ENVIRONMENTAL STEWARDSHIP:

TRACKING WATER CONTAMINATION IMPROVES PROCESS CONTROLS, COMPLIANCE, AND SUSTAINABILITY

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Sievers instruments are products of SUEZ – Water Technologies & Solutions.

Agenda

Discharge Compliance Control with Benefits

- **Emerging Challenges & Trends in the Chemical Industry**
- **Monitoring Solutions Yield Opportunities to Save**
- **Case Study #1 - Utility Water**
- **Case Study #2 - Wastewater**
- **Conclusion**

Future Environmental Impact from the Chemicals Industry

The chemical industry provides significant value and benefits to society yet has also had some detrimental impacts to the natural environment, humans, and ecosystems.

- **Climate change**
  - Too much water
  - Too little water
- **Water shortage**
  - Finite amount of resource
- **Emerging contaminants**
  - PFAS
  - Pharmaceuticals
  - Endocrine disruptor compounds
  - Pesticides, herbicides
  - Heavy metals
  - Nutrients

According to the *UN Environment Programme*, ”the size of the global chemical industry **exceeded US $5 trillion in 2017** and is projected to **double** by 2030.

The benefits of action to minimize the **adverse impacts** of chemicals have been estimated in the **high tens of billions of US dollars annually**.”

https://www.unep.org/news-and-stories/press-release/un-report-urgent-action-needed-tackle-chemical-pollution-global

Accenture Chemical (Re)action: Growth in a circular economy

- **Environmental and sustainability practices affect:**
  - Permits and fines
  - Brand image
  - Waste treatment
  - Supply chain
  - Product lifecycle
  - Workforce
- **Survey of over 6,000 consumers in 11 countries:**
  - **81%** of consumers plan to **buy more eco-friendly products** over the next five years
  - **83%** of consumers believe companies should design products that can be **reused, recycled, or never sent to a landfill**
  - **77%** of consumers perceive plastics to be the **least environmentally friendly** packaging material
  - **50%** of consumers, on average, are willing to **pay more** for a product designed to be reused or recycled

Source: https://www.accenture.com/_acnmedia/PDF-107/Accenture-Chemicals-Circular-Economy-Growth.pdf

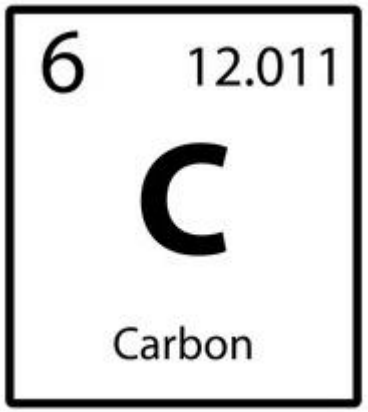
Corporate Sustainability: Water Stewardship

