Better Plants
U.S. DEPARTMENT OF ENERGY

Industrial Water Systems
Virtual INPLT Training & Assessment

Session 6

Tuesday – July 20th, 2021

10 am – 11:30 pm

U.S. DEPARTMENT OF ENERGY

Water Virtual INPLT Agenda

- Week 1 (June 15) – Introduction to Industrial Water Assessment and Plant Water Profiler
- Week 2 (June 22) – Understanding System Level Water use
- Week 3 (June 29) – True Cost of Water
- Week 4 (July 6) – Plant Water Profiler Working Session
- Week 5 (July 13) – Identifying Water Savings Opportunity
- Week 6 (July 20) – Virtual Treasure Hunt
- Week 7 (July 27) – Estimating Water Savings Opportunities
- Week 8 (August 3) – Industrial Water System VINPLT Wrap-up Presentations

Agenda – Session Six

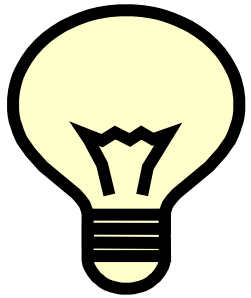
Today's Content:

- Treasure hunt
- Finding Opportunities – Scenarios
- Q&A

Better Buildings is an initiative of the U.S. Department of Energy

Water Treasure Hunt – Overview

Treasure Hunt - The Basic Mission



Assemble with your teams

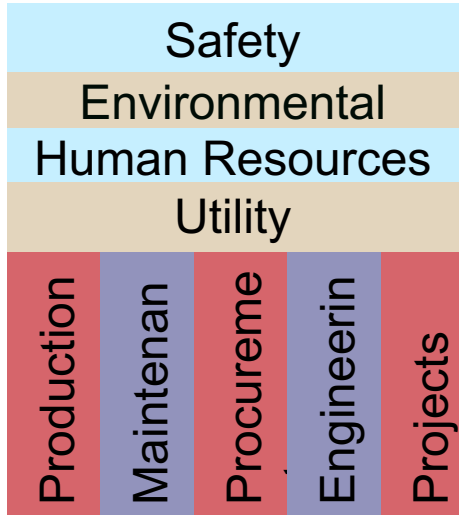
Facility walk through for each team to generate ideas

Assess idea feasibility, gather data, quantify

At the end of each day the teams brief each other on what they will pursue

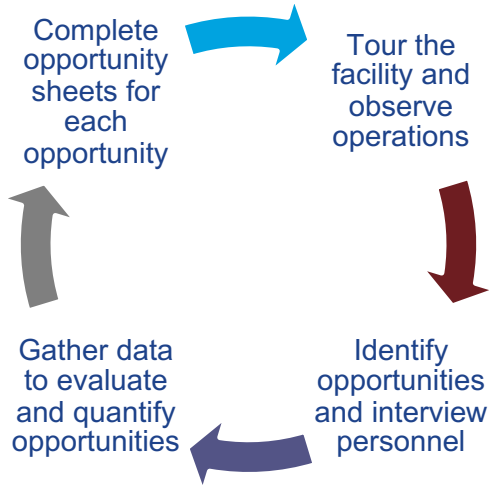
Treasure Hunt – Best Practices

- Include participants from across all operations and from outside the host facility
- Operational opportunities can be ideally identified when facility is ideal.
- Target 3 teams of 5 participants, select focus areas based on your facility



•Following the treasure hunt approach

- Walkthrough the facility and observe operations
- Identify opportunities
- Collect relevant data
- Quantify Savings



