year pilot program for water audit data collection from 2009-2011
- Mandatory data collection launching incrementally in 2012 & 2013
- AWWA/PUC Workshops held in March 2010 and April 2011
- http://www.puc.state.pa.us/General/press_releases/Press_Releases.aspx?ShowPR=2876

# State of California

- California Urban Water Conservation Council
  - Revised BMP 1.2 Water Loss Control in 2009
  - Affects ~ 270 water utilities
  - Water audit data collected annually since 2010 calendar year
  - CA Dept of Water Resources is monitoring these developments


***This is the most ambitious Water Audit and Loss Control Program authorized to date in the US***

- Four Year Validation Phase: advance utilities to Level IV by year 5
- Years 4-6: conduct component analysis, select KPI & & target level
- Final four years: must meet level for leakage control by year 10 (2019)

http://www.cuwcc.org/mou/bmp1-utility-operations-programs.aspx

# *New Mexico – Office of the State Engineer*

- Adopted IWA/AWWA Water Audit Method and advocates use of software
- Sponsored pilot water audit and study in small water utility (Gallup, NM)

See website references at:
http://www.ose.state.nm.us/wucp_accounting.html

# State of Tennessee

- Tennessee Comptroller of the Treasury – Water & Wastewater Financing Board: governing agency for "Utility Districts" – rural or semi-rural water utilities (a *financial* regulator)
- 2007 law prescribed average "% unaccounted-for water" as performance indicator
- Strong outreach by AWWA WLC Committee has advanced acceptance of IWA/AWWA Water Audit Methodology starting in 2013
- http://www.comptroller.tn.gov/wwfb

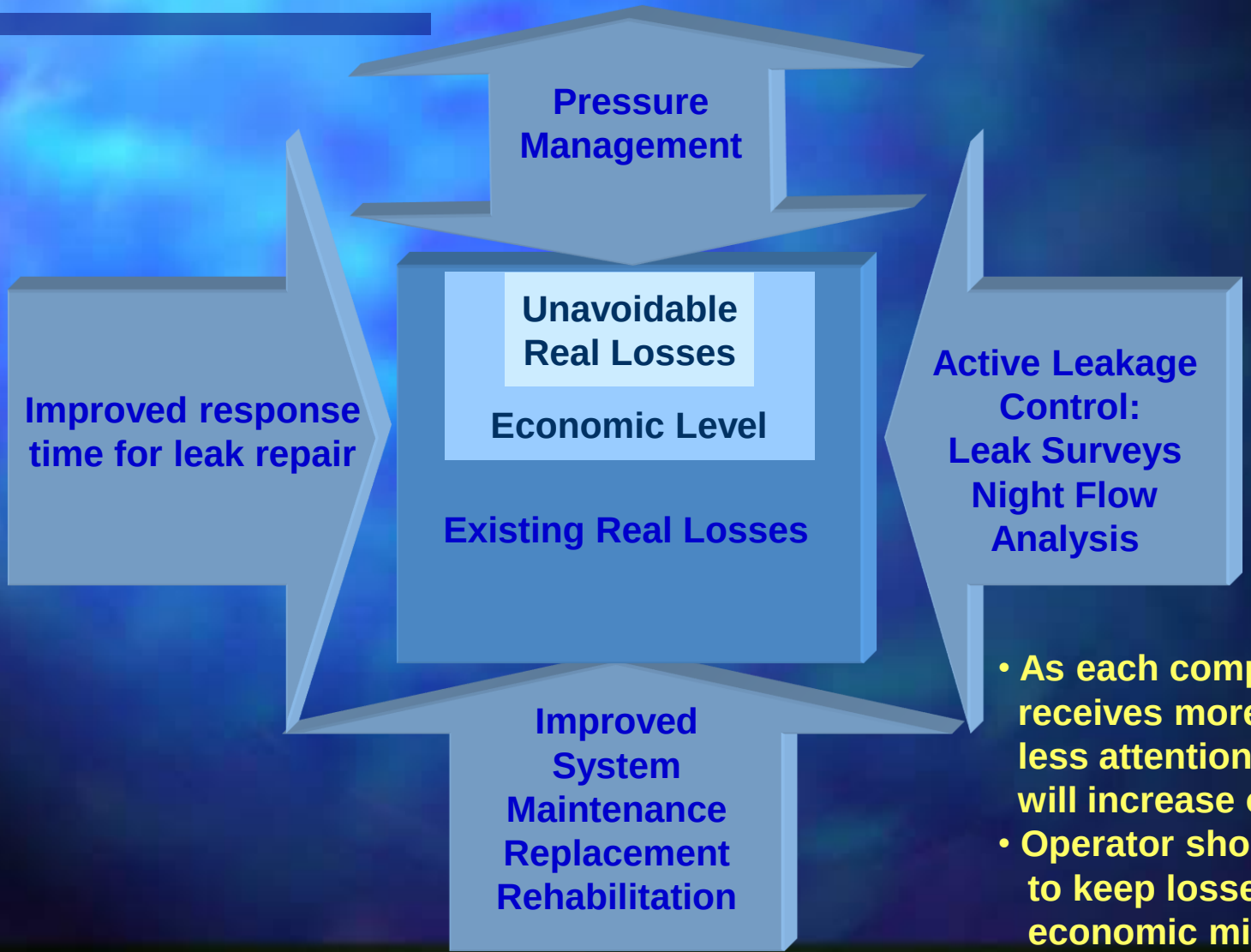
# State of Tennessee – Monitoring Requirements