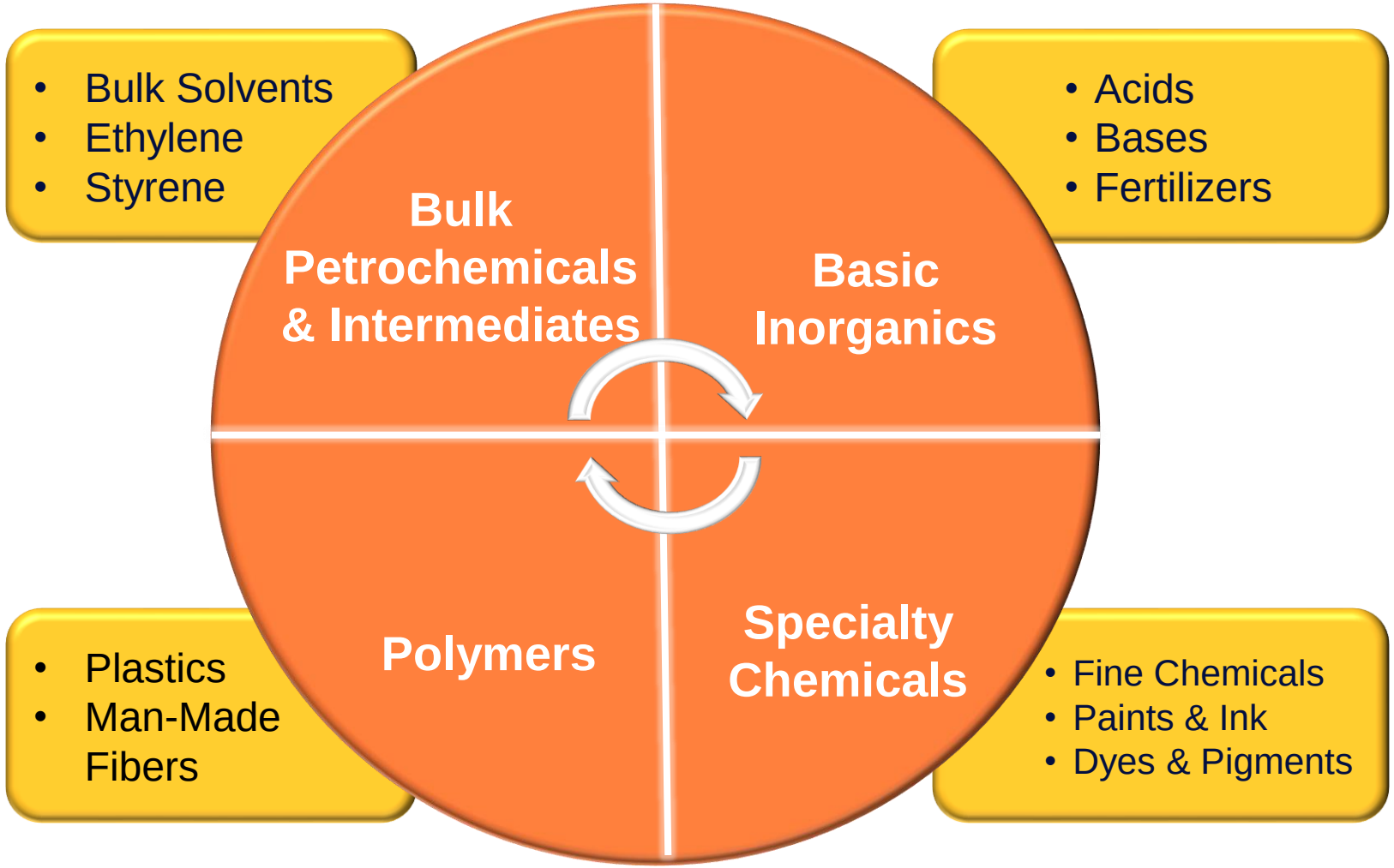
- **Growing request from consumers**
- **Drives internal cost savings**
- **Advances corporate sustainability goals**

  - Efficient energy, water use
  - Reuse, reclaim and recycling
  - Advanced treatment technologies
  - Monitoring, detection, automation