Water Treasure Hunt Agenda

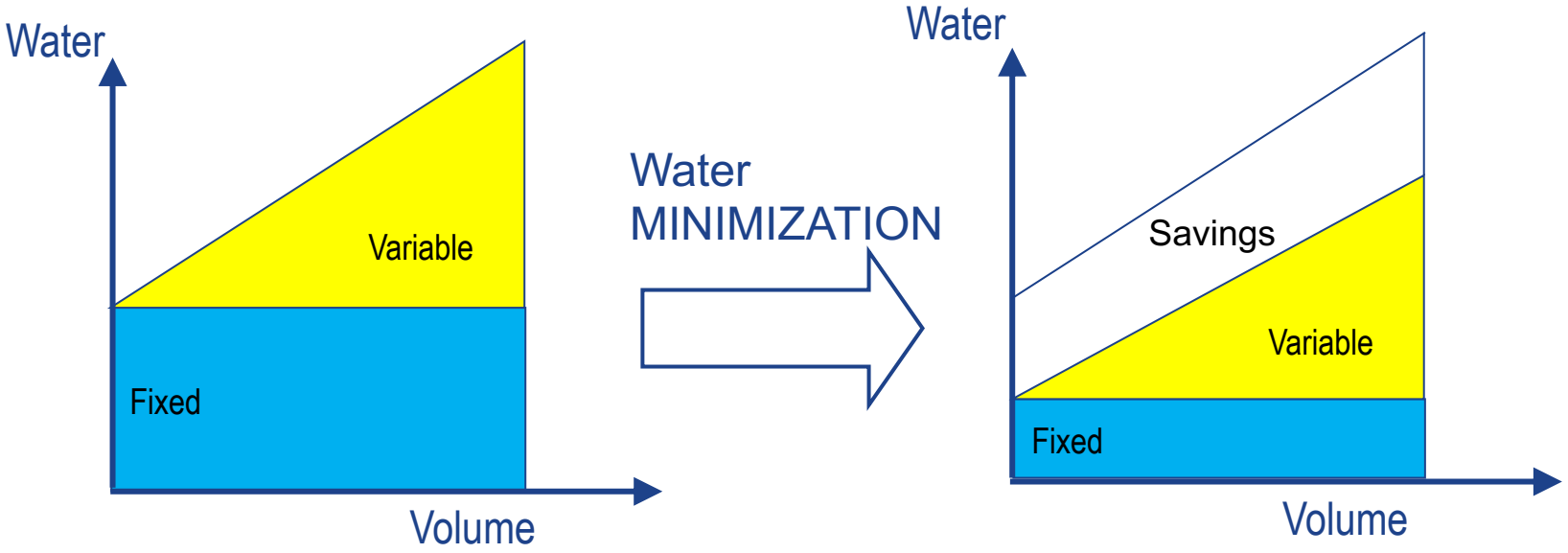
- **Week 6 – Virtual Treasure Hunt**
  - **July 20: 10am to 11am ET – Treasure Hunt Resources Overview**

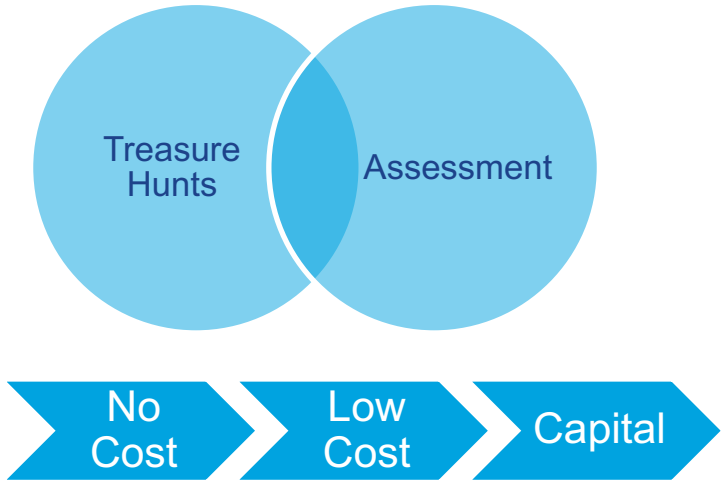
  Participants run a treasure hunt walkthrough and identifies opportunities

  - **July 21st: 4pm to 5pm ET, July 23rd: 4pm to 5pm ET - Reviewing Opportunities Identified**
- **Week 7 (July 27) – 10am to 1230am ET**
  - **Estimating Water Savings Opportunities: Overview of Tools**
  - **Estimating Savings for Opportunities Identified**
- **Week 8 (August 3) – 10am to 1230am ET**
  - **Industrial Water System Assessment Wrap-up Presentations by Participants**

Water INPLT Team is always available between the weeks for individual calls and discussions

