

Water System Audits: The Key to Supply-Side Water Loss Management



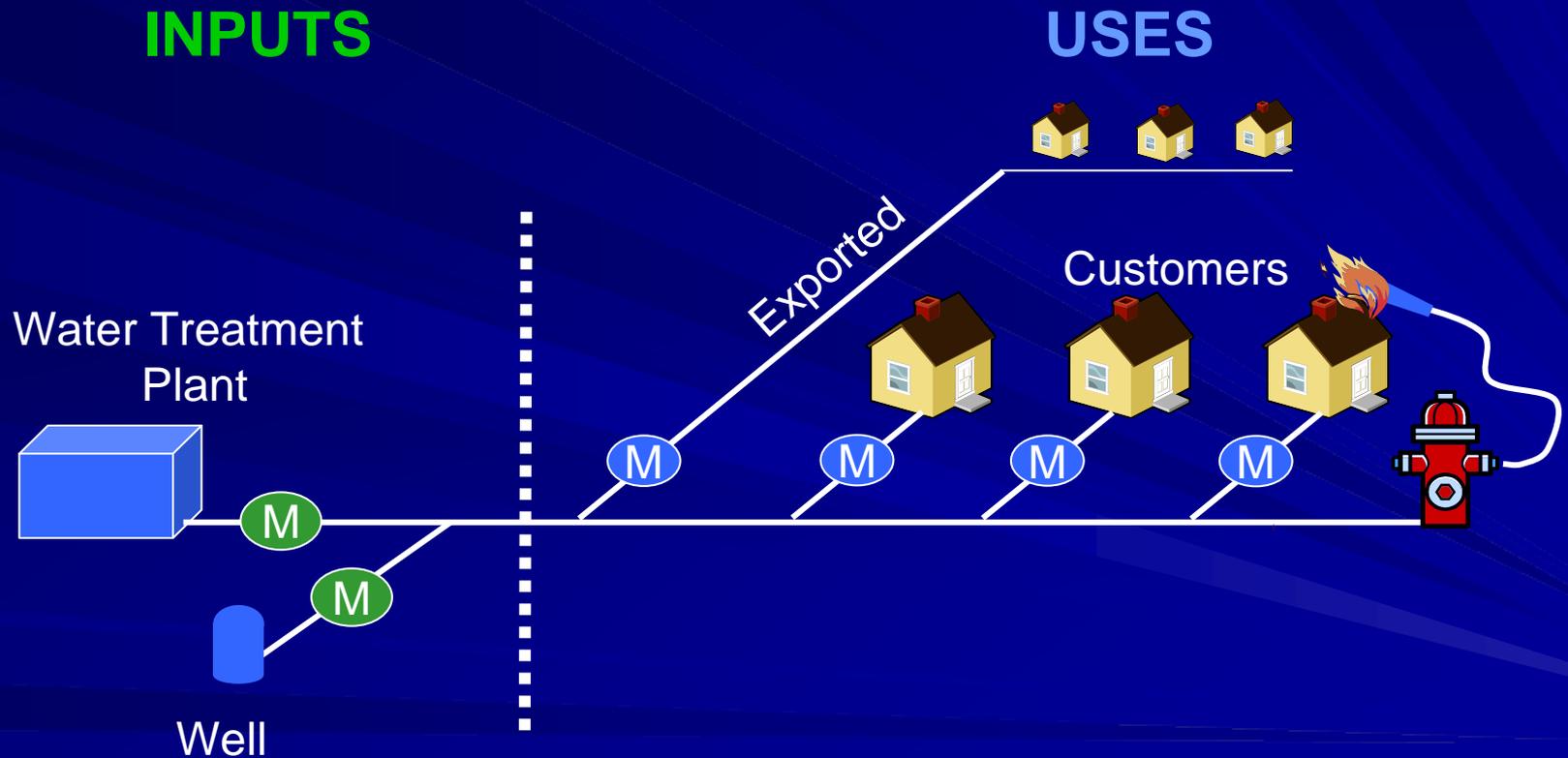
Arizona Department of Water Resources
Municipal Conservation BMP Program
March 20, 2009

City of Phoenix
Water Services Department



What is a Water Audit?