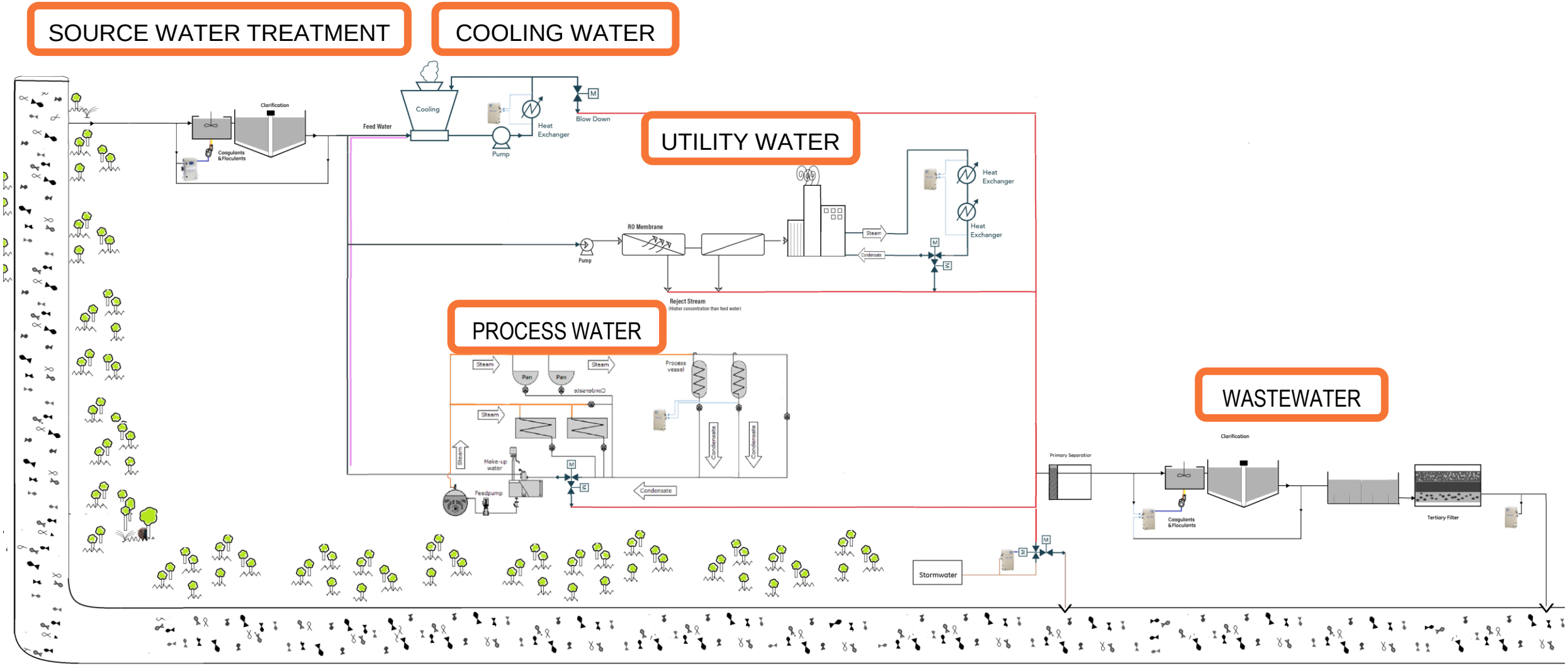
Chemical Industry

- **Various segments**
- **Water intensive**
- **Regulation growing**
- **Areas of Water Use**
  - Source water
  - Ingredient water
  - Process water
  - Utility water
  - Wastewater





Follow the Carbon from River to River



Carbon applications - Overview

Application	Purpose
Source Water	▪ Real-time detection of source water quality changes that could affect production and/or process equipment
Utility Water	▪ Detect heat exchanger leaks and product loss ▪ Prevent condensate contamination and enable reuse ▪ Control boiler corrosion and scaling from poor feedwater quality
Ingredient / Process Water	▪ Verify equipment effectiveness & treatment efficiency ▪ Safeguard product quality; avoid cross-contamination
Wastewater	▪ Quantify carbon loading in raw wastewater ▪ Nutrient balancing for biological treatment ▪ WW discharge monitoring for environmental compliance

Utility Water

Goals

- Rapid and comprehensive leak detection
- Ability to capture key contaminants
- Maintain UPW systems

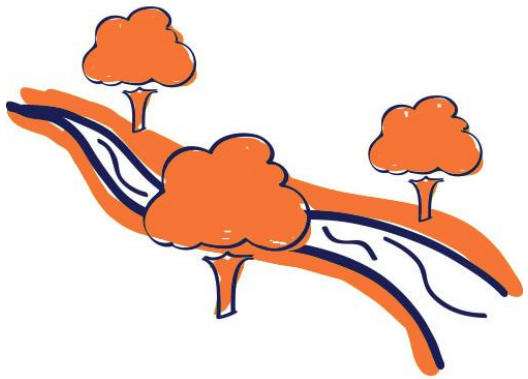
Value

- Equipment protection from damage, downtime, and repairs
- Enable effective reclaim or diversion strategies
- Ensure purity with accuracy, precision, and reliability

Solutions with TOC Monitoring – Steam Condensate

Cooling & recycling steam back to the system helps with water savings & process efficiency

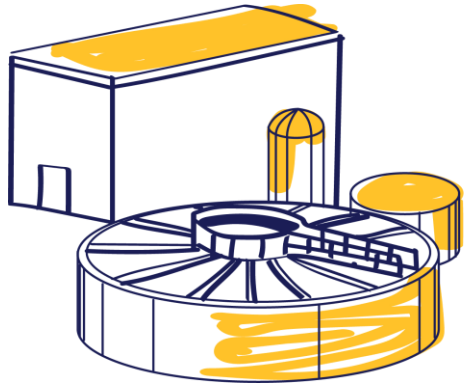
- Closed loop systems especially need to monitor for coolant leaks into the condensate to protect boilers and treatment equipment
- Open systems need to monitor for water loss and concentration of contamination