Fixed vs. Variable Water Usage



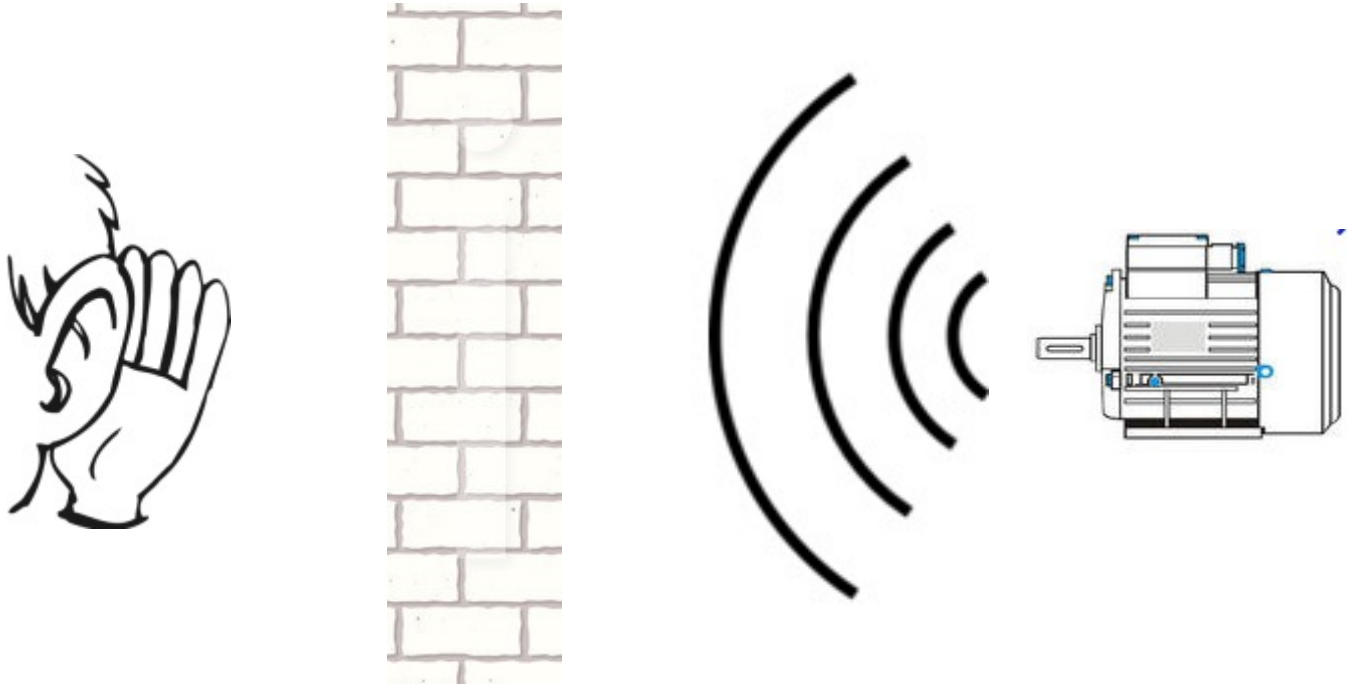


1) Converting fixed water uses to variable
   - Automate shutdowns
   - Tie water use to production with control values

2) Reducing fixed and variable water usage
   - Controlling set points and float levels
   - Control operating times

Observing the idle Facility

- Most important time for generating ideas
- Rarely is production activity 24 hrs / 7 days a week
  - Take note of maintenance downtime / shift changes / off shifts
- Use your eyes and ears to find wasted water!



Typical Treasure Hunt opportunities – Steam

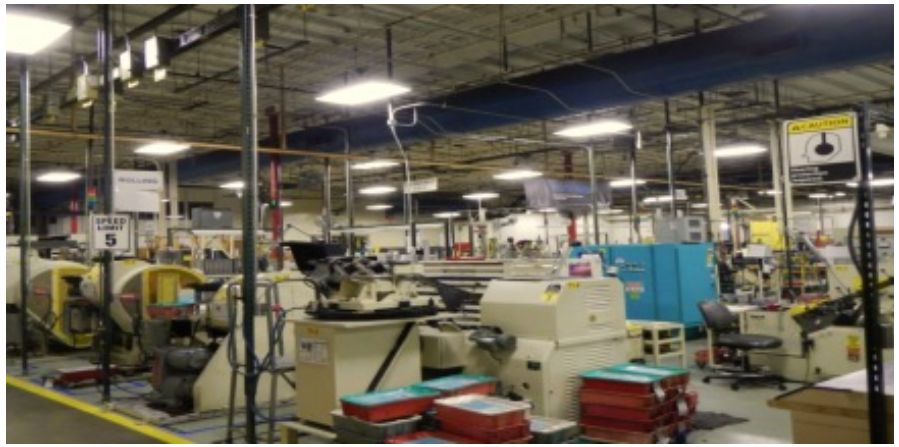
- Condensate Return
- Boiler blowdown optimization
- General steam and Condensate leaks
- Broken Steam Traps
- Reducing open steam usage

Typical Treasure Hunt opportunities – Cooling System

- Optimize Tower blowdown
- Fix leaks and overflows
- Eliminate Single Pass Cooling
- Drift Eliminators and anti-splash louvers for towers
- Use air cooling where possible

Typical Treasure Hunt opportunities – Process Equipment

- Ensure auxiliary water use is minimized during non-production/ idle time
  - Install Automated Control Valves ; Shut off water flows
- Process Equipment Modifications/ Design
  - Low flow nozzles
- Improved Production/ Operations Planning
  - If the process is not a bottleneck in plant production, consider batch processing and avoid constant idle time waiting for product
- Install Automated Control Valves
- Using waterless techniques for process
- Opportunities for recycle and reuse