A standardized, systematic, approach to determine where water goes in the distribution system.



$$\text{INPUTS} - \text{USES} = \text{LOSSES}$$

Why do a Water Audit?

- Basis for establishing a proactive water losses reduction program.
- Used to evaluate the economic impact of water losses.
- Findings can be included in water conservation portfolio.
- Improves demand forecasting and supply/demand balance analysis.
- Ensures that good investment decisions are made for the management of water losses.
- Focuses efforts on the most effective water loss management programs.



Benefits of Water Loss Reduction

- Does not reduce revenue
- Improves public health protection
- Increases reliability of water service
- Often cheapest new resource in areas facing water supply shortages
- Lowers energy costs
- Can defer capital expenditure on water resources and supply infrastructure
- Improves public perception



AWWA Water Balance

System Input Volume	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	
	Unbilled Authorized Consumption	Unbilled Metered Consumption		
		Unbilled Unmetered Consumption		







AWWA Water Balance

System Input Volume	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Consumption	Non Revenue Water
			Unbilled Unmetered Consumption	
	Water Losses	Apparent Losses	Unauthorized Consumption	
			Customer Meter Inaccuracies	
		Real Losses	Leakage on Transmission and Distribution Mains	
			Leakage and Overflows at Storage Tanks	
			Leakage on Service Connections up to point of Customer Meter	

Types of Water Losses

- Reducing Apparent Losses increases revenue but creates no *new* water.
- Reducing Real Losses creates an additional resource, which reduces operating costs and can be used to defer capital expenditures.



Components of Apparent Losses

- Water Meter Inaccuracies
- Data Handling Errors
- Water Theft



Components of Real Losses

- **Reported Leaks and Breaks**

Typically high flow rates, short run-time and notified by customers, utility personnel etc.



- **Unreported Leaks and Break**

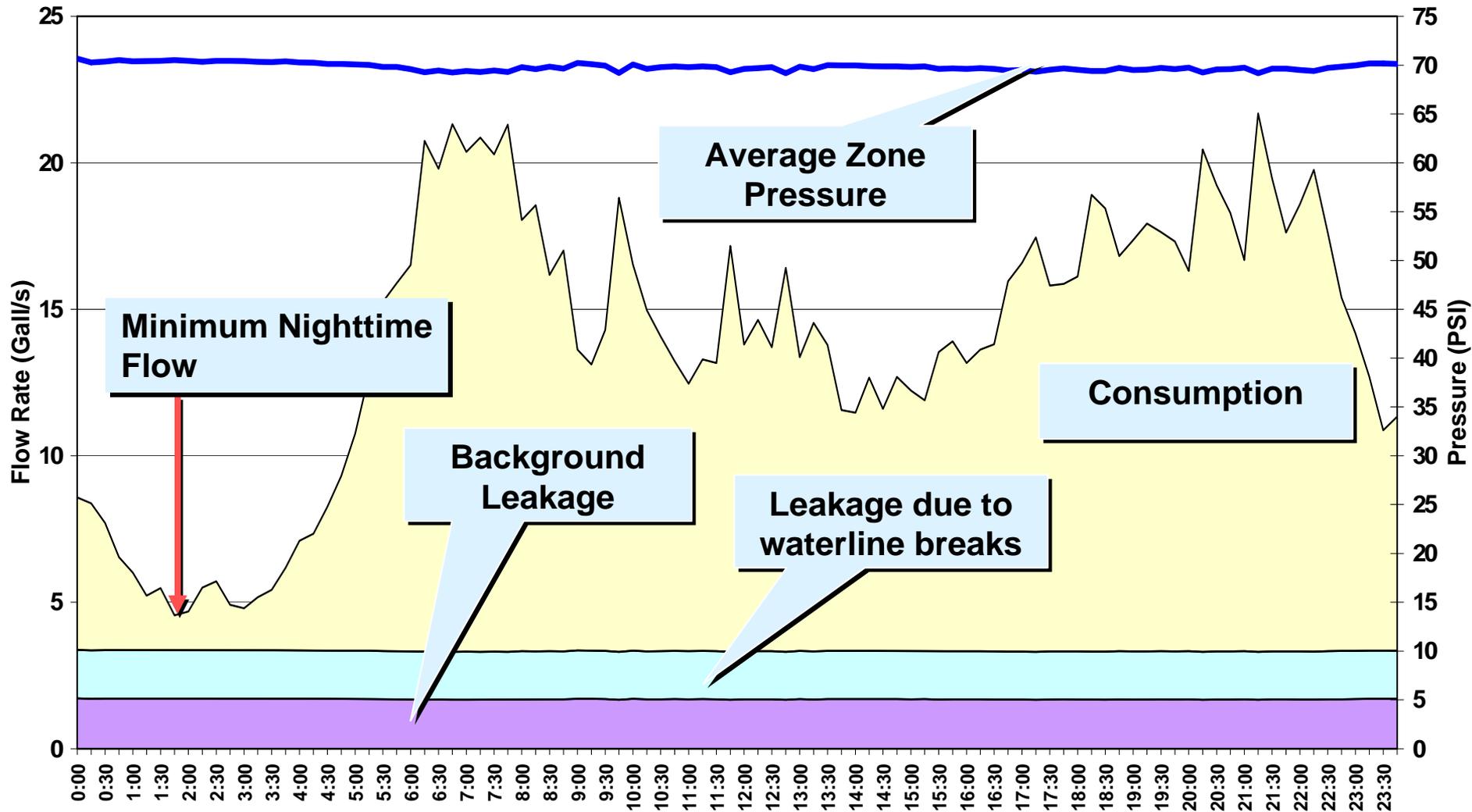
Typically moderate flow rates, long run-time and located by active leakage control.