Wastewater

Goals

- Remove concentrated contamination - municipal & industrial
- Treat to effluent standards with combination of physical, chemical, and biological treatment
- Effective use of energy, chemicals, and equipment



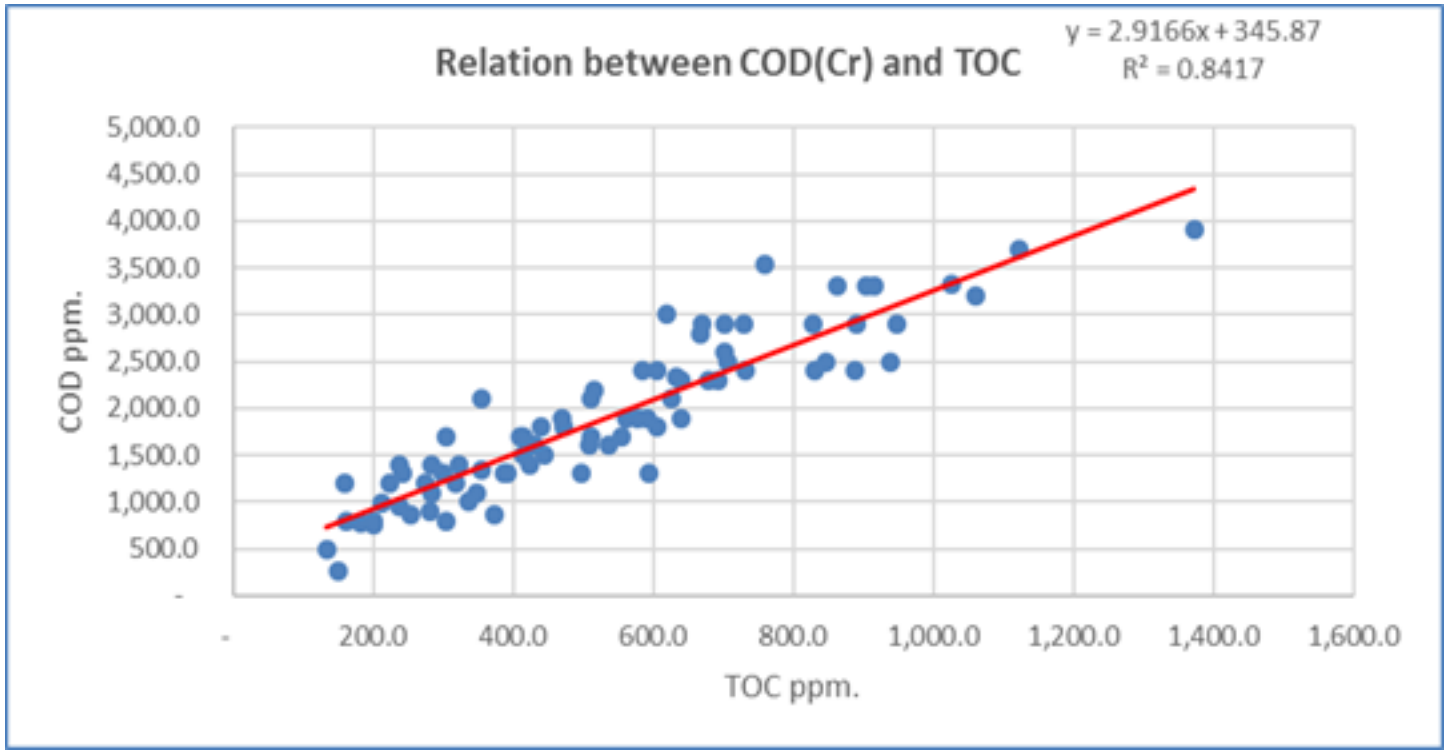
Value

- True understanding of contamination loading and changes
- Ensure continuity of treatment and maintenance of compliance
- Know, control, and improve treatment to save $

Effluent Exam

Customer Challenges

- BOD & COD are time consuming analyses but more familiar
- WWTP operators typically need real-time data for process optimization to know whether to retain, divert, or dilute discharges



Solution

- Track continuous carbon loading, separation, and removal for true control
- Correlate TOC to BOD/COD allows a facility to better manage their WWTP & avoid paying high organic load surcharges or penalties

