

The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance. The largest droplet is in the bottom right corner, and there are smaller ones in the top left, bottom left, and center-right areas.

# SMART METERS

ADVANCES IN WATER METER TECHNOLOGY

BILL KASPER

NORTH PENN WATER AUTHORITY

# COMMON CURRENT METER TYPES

MECHANICAL

- Positive displacement
  - Nutating disk
  - Oscillating piston
- Multijet
- Singlejet
- Compound
- Turbine
- Fire Service



# COMMON CURRENT METER TYPES

## Electromagnetic



## Ultrasonic



# MAGNETIC AND ULTRASONIC METERS HOW DO THEY WORK?

## Magnetic

- Faraday's law
  - Magnetic field is generated
  - Water passing through creates small electric current that is proportional to velocity of flow
  - Current is measured and converted to number

## Ultrasonic

- A pair of transceivers positioned in tube
- Ultrasonic pulses up and downstream
- Time difference of the pulses is computed into the flow rate

# MAGNETIC AND ULTRASONIC METERS

- As of now AWWA manual M6 does not include a standard for either
- AWWA manual M33 does include and describe both
- Both come in a wide range of sizes
  - Mag- 1/10" – 120"
  - Ultrasonic – 1/4" – 360"
  - Popular manufacturers have common residential, commercial, industrial sizes
- No moving parts
- Can accurately measure very low flows

# MAGNETIC AND ULTRASONIC METERS

- No or very low head loss
- No loss of accuracy over time
- Testing
  - Mag – follow manufacturer test procedures
  - Ultrasonic – no special testing procedures
- Battery has a limited life
  - Most manufacturers claim 20 years

# MAGNETIC AND ULTRASONIC METERS

- A 2016 Utah Water Research Lab study was released showing the accuracy differences between mechanical and Mag/Ultrasonic meters.
  - This study showed that the “electronic” meter more accurate at flows  $\frac{1}{4}$  gallon and less.
  - Low flow accounts for large part of residential usage
    - Will record overall usage more accurately
  - A plus is the usual digital display that gives better resolution than analog



# SO, IS MY MECHANICAL METER NOT SMART?

- MAYBE. DEFINITELY MAYBE
  - A mechanical meter can be a smart meter with the right register
  - Encoder registers allow transmission of information to the reading device



The image features a light gray background with several realistic water droplets of various sizes scattered in the corners. The droplets have highlights and shadows, giving them a three-dimensional appearance. The text is centered in the middle of the page.

**SO WHAT MAKES THESE METERS SO  
DARN SMART ANYWAY?**

# IT'S ALL ABOUT THE INFORMATION

- What information does the meter get for me?
- Depending on the brand:
  - Leak/Broken Tube/Continuous flow
  - Tamper/Empty Pipe
  - Reverse flow
  - No flow
  - No communications

# THE ENDPOINT

- Most brands of radio read are compatible with other brands of meters
- Reads the meter multiple times a day
- Transmits to collector one to several times per day
- Data sent
  - Intermittent usage
    - 15 minutes to hourly
  - Alerts/Alarms
    - Leak
    - Tamper
    - Reverse flow
    - No flow



# THE ENDPOINT



# HOW DO I OBTAIN THIS INFORMATION?

Now for a brief discussion on meter reading

# HISTORY OF METER READING

- Direct reading
  - Meter readers
  - Customer post cards
- Remote read registers – late 1960's
  - GTR
  - Touch Pads
- AMR – 1970's – Automated Meter Reading
  - Telephone lines
  - Low power RF



