



Municipal
Conservation

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System Audits,
Metering, &
Leak Detection

March 10, 2009
Workshop

Importance of Water Measurement and Quantification: Metering



Lee Ester, Salt River Project



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Why Measure?

- "Can't manage what you can't measure."
- Revenue (cash registers)
- AWWA Standards, for example:
 - AWWA C704 – Propeller & Turbine Meters
 - AWWA M33 – Flow meters in Water Supply
 - AWWA M-6 – Testing of Meters
 - <http://www.awwa.org/>



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Measurement

- There are three common methods of flow measurement in use:
 - Displacement
 - Velocity
 - Electromagnetic
- Common types of water meters:
 - Multi-jet Meter
 - Single-jet Meter
 - *Positive Displacement Meter*
 - *Turbine Meter / Compound Meter*
 - Fire Meter
 - Fire Hydrant Meter
 - *Mag Meter*
 - *Propeller Meter*



Measurement Devices

- Positive Displacement Meter
- Turbine meter (& Compound)
- Propeller meter
- Magnetic flow meter





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Measurement Devices

- Positive Displacement
 - These meters register by recording the revolutions of a measuring chamber set in motion by the force of flowing water moving through the chambers.





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Typical Measurement Devices

- Turbine Meter (& Compound)
 - These meters register by recording the revolutions of a turbine blade set in motion by the force of flowing water striking the turbine.





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Measurement Devices

- Propeller Meter

- These meters register by recording the revolutions of a propeller set in motion by the force of flowing water striking the blades.



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Measurement Devices

- Magnetic Meter
 - No moving parts and offer no obstruction to the flow of liquids.





Meter Registers

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Mechanical meters can be provided with open or sealed, or permanently sealed registers; with units of measure, with a center sweep-test hand, or with an instantaneous flow-rate indicator reading in units (gpm, cfs, or other units).



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Installation – General Considerations

- Select a meter that ensures that the maximum flow rate won't be exceeded for extended periods.
- Locate upstream of a chemical injection point.
- Can be installed with an upstream strainer to prevent solids from interfering with the rotor mechanism.
- Consider future testing and repair taps bypasses for testing needs.
- Locate horizontally in such a way that the register is easily read.





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Meter Accuracy & Precision

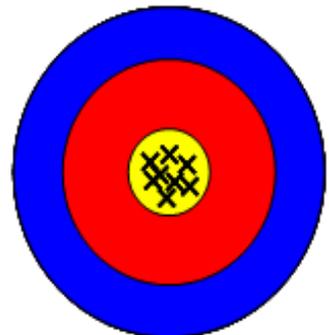
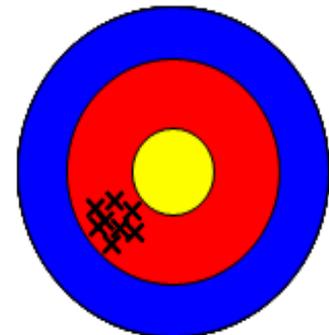
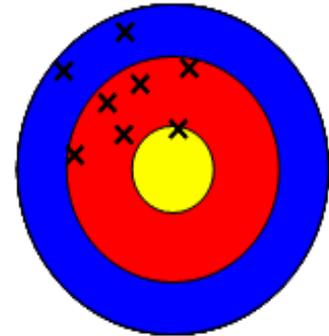
- Accuracy is the degree to which a measured value matches the actual value.
- Precision (or repeatability) is a measure of the flow meter's ability to indicate the same flow after the flow has deviated. For example, 3 gpm up to 10 gpm, then back to 3 gpm.



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	Accurate	Inaccurate (systematic error)
Precise		
Imprecise (reproducibility error)		



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Process Issues

- Theft
- Leaks
- Misreads
- Billing issues
- Malfunctioning meters
 - Maintenance
 - ✓ Flow rate
 - ✓ Age
 - ✓ Tampering





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Verification Methods

- In field
 - Testing tap – old meter remains in service, water runs thru test meter
- On-bench
- Scheduled rotation





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AMR – Automatic Meter Reading

Automatic meter reading, or AMR, is the technology of automatically collecting data from a water meter.

- **Touch Technology**

With touch based AMR, a meter reader carries a handheld computer or data collection device with a wand or probe. The device automatically collects the readings from a meter by touching or placing the read probe in close proximity to a reading coil enclosed in the touchpad.

- **Radio Frequency Network**

Radio frequency based AMR can take many forms. The more common ones are Handheld, Mobile, and Fixed network. There are both two-way RF systems and one-way RF systems in use that use both licensed and unlicensed RF bands.

- **Handheld**

In handheld AMR, a meter reader carries a handheld computer with a built-in or attached receiver/transceiver (radio frequency or touch) to collect meter readings from an AMR capable meter

- **Mobile**

Mobile or "Drive-by" meter reading is where a reading device is installed in a vehicle. The meter reader drives the vehicle while the reading device automatically collects the meter readings

- **Fixed Network**

Fixed Network AMR is a method where a network is permanently installed to capture meter readings. This method can consist of a series of antennas, towers, collectors, repeaters, or other permanently installed infrastructure to collect transmissions of meter readings from AMR capable meters and get the data to a central computer without a person in the field to collect it.





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AMR Registers

Questions





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Lee W. Ester, Manager, Measurement Services, SRP

Lee Ester received an AA Degree from Glendale Community College in 1982 and a BS Degree in Business Management from the University of Phoenix in 1996. Lee began his career at SRP in the Hydrology Division in June of 1987. His division of eleven analysts, specialists, and technicians design and operate a variety of forms of instrumentation, telemetry, and quantification of flow discharge at many of Arizona's native rivers on the Salt and Verde watersheds.

Mr. Ester also provides water measurement/quantification on SRP's canals and laterals as well as in pressurized pipe configurations. His division operates a one-of-kind flow meter testing laboratory in the Phoenix area. He oversees accuracy verifications at all local City Water Treatment Plants as well as at other points of measurement detailed within local Contracts, Agreements and Indian Settlements.