True Food Loading – Food: Microorganism

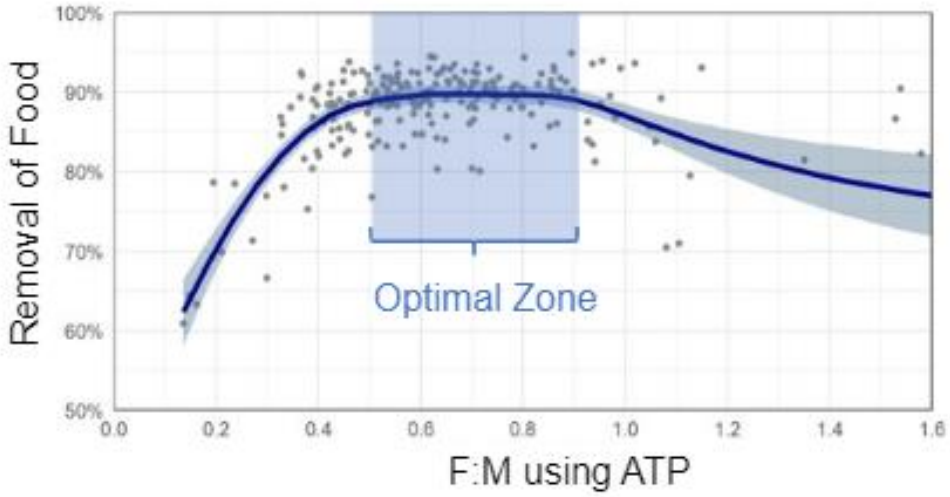
What we measure:

The actual carbon levels feeding the microbiology vs. surrogate oxygen demand

What this allows us to do:

"Dial in" the optimum F:M for biological system by calculating the lbs of DOC or TOC per lb of Active Biomass Population

- F:M too big – excess food, inefficient treatment
- F:M too small – not enough food, bacteria die



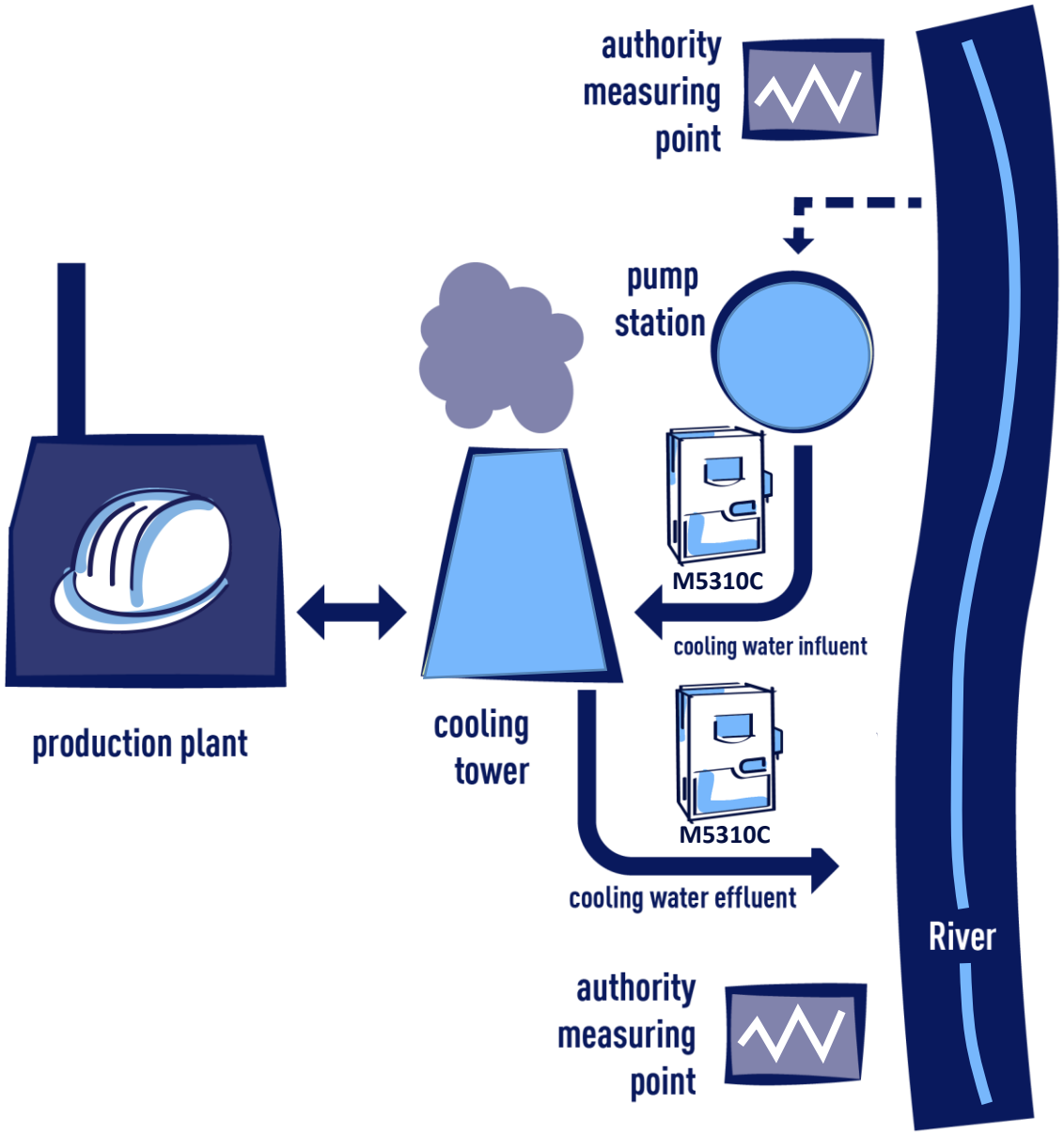
cATP	TOC
Actual living biomass **Reliability**: Reduction in outfall variance and possible permit exceedance	True organic content **Reliability**: Contributes to steady operation-avoids permit exceedance, fines, possible plant shutdown