Resource – PWP Tool (Tab 9 & 10)

Checklist of plant and system level measures

System Water Efficiency Status	Response
Process	
Cooling/condensing for process	
Has once-through cooling water been eliminated with the use of chillers, cooling towers, or air-cooled equipment?	No
Has blow-down/bleed-off control on cooling towers been optimized?	No
Is treated wastewater (or other sources of water for cooling tower make-up) reused where possible?	No
Are cycles of concentration for cooling towers maximized through efficient water treatment?	No
Cooling/condensing for air conditioning	
Boiler for Facility	
Kitchen and Restrooms	
Landscaping	

Process Equipment

Have you installed equipment (e.g., timers, solenoids, level/pressure switches) to automatically shut off water flow when water is not required, such as at the end of a production cycle?
Are solenoids and automatic shutoff mechanisms checked regularly to ensure that they are working properly?
Is equipment set to the minimum flow rates recommended by the manufacturer?
Have pressure-reducing devices been installed on equipment that does not require high pressure?
Does process equipment reuse water (i.e., closed loop) or use reclaimed water from other parts of the facility?
Have you replaced water-based transportation with either waterless techniques or recycled water?
Are signs posted near equipment encouraging employee awareness of water use and discouraging tampering with equipment flow rate?
Are all hoses equipped with an automatic shutoff nozzle?
Has process cleaning or facility cleaning been replaced with or supplemented by waterless techniques (e.g., burnout ovens, ultrasonic cleaning) where possible?
Are improved rinsing techniques used and optimized: counter-current systems?

Are improved rinsing techniques used and optimized: sequential use from high to lower quality needs?
Are improved rinsing techniques used and optimized: conductivity flow controls?
Are improved rinsing techniques used and optimized: improved spray nozzles/pressure rinsing?
Are improved rinsing techniques used and optimized: fog rinsing?
Is spent rinse water reclaimed and reused for lower grade processes or for other facility applications?
Have steps been taken to reduce the water used by open steam sterilizers (e.g., utilizing jacket and chamber)?
Are you using detergents that can easily be removed with little water?
Is water used for cleaning submetered?
Are the flow parameters for cleaning systems monitored periodically?
Are employees aware of deionized/reverse osmosis (or other specially treated) water use?
Are conductivity controllers used in rinses?
At wash station, are booster pumps used with low-pressure water instead of high-pressure water?

Cooling and Boiler Systems

Has once-through cooling water been eliminated with the use of chillers, cooling towers, or air-cooled equipment?
Has blowdown/bleed-off control on cooling towers and boilers been optimized?
Is treated wastewater (or other sources of water for cooling tower makeup) reused where possible?
Are cycles of concentration for cooling towers maximized through efficient water treatment?
Has a conductivity controller been installed on each cooling tower?
Have cooling towers been equipped with overflow alarms?
Have the ball float valves been set correctly?
Do condenser water pipes run above the height of the tower spray heads?
Have maintenance programs been implemented to ensure leaks are routinely checked and fixed as needed?
Are antisplash louvers installed?
Are drift eliminators inspected and assessed by a specialist?
Have flow meters been installed on makeup and blowdown lines?
Are conductivity meters installed on blowdown lines?
Are blowdown lines operated in continuous mode?
Has side stream filtration been installed?
Has an automatic shutdown unit been installed for the unit?
Has sulphuric acid been added to adjust pH?
Are high-efficiency drift eliminators in use?

Is condensate return for reuse optimized?
Are steam traps properly located?
Are automatic blowdown control installed?
Is a conductivity sensor installed on boiler?
Is a boiler blowdown flash tank installed?