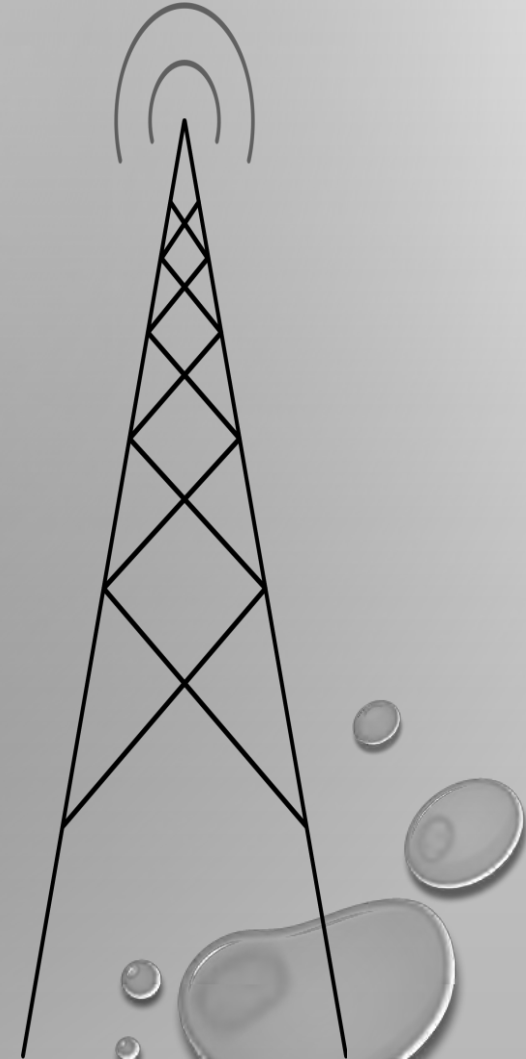
# HISTORY OF METER READING CONTINUED

- AMI - Advanced Metering Infrastructure -Fixed base
  - A few ways to get the readings and other available information
- RF
  - Collectors/Antennas
    - On tanks



# HISTORY OF METER READING CONTINUED

- AMI - Advanced Metering Infrastructure -Fixed base
  - A few ways to get the readings and other available information
- RF
  - Collectors/Antennas
    - On tanks
    - On buildings
    - Radio towers