- **Background Leakage**

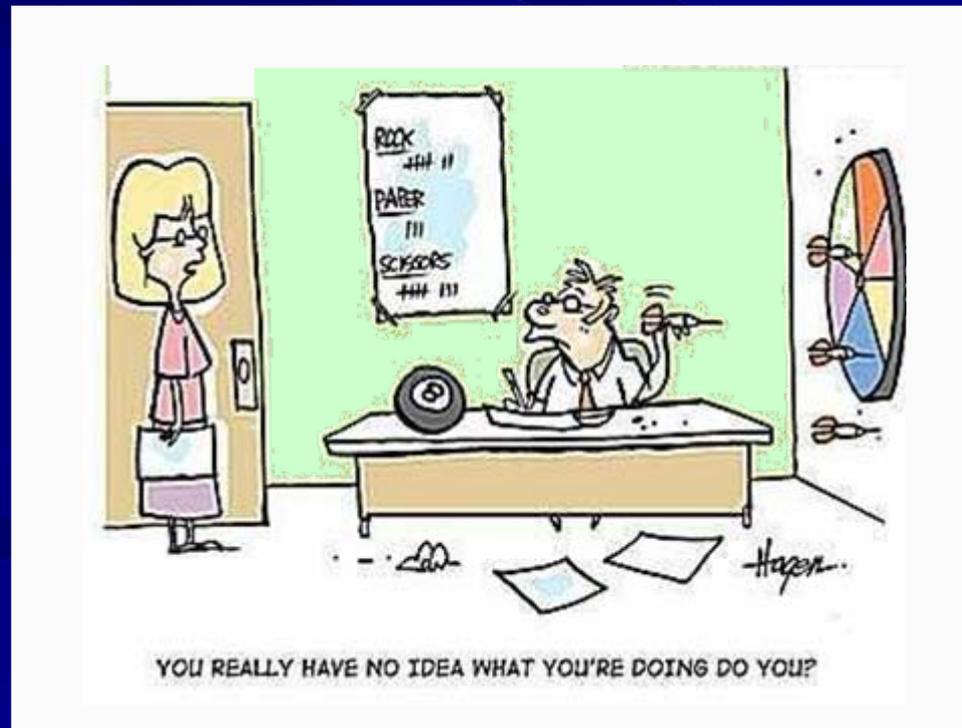
Flow rates too small to be detected if hidden (generally < 1 gpm), but run continuously. Can only be practically reduced by reduction in pressure.