Data Collection

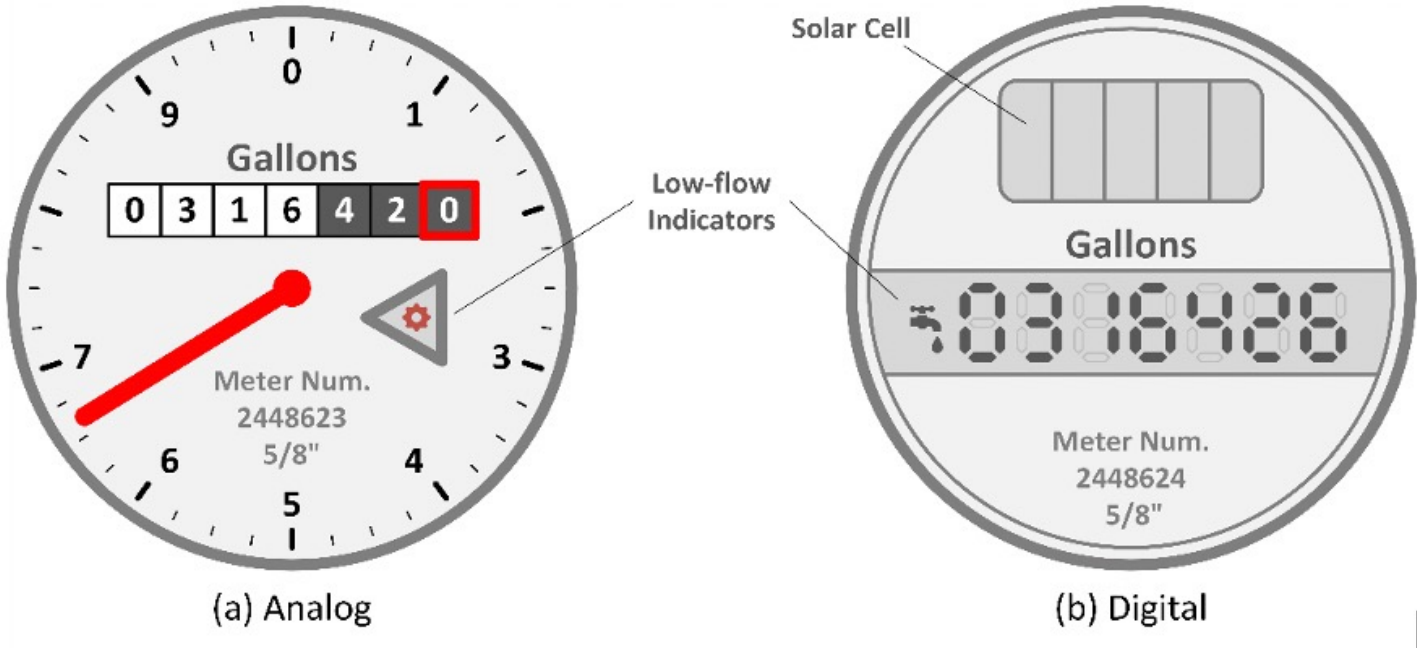
In addition to identifying opportunities, quantifying its savings is also important → Try to collect initial information about the opportunity during the facility walkthrough

- Number of nozzles that can be reduced
- Nameplate data
- Water flow if easily estimated
- Cooling Towers and Boilers
  - Cycles of concentration; conductivity measurements

Resource for Data Collection – Diagnostic Equipment

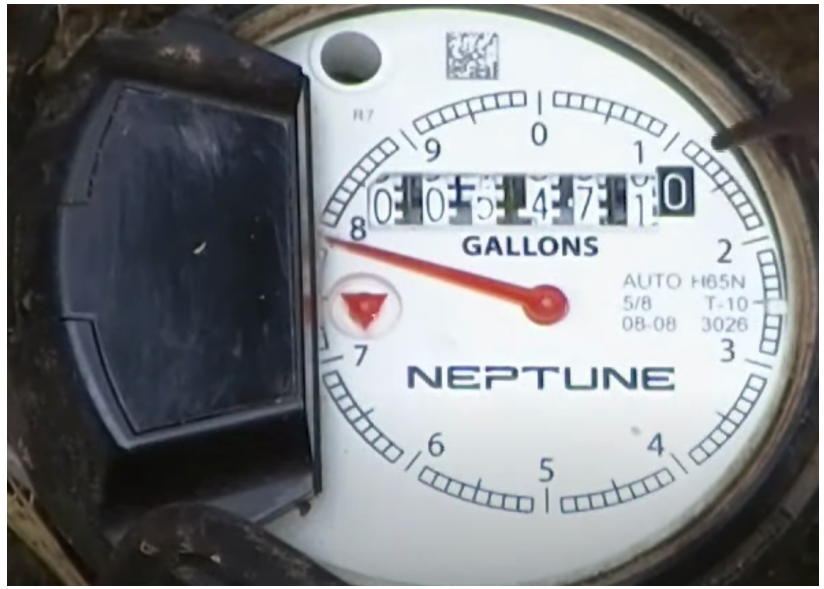
- Instruments and data loggers for onsite data collection

Existing Meters



Analog meters are read by reading the rolling tick dial which records to the tens place.