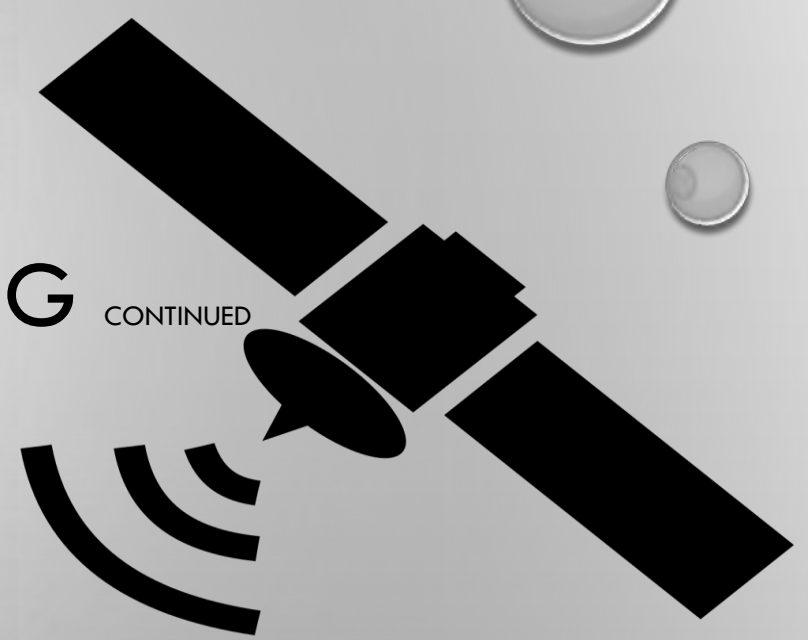




# HISTORY OF METER READING CONTINUED

- Satellite

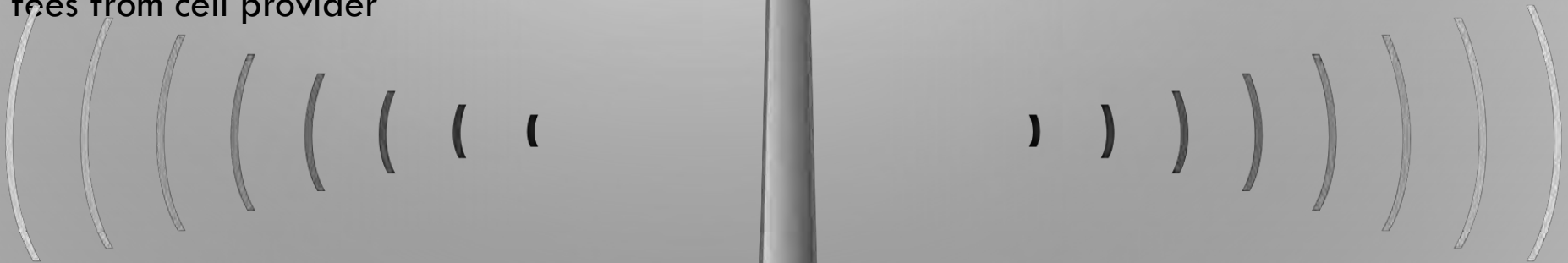
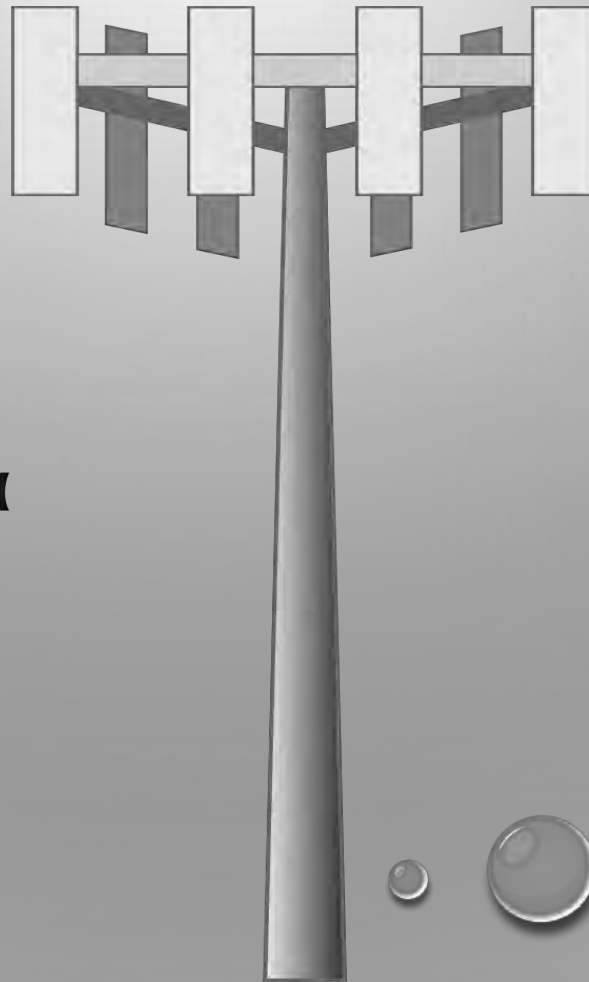
- Excellent for remote areas
  - Good for sparsely metered areas
  - No cell network available
- No infrastructure for utility



# HISTORY OF METER READING CONTINUED

- Cellular

- Must have cell network
- Good for sparsely metered area
- Data fees from cell provider



# HISTORY OF METER READING CONTINUED

- RF is most common in PA
  - Usually line of sight
  - RF signal can be easily blocked by:
    - Geography
    - Cast iron pit lids
    - Structures
  - Distance restrictions require multiple collectors
  - Health concerns from radio frequency waves