Real Water Losses



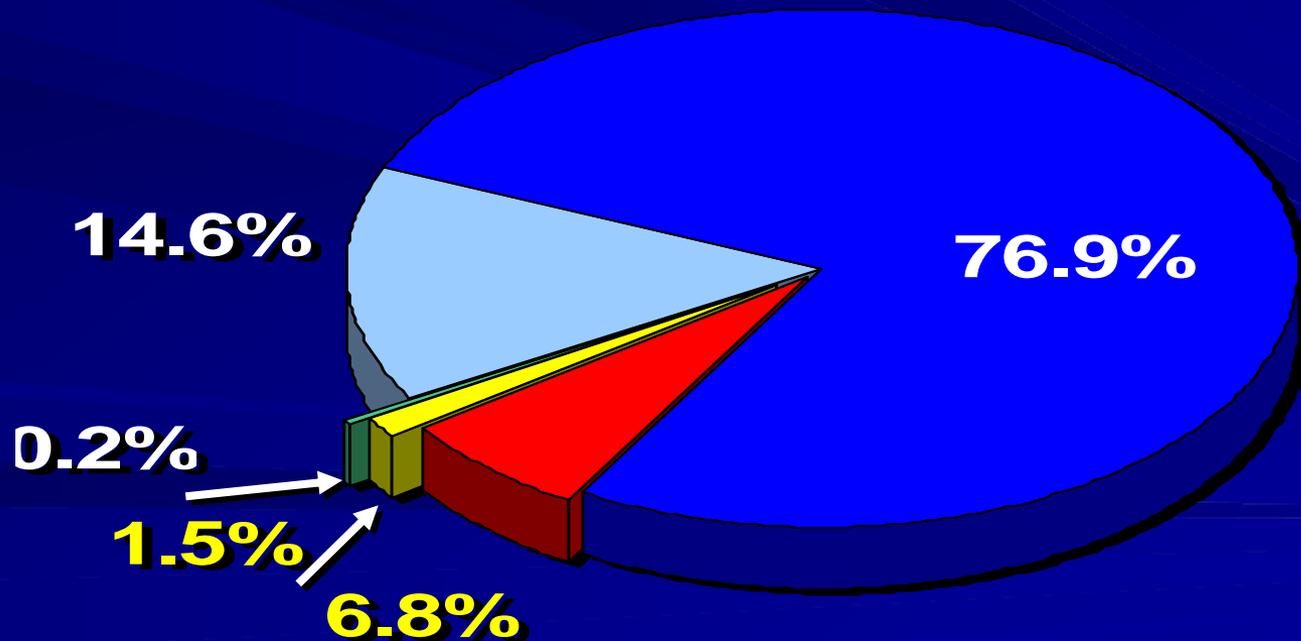
Performance Indicators

Establish standards by which you can measure how well you are actually doing!