Case Study #1 Utility Water

Cooling Water Monitoring before Discharge to River

Challenges

- Multiple water uses across a facility must meet specific water quality needs *by use*
- Once-through cooling system uses river water - compliance requirements include control of organic contamination
- Exceeding TOC limits will result in fines
- Accurate and rapid TOC measurement tool is needed



Case Study #1 Utility Water

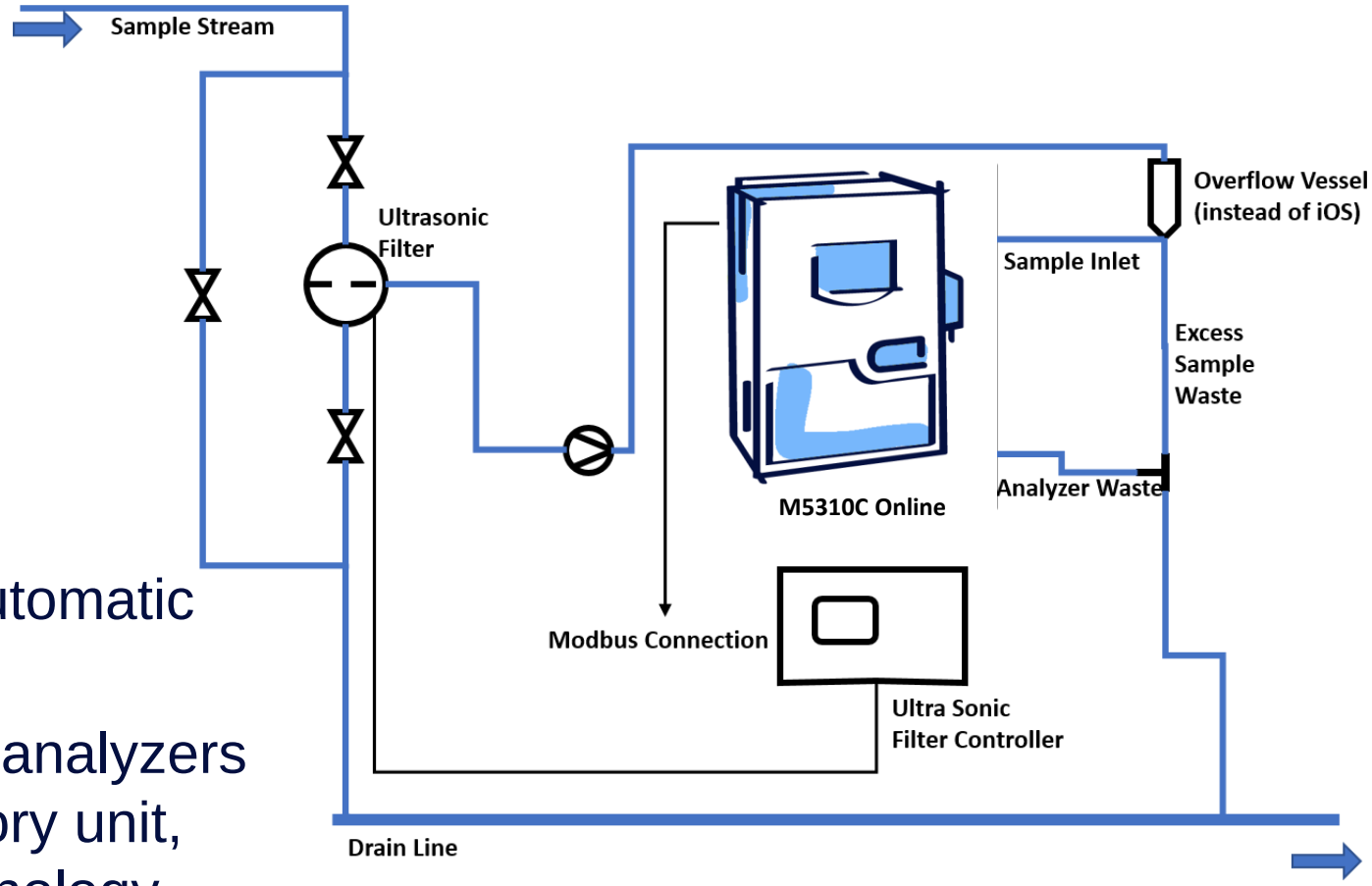
Cooling water monitoring before discharge to river