# RF HEALTH CONCERNS

- The American Cancer Society has done research and recently released a short report that states:
  - “RF radiation doesn’t have enough energy to remove charged particles such as electrons (ionize), and so is called non-ionizing radiation. Non-ionizing radiation has enough energy to move atoms in a molecule around or cause them to vibrate, which can lead to heat but it can’t damage DNA directly.”
- Same type of RF waves that cell phones produce
- Meter pit
  - Takes transmitter away from house

# PRIVACY CONCERNS

- Common concerns are:
  - Personal information
  - Billing information
  - Usage patterns
- Offer an alternative
- Offer an opt out solution
  - Defeats the purpose of the smart meter, but satisfies the customer

# TO AMR or AMI? THAT IS THE QUESTION

- AMR

- Meter reader needed
- After the fact review of:
  - Usage
  - Alarms/alerts
  - No reads
  - Com failures
- Assets on the street
- Reactive

- AMI

- Infrastructure needed
- Daily review of:
  - Usage
  - Alarms/alerts
  - No reads
  - Com failures
- No assets on the street
- Proactive

# A VERY IMPORTANT REASON THAT AMI IS THE WAY TO GO...

- NOBODY HAS EVERY BEEN CHASED OR BIT BY A DOG WHILE READING A METER THROUGH AN AMI SYSTEM.



# I HAVE THE “SMART METER”. NOW WHAT DO I DO WITH IT?

## Automated Meter Infrastructure and Smart Water Metering





# SOFT COMPONENTS OF THE AMI

- RNI
  - Regional Network Interface
- Analytical Software
  - This is a valuable tool to remain proactive
  - Shows alerts and alarms
  - Develops usage history
  - Shows incremental reads and usage
  - Graphs and charts
- Utility can host or pay hosting fee

# BENEFITS TO THE UTILITY

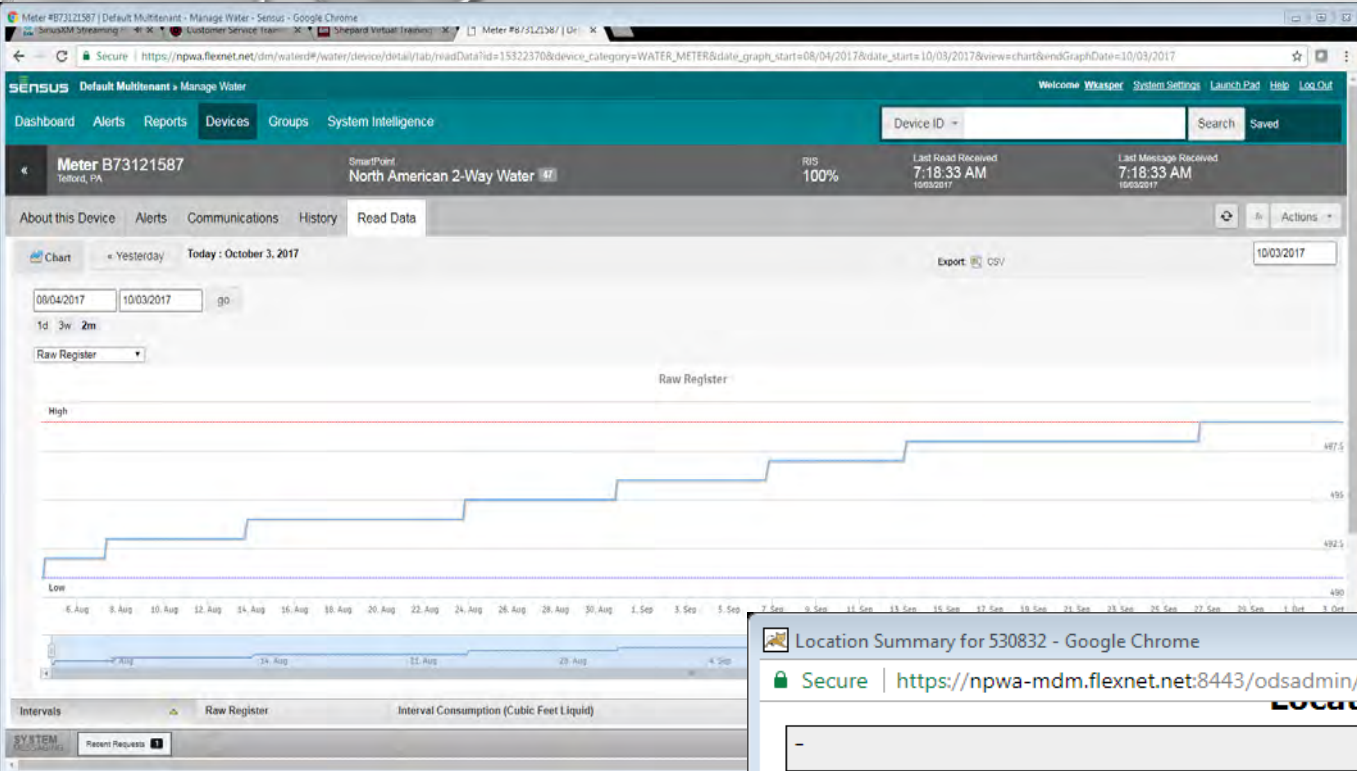
- On demand data
  - Saves windshield time for final reads
  - Customer high bill complaints
- Reduce meter reading costs
- Builds usage history on all accounts
  - Compare time periods
  - EDU audits