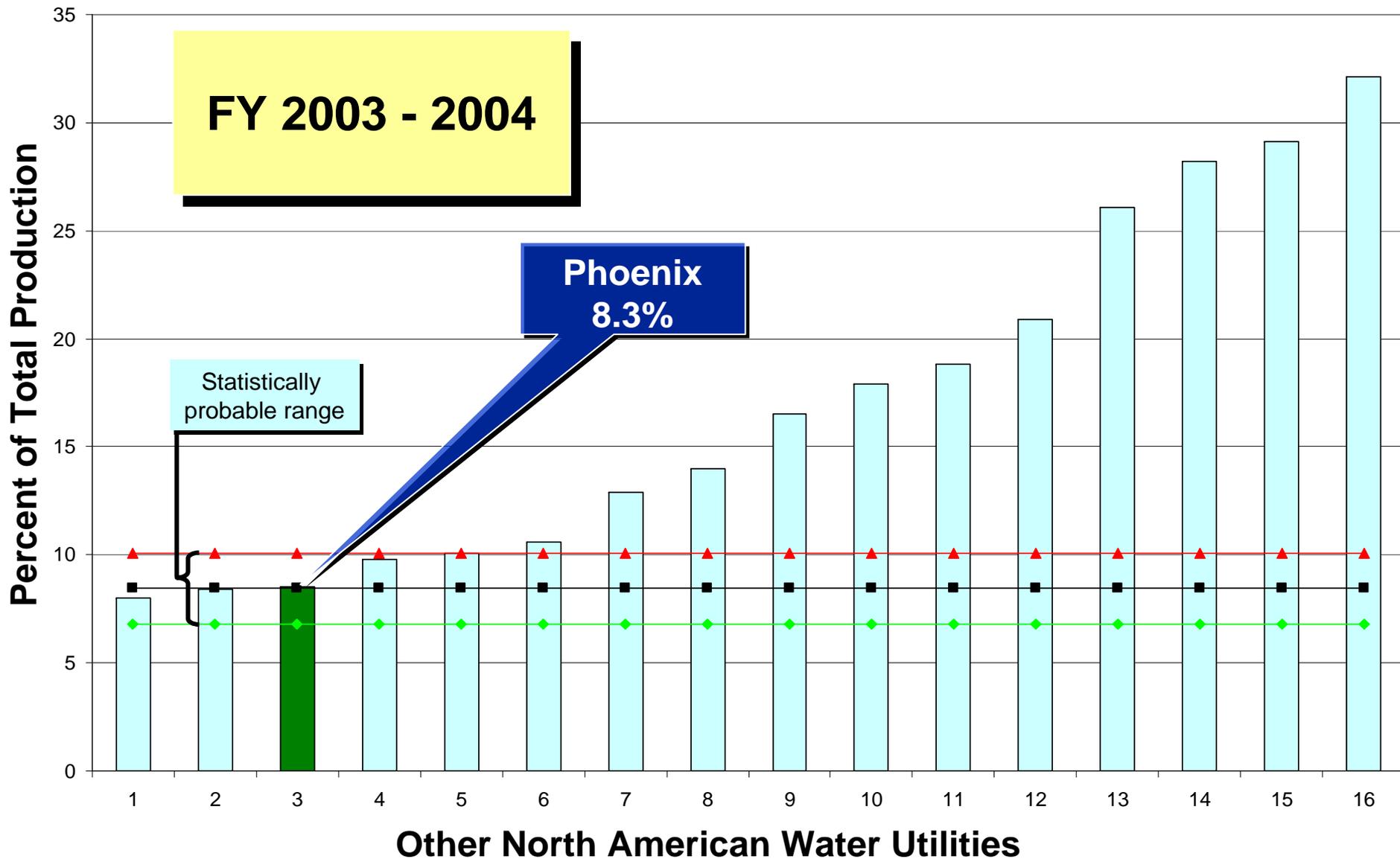


Phoenix Water Balance

	Billed Authorized Consumption	96,221 MG
	Water Exported	18,305 MG
	Real Losses	8,490 MG
	Apparent Losses	1,856 MG
	Unbilled Authorized	215 MG