The value in the red box fixed and the last whole digit is read by reading the sweeping hand



Both reading 316,426 gallons

Bucket and Timer

$$GPM = \frac{60}{Time\ to\ fill\ in\ Sec} \times Volume\ of\ Bucket\ \ in\ Gallons$$

Specification Sheets or Cutsheets

NC8413N-1	604	647	10	41955	19586	11'-10¾"	12'-2¼"
NC8413P-1	680	735	15				
NC8413Q-1	739	788	20				
NC8413R-1	791	845	25				
NC8413S-1	834	890	30				
NC8413T-1	905	970	40				
NC8413U-1	961	1023	50				
NC8413V-1	1012	1076	60				
NC8413W-1	1073	1140	75				
NC8413X-1	1149	1219	100				
NC8414P-1	761	806	15	48355	22096	13'-10¾"	14'-2¼"
NC8414Q-1	827	876	20				
NC8414R-1	883	933	25				
NC8414S-1	929	983	30				
NC8414T-1	1011	1078	40				
NC8414U-1	1101	1161	50				
NC8414V-1	1154	1215	60				

Cooling Tower

SPECIFICATIONS

Model No**	Flow Rate Specifications GPM Nominal (m^3/hr)			Vessel Staging	Membrane Vessel	Membrane Quantity	Customer Connection Specifications			Utility Requirements***			Approx Shipping Weight lb (kg)
	Product*	Feed	Reject				Feed	Product	Reject	High Voltage Service	High Voltage FLA	Pump HP	
M84R024	107 (24.3)	143 (32.5)	36 (8.7)	3:2:1	4	24	3"	3"	2"	480 VAC 3ph	67	50	5576 (2529)
M84R036	160 (36.3)	215 (48.8)	53 (12.0)	4:3:2	4	36	4"	4"	2"	480 VAC 3ph	79	60	6115 (2774)
M84R048	214 (48.6)	285 (64.7)	71 (16.1)	6:4:2	4	48	4"	4"	2"	480 VAC 3ph	79	60	6465 (2932)

* Product flow rates are based on a flux rate of 16 GFD and equipment design parameters listed below. Product flow rates may not be appropriate for other feed waters.
** The 8 designates 8" housing, the 4 designates 4 elements in length, and the -R0XX designates the number of membranes.
*** Additional voltage options are available. Refer to equipment specifications.

RO System

M-159TG

Strahman M-159 (bronze) and M-750 (stainless steel) Mixing Units-Hose Stations are designed to thoroughly mix hot and cold water in any desired proportion.

Our Temperature Indicating (TG) models are equipped with a blending chamber and quick acting dial-type dual Fahrenheit and Centigrade temperature gauge, which accurately indicates the water's temperature exiting a specially designed blending chamber.

NOTE: Not suitable for steam service

M-159TG-Globe Series Mixing Unit-Hose Stations

- Simple visual recognition of valve position
- Flow rates adjustable from low to high

M-159TG-Ball Series Mixing Unit-with Ball Valves

- Single ¼ turn to On/Off position
- Simple visual recognition of valve position
- Easy to maintain and replace ball valves
- Flow rates adjustable from low to high
- Less wrist fatigue in turning valves to On/Off position

Max. Pressure (BAR)	Max. Flow (LPM)	Max. Temperature
10	38	93° C

Water Mixing Sprays

Virtual Treasure Hunt

Virtual TH Scenario 1 - Fiberglass manufacturing

Source: https://www.youtube.com/watch?v=h8JYKZbsnrk

Scenario 1 – What did you see?

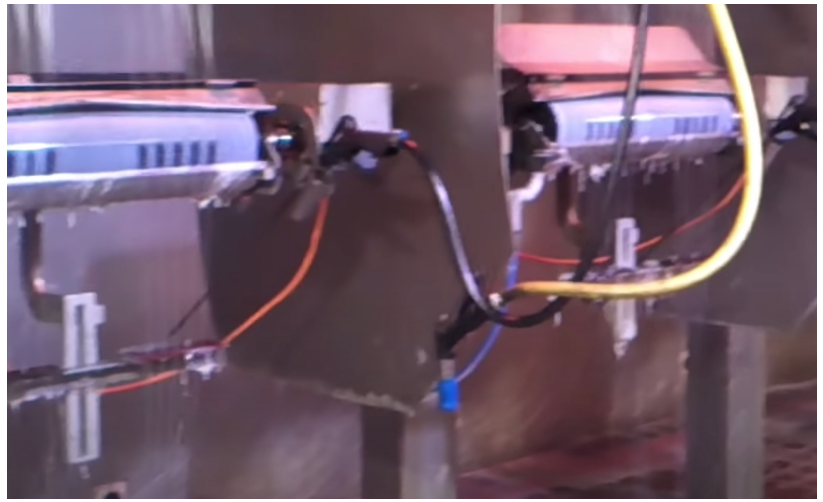
What are the water users?