Solution

- Low maintenance
- Long-term stable calibration
- Excellent sensitivity
- Fast response

Results

- 99.8% uptime
- Immediate alert of an upset with automatic diversion
- Overall, more than 40 Online TOC analyzers at inlet and outlet points, 1 laboratory unit, 1 portable, all using the same technology
- Sustainable water management goals met



Case Study #2 Wastewater

Large caprolactones manufacturer in the UK monitors wastewater to avoid fines

Challenges

- Chemical company discharges wastewater to regional effluent treatment plant
- High overall organic wastewater load = possible discharge of contaminated water to the environment and unstable processes
- Fines assessed when discharge limits are exceeded
- Fix will be expensive and take several weeks
- Need for improved organics monitoring and control tools to guarantee discharge limits

Wastewater Monitoring before Discharge to River

Large caprolactones manufacturer in the UK monitors wastewater to avoid fines

Solution

- Sievers InnovOx Online TOC Analyzers employed
- 7 online analyzers with plant expansion and upstream control
- Operators can adjust organic discharge load to avoid exceeding limits

Results

- Immediate decision making = Avoid excess surcharges and fines
- After detecting just 2 upsets, the investment was financially and operationally justified
- Ensure reliable operation of the WWTP
- Helps identify root causes in manufacturing

Solutions for TOC Monitoring

Sievers M5310C TOC Analyzer

- Wide dynamic range: 4 ppb to 50 ppm
- 2 minute measurement cycle, turbo mode 4s
- UV persulfate & stable membrane conductivity
- Low maintenance – annual calibration
- No gas requirements, no catalyst, no external reagents

Source water · Pure condensate
Boiler feed · Cooling water

M5310C Portable, OnLine (Single and Dual Stream), Laboratory Analyzers and Autosampler

Sievers InnovOx TOC Analyzer

- Wide dynamic range: 50 ppb to 50,000 ppm
- State-of-the-art Supercritical Water Oxidation technology
- Able to handle high particulates & high dissolved salt
- Robust performance; calibration 6 months

Polluted condensate wastewater

InnovOx OnLine

InnovOx Lab with Autosampler

Solutions for organics analysis – Sievers TOC Analyzer portfolio

Microelectronics water

UPW loop • UPW make-up • diagnostics • reclaim

Pharmaceutical water

Purified water • water for injection • cleaning validation • diagnostics

Drinking water

EPA/state compliance monitoring • environmental • process optimization • disinfection byproduct control