Non-Revenue Water as Percent of Total Production



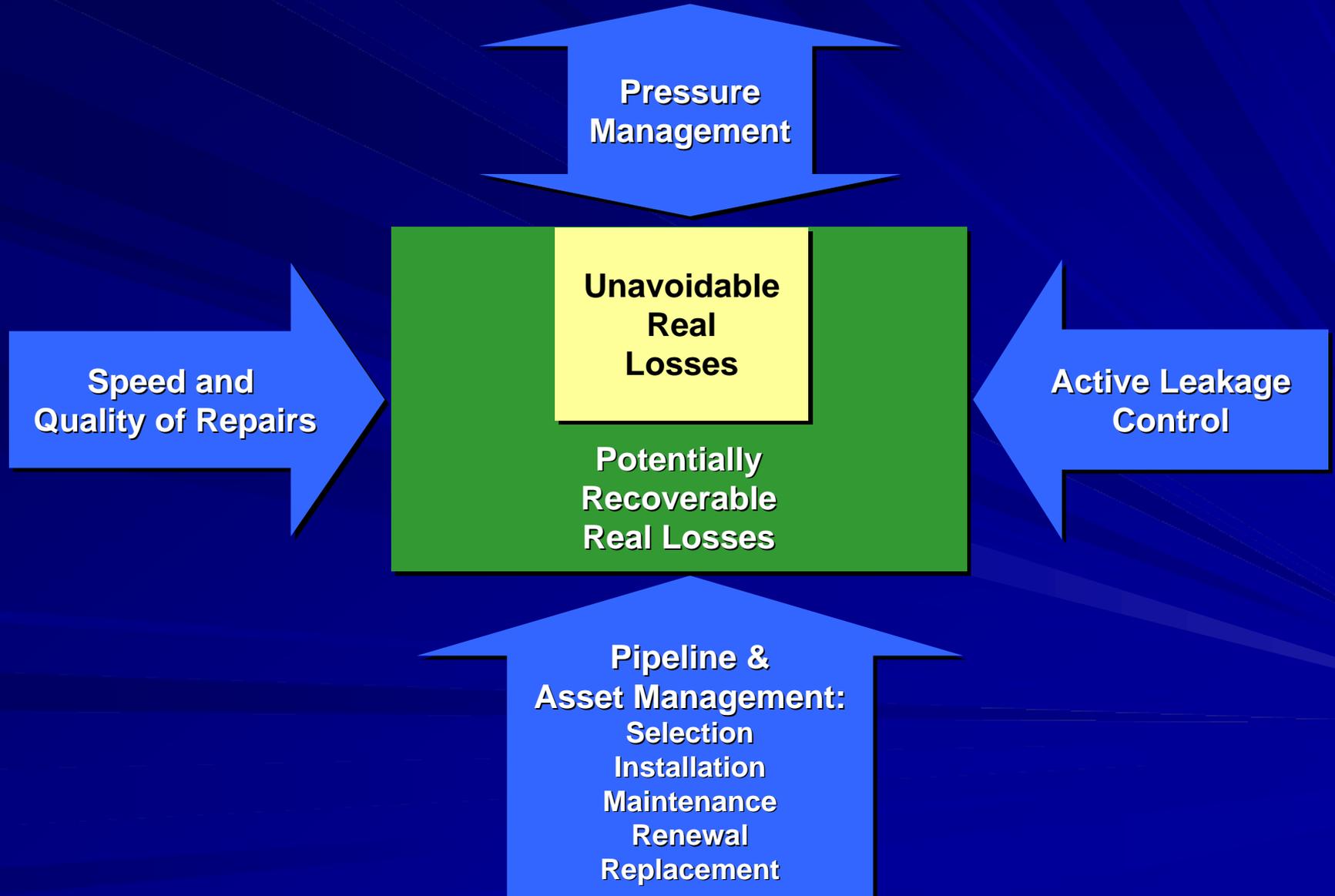
Interpreting Results

- Leakage occurs regardless of customer demand.
- If customer demand decreases, real losses will appear to increase!
- Expressing losses as a percentage is not a good standard of measure.