# BENEFITS TO THE UTILITY

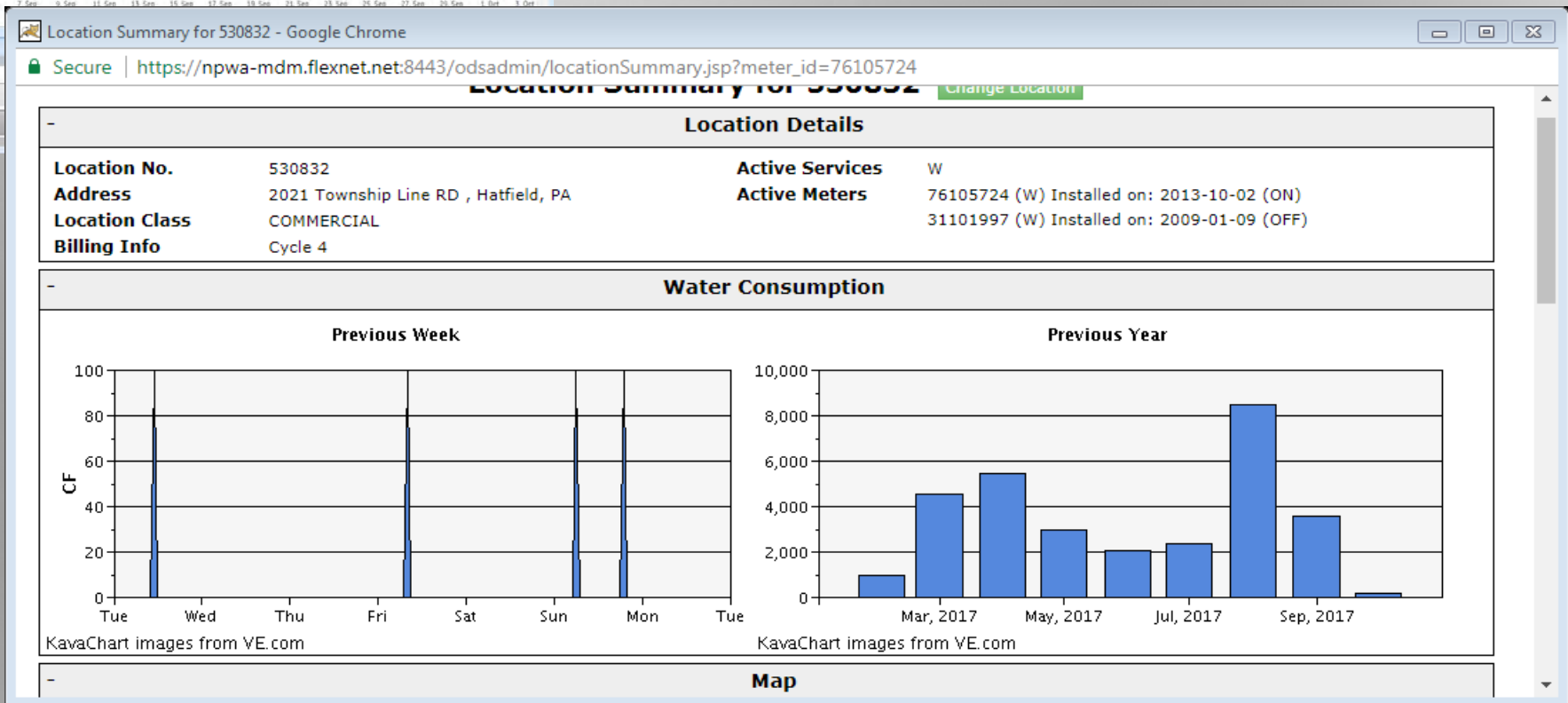
- Non-revenue water
  - Zone/virtual metering
  - Daily system output
- Problem meters are reported daily
  - Repairs can be completed prior to billing
- The software does the analyzing, not the CSR or billing clerk