What opportunities did you find

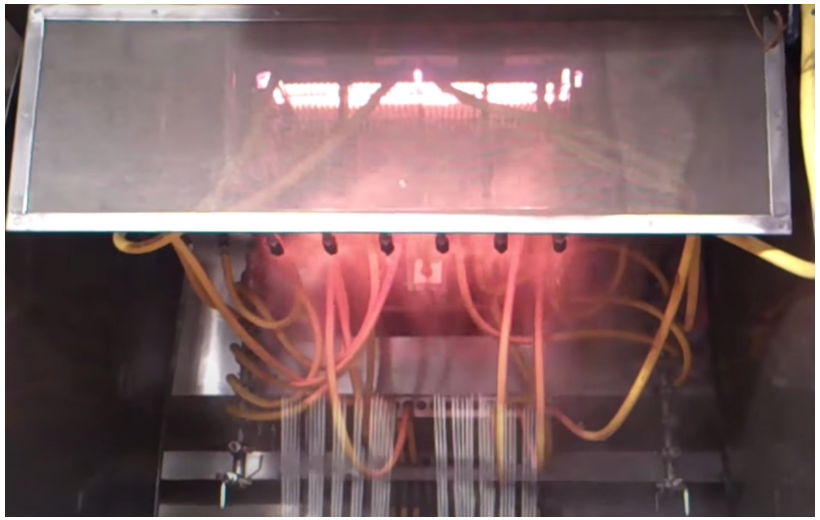
Points of interest to investigate further

Others

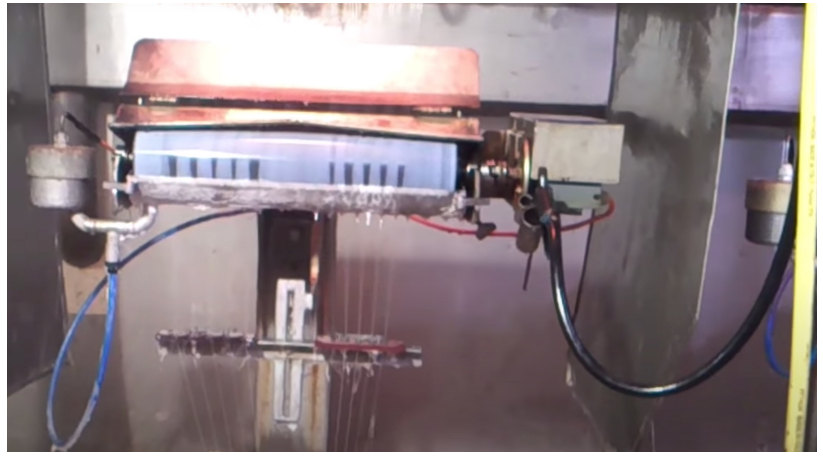
Scenario 1 – Water Users



2 hand guns per unit



Automated water nozzles



Roller (water cooled?)

Multiple units with same configuration

Scenario 1 – Opportunities / Things to investigate

- Are the automated water nozzles optimized?
  - Can the number of nozzles be reduced?
  - Can the configuration of the nozzles be changed to optimize operations
  - Is the nozzle configuration in all the lines the same?
- Can water be cut out automatically when there is no product to be cooled?
- Is there room for water recycling in this process?
  - What is the type of contaminates in wastewater?
  - What is the quality of water needed for the process?
  - Is it possible to economically treat the water to be used back in the product?
- Can the handguns use be optimized?

Virtual TH Scenario 2 – Cooling Tower

Source: https://www.youtube.com/watch?v=mG1k6LzwqkE ; https://www.youtube.com/watch?v=wB7RQOiBC_4

Scenario 2 – What did you see?

What opportunities did you find?