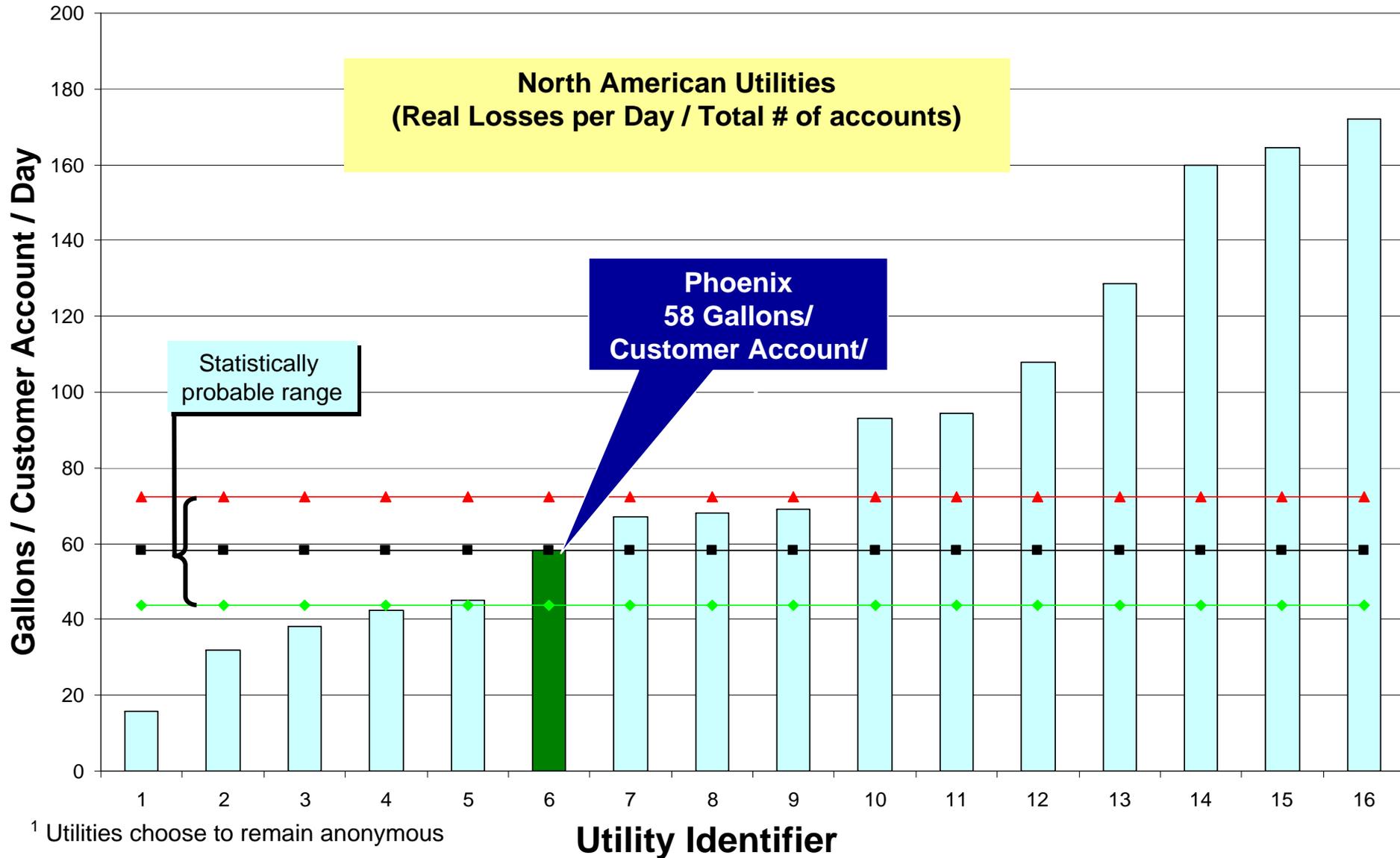


Infrastructure Leakage Index (ILI)

Ratio of Current Annual Real Losses to Unavoidable Annual Real Losses (UARL)



Loss Per Account Per Day



Steps for Reducing Water Losses

- Calculate Detailed “Top-Down” Annual Water Balance
 - Verify system input volumes
 - Identify, standardize and confirm consumption volumes
 - Analyze customer meter accuracy
 - Assess and calculate unmeasured uses
- **Identify Volumes of Apparent and Real Losses**
- **Determination of Performance Indicators**
 - IWA and AWWA have established methodology
- Determine Components of Real and Apparent Losses
- Assess Economic Impact of Losses – Target Setting and Intervention
- Develop Program Based Greatest Economic Impact

Free Software!

Leak Detection

Meter Replacement