# THE DASHBOARD





Two months of raw history



Weekly and yearly usage graphs

# CUSTOMER BENEFITS

- Utility receives alerts/alarms daily – can act quickly to resolve
  - Not monthly or quarterly
  - Can notify the customer when leak begins
- Customer engagement software
  - Web portal
  - Email/text alerts
  - DIY how to videos



# THINGS TO CONSIDER

- Cost – initial investment
  - Meters
  - Endpoints
  - Infrastructure
  - Software
    - Maintenance contracts
    - Hosting
- Upkeep

## THINGS TO CONSIDER

- But the ultimate questions are:
- Are you ready to be more **efficient**?
- Are you ready to be **proactive** rather than reactive?



# REFERENCES:

- NEPTUNE TECHNOLOGY GROUP
- SENSUS/XYLEM
- BADGER METER
- MUELLER METER SYSTEMS
- MASTER METER
- AWWA – M6 & M33
- AWWA OPFLOW & JOURNAL
- UTAH WATER RESEARCH LAB

# EASTERN METER MANAGEMENT ASSOCIATION

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WE ARE COMPRISED OF UTILITY MEMBERS AND VENDORS WHO SHARE THE MOST CURRENT INFORMATION RELATED TO METER PRODUCTS AND SERVICES. OUR ORGANIZATION MEETS ON A QUARTERLY BASIS TO DISCUSS THE LATEST TRENDS IN METERING; TO VIEW PRESENTATIONS BY EXPERTS IN THE FIELD OF METERING, AND TO STUDY BEST PRACTICES IN OUR INDUSTRY.

DO YOU NEED INFORMATION ON CROSS CONNECTION CONTROL; WATER METER REPLACEMENT PROGRAMS OR WATER METER TESTING PROGRAMS? DO YOU WANT TO FIND OUT ABOUT "LESSONS LEARNED" FROM IMPLEMENTING NEW METER INITIATIVES? ARE YOU A VENDOR OF METER RELATED PRODUCTS? DO YOU OFFER METER INSTALLATION SERVICES OR METER TESTING SERVICES? DO YOU PROVIDE METER CONSULTING SERVICES?

IF YOU ANSWER "YES" TO ANY OF THE ABOVE QUESTIONS THERE IS NO BETTER TIME TO JOIN THE LEADING METER ORGANIZATION ON THE EAST COAST.