- Water Audit Requirement in effect – June 2012. Utilities will be referred for Board action, if:
  - Incomplete AWWA water audit submitted anytime on or after January 1, 2013;
  - For audits received by the Comptroller of the Treasury from 1/1/2013 to 12/31/2014 -Validity score of 65 or less or non-revenue water as a percent by cost of operation system of 30% or greater;
  - For audits received by the Comptroller of the Treasury from 1/1/2015 to 12/31/2016 -Validity score of 70 or less or non-revenue water as a percent by cost of operation system of 25% or greater;
  - For audits received by the Comptroller of the Treasury from 1/1/2017 to 12/31/2018 - Validity score of 75 or less or non-revenue water as a percent by cost of operation system of 20% or greater;
  - For audits received by the Comptroller of the Treasury from 1/1/2019 to 12/31/2020 Validity score of 80 or less or non-revenue water as a percent by cost of operation system of 20% or greater.

# Component Analysis of Losses

- Losses can be broken down into two types:
  - Real and Apparent
- Real Losses are physical losses (leakage); can be broken down into four components
- Apparent Losses are paper losses (meter or billing error, unauthorized use) and can be broken down into four components
- Component analysis helps us to model where our losses are and the impact they have on our annual loss
- Appropriate intervention methods exist for each type of loss

# Four Components of Managing Real Losses



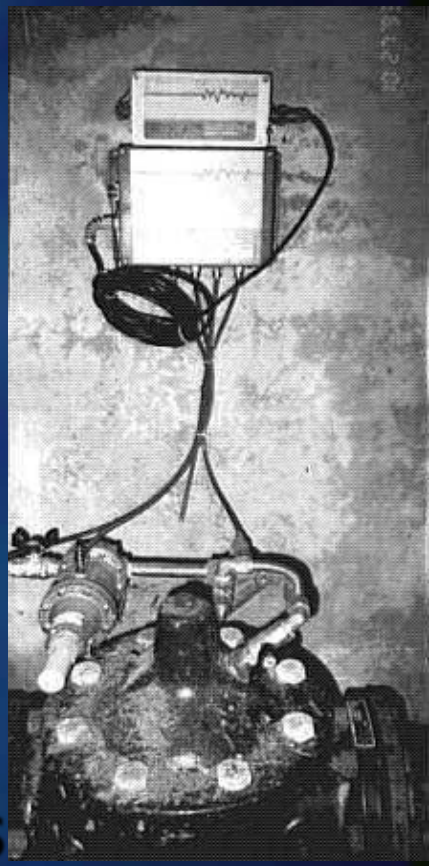

- As each component receives more or less attention, the losses will increase or decrease
- Operator should strive to keep losses to an economic minimum

# Active Leakage Control

- Leakage is constantly occurring in our systems and can be managed by:
  - Leak Surveys
  - Flow Measurement (Night Flow)
  - Improved technology for Leak pinpointing: leak correlators, leak noise loggers