Points of interest to investigate further

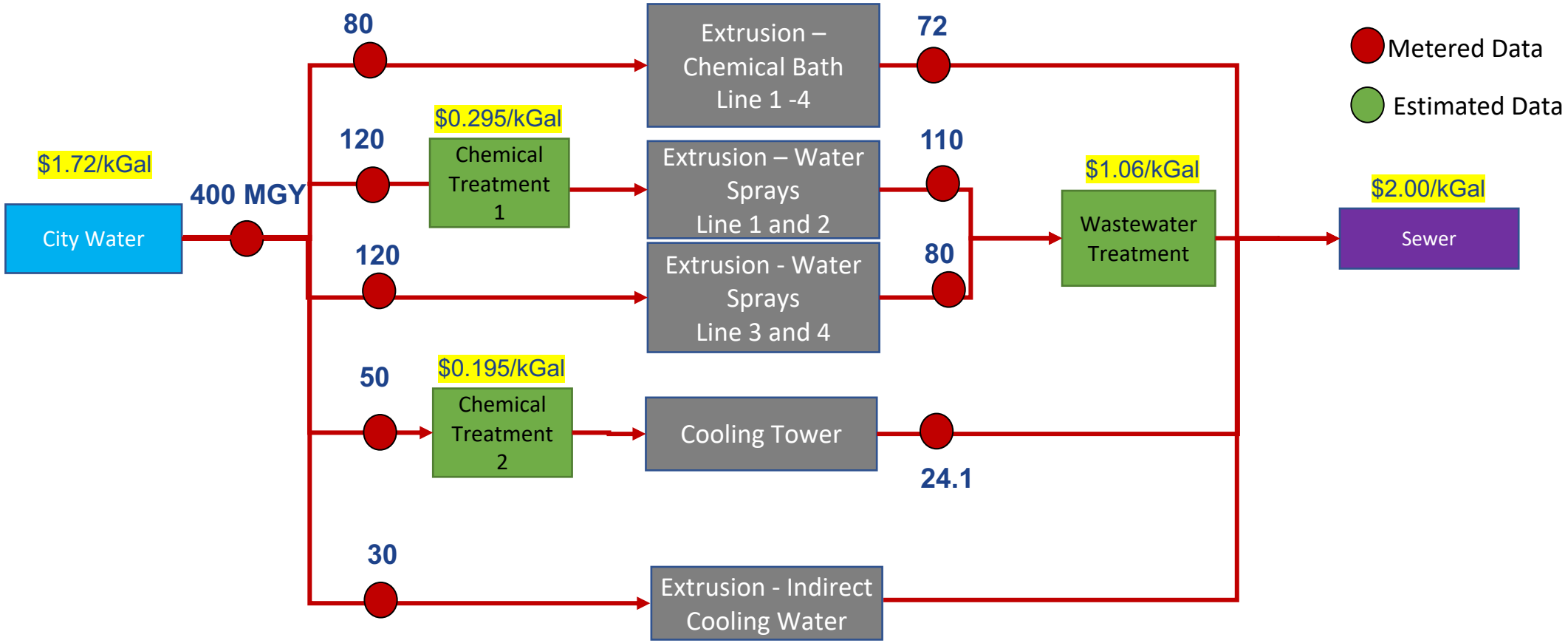
Others

Scenario 2 - Opportunities / Things to investigate

- Why is the drift so high?
  - Are drift eliminators damaged or not properly installed
- Is there a way to reduce slash out from the sides of the cooling tower
- Why is the blowdown leaking to the drain continuously?

- Blowdown meter reading
- Conductivity setting on the controller
- Is the bypass completely shut after maintenance

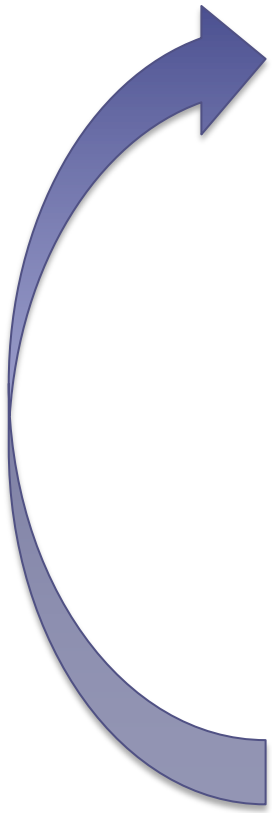
Virtual TH Scenario 3 – Water Flow Diagram



Scenario 3 - Opportunities / Things to investigate

- Recycling opportunity with wastewater effluent
- Opportunity to claim evaporative credits
- Optimize cooling tower, cycles is low
- Optimize line 3 and 4 ; losses are high compared to line 1 and 2
- Can water treatment in line 1 and 2 be eliminated
- Eliminate once through cooling

Summary



1. Walkthrough the facility and observe operations
2. Identify opportunities
3. Collect relevant data
4. Quantify Savings
5. Create Opportunity Sheet

Leverage available Resources

Tips for Facility Walkthrough

- Review your PWP results for insights into water use
- Walkthrough your facility with your team
- Talk to the operators, vendors and understand the water use
  - Does water usage meet the demand optimally?
- Note down all opportunities that was identified ; best opportunities can be identified later – No opportunity is too small
- Take pictures of opportunities
- Collect initial data that is available of the process

Questions / Comments

Gather your teammates and head out !

Thank You all for attending today's webinar.

See you all on Wednesday or Friday – July 21st or 23rd – 4 pm ET

If you have specific questions, please stay online and we will try and answer them.

Alternately, you can email questions to me at thirumarank@ornl.gov

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