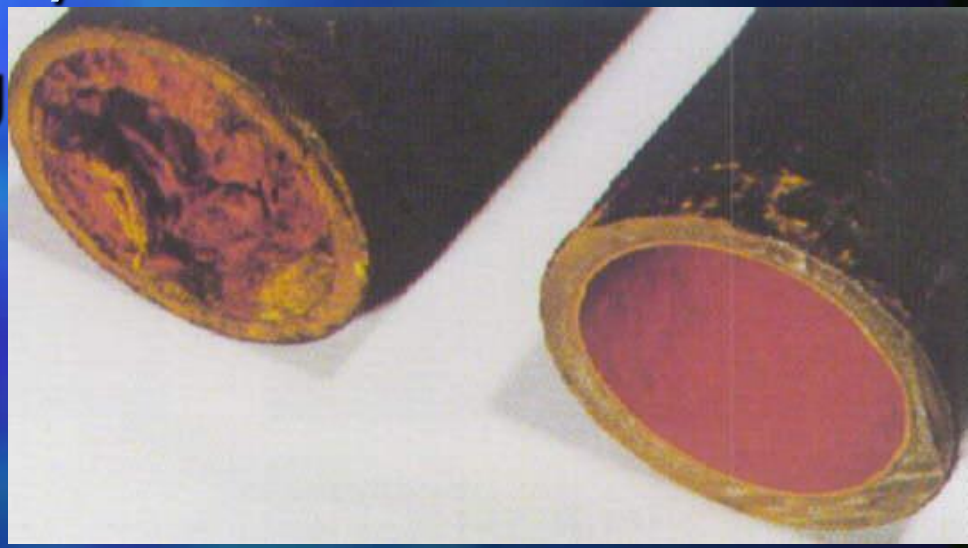
# Pressure Management

- Many systems are over pressurized, which can lead to higher break frequencies and volume of losses
- Background leaks are pressure sensitive
- Pressure reduction can be done safely
- Pressure reduction can aid conservation and be revenue neutral
- Pressure management reduces transients
- Pressure management is cost-effective



# Improved System Management Rehabilitation and Replacement

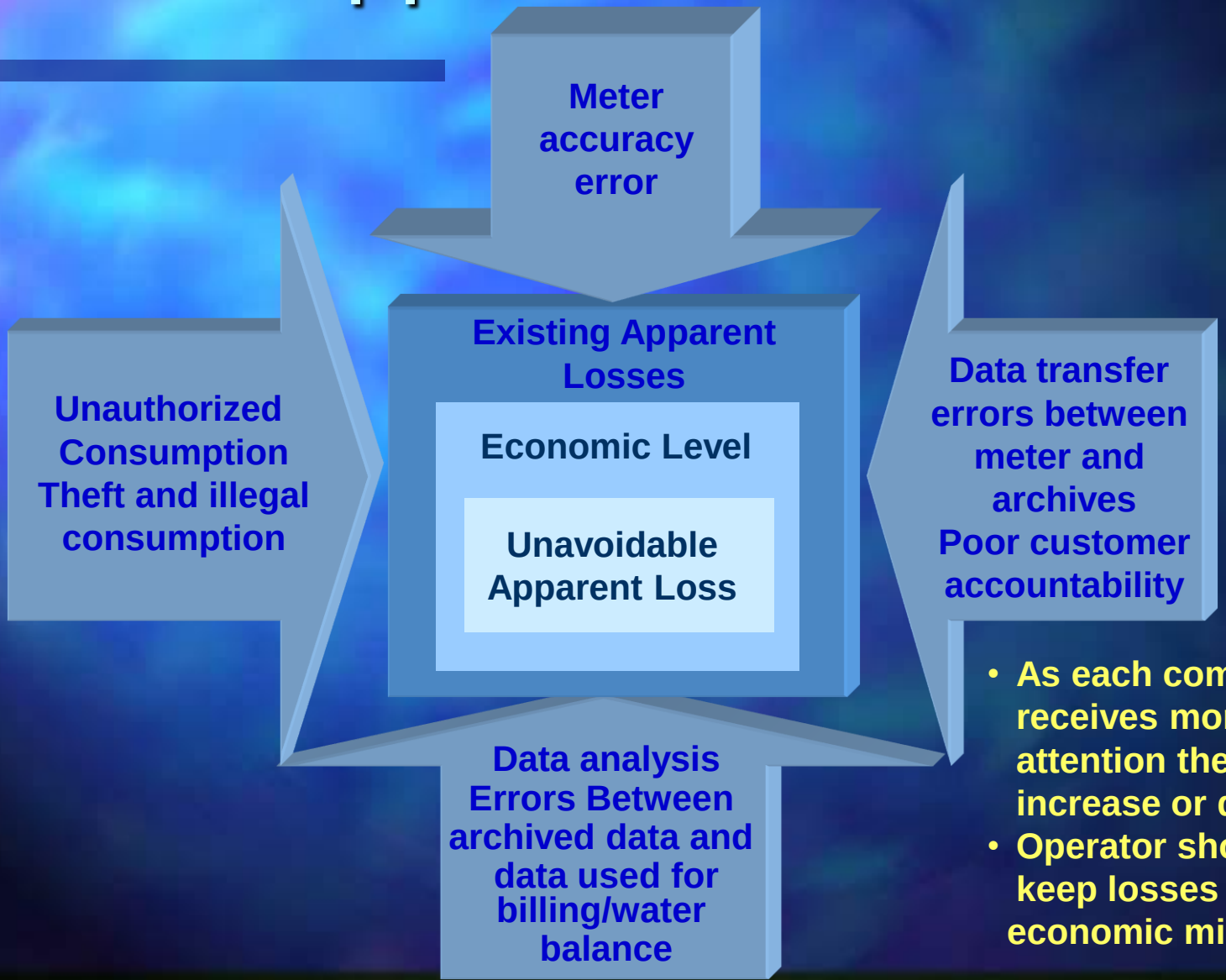
- Systems become old, corroded and inefficient and can be improved by:
- Pipe cleaning, relining
- Pipe rehabilitation
- Network replacement
- Service replacement
- Valve and hydrant maintenance



# Improved Response Time for Leak Repair

- Not all leakage is repaired efficiently, Example Customer Service Piping repair policies
- Leaks are classified in as:
  - Reported: High impact but gets fast response
  - Unreported: Unseen, source of greatest losses
- Each category has a run time
  - By reducing this run time we save significant volumes of lost water
- We can model the potential savings

# Four Components of Managing Apparent Losses




- As each component receives more or less attention the losses will increase or decrease
- Operator should strive to keep losses to an economic minimum

# Meter Accuracy Error

- Meters can be in error for a number of reasons:
  - Wear over time, excess volume or abrasive waters
  - Incorrect installation or lack of maintenance
  - Incorrect sizing
  - Incorrect meter type for the application
  - Environmental problems such as freezing or over heating
  - Good installation, selection & sizing practice routine testing and replacement will resolve these issues

# Data Transfer Errors

In many situations data can be recorded correctly by the meter but transferred incorrectly due to:


- Scaling problems
- Zero problems
- Pulse or factor problems
- Meter reader error in the case of manual reads
- Poor customer accountability
- Auditing, inspections, standardization and a good data trail will resolve many of these problems

# Data Analysis Errors

- Once data arrives at the utility office it can often be misused
- Estimates are generated and volumes inferred
- Rebates are given and volumes inferred
- Customers can be lost or temporarily transferred to other accounting systems
- Routine audits, system upgrades, operator education and clear operating guidelines will resolve many of these problems

# Theft and Illegal Consumption

In many situations clients may

- Not report a connection
- Make a bypass
- Tamper with the meter
- Misuse fire hydrants to supply various activities
  - Street cleaning, refill boat tanks, etc
- Routine inspections, prepay schemes, legal action and flow and pressure control can resolve many of these problems

# Using the International Water Audit Methodology

- Gain support from the top for the long haul!
- Phase I: The "Top-Down" Approach
  - Desktop analysis; gather records & conduct interviews
  - Uses many estimates, but gets things started!
  - Initially generates a "Balancing Error" difference between Input and explained Use & Loss
- Phase II: Place Cost Values on Use & Loss
  - Real Losses: Marginal Production Costs
  - Apparent Losses: Customer Retail Rate

# Using the International Water Audit Methodology

- Phase III: Assemble Performance Indicators
  - Technical: Leakage over "Unavoidable" Losses
    - Infrastructure Leakage Index (ILI) - gives leakage standing
  - Financial: Non-Rev. Water as % operating costs
- Phase IV: The "Bottom-Up" Approach
  - Gather Field data (Night flow Leakage Analysis)
  - Replace estimates with actual field data
  - Compile the Water Audit regularly (annually), gradually refining it to reduce the Balancing Error

# AWWA WLC Committee Report Recommendations

- Use the IWA Water Audit methodology and Performance Indicators as the current best practice method
- Drop the term "Unaccounted-for" Water - it has no consistent meaning
- Adopt the four component approaches to controlling Real Losses and Apparent Losses as leading practices to economically control these losses
- Refer to M-36 AWWA Water Audits & Leak Detection

# Goodbye to the Old—Welcome to a new era of Water Loss Control

LISTENING WITH STETHOSCOPES AND AQUAPHONES ALONG A MAIN SUPPLY PIPE DURING A NIGHT INSPECTION.