Process water and wastewater

Process/industrial • environmental • municipal • wastewater

0.05 ppb | 5 ppb | 500 ppb | 5 ppm | 50 ppm | 500 ppm | 5000 ppm | 50,000 ppm

M500e Online
0.03 ppb - 2,500 ppb

M500 Online
0.03 ppb - 2,500 ppb

CheckPoint
Pharma: 0.21 ppb - 1,000 ppb
Micro: 0.05 ppb - 1,000 ppb

M9e Online and Portable
0.03 ppb – 50 ppm

M9 Laboratory, Portable, Online
0.03 ppb - 50 ppm

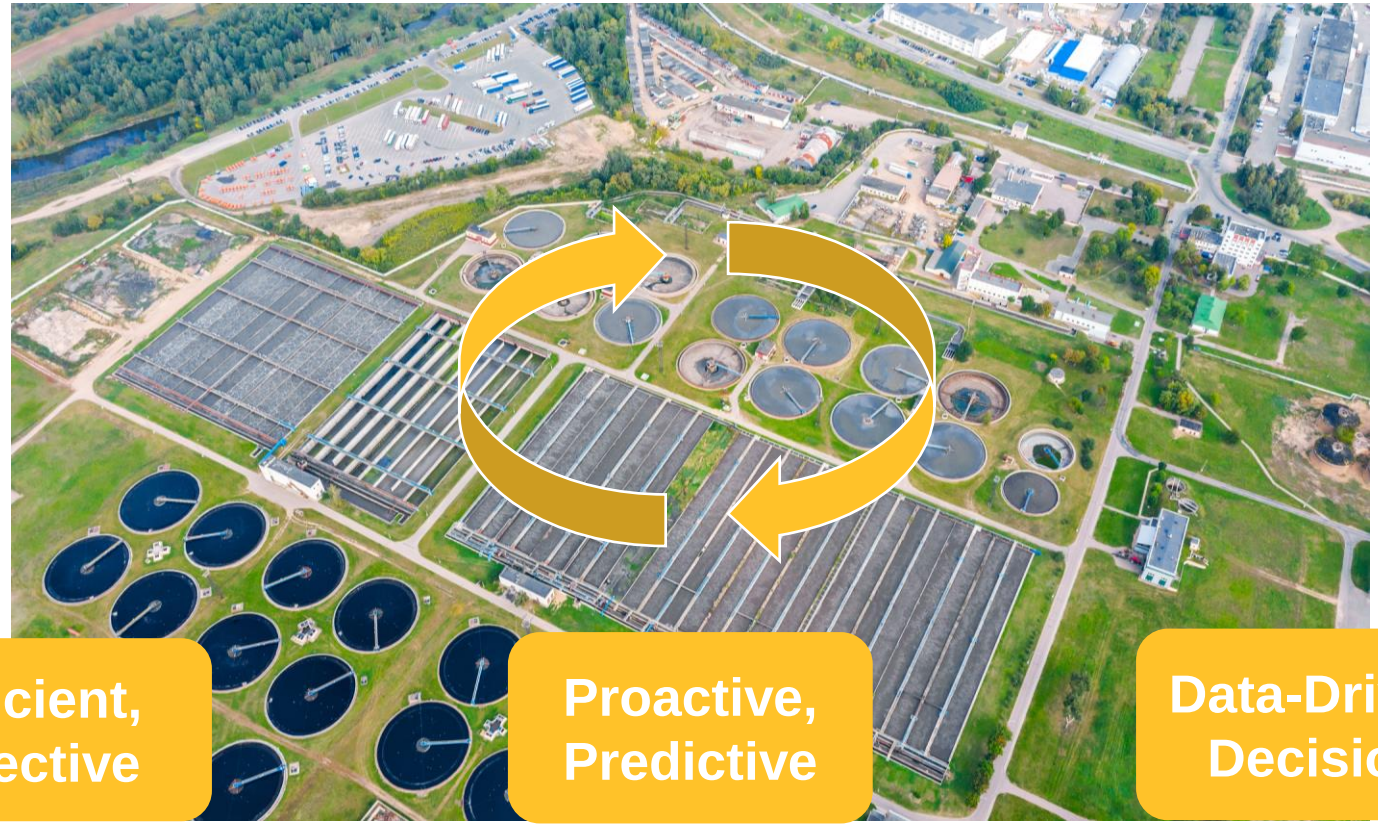
M5310 C Laboratory, Portable, Online
4 ppb - 50 ppm

InnovOx Laboratory and Online
50 ppb - 50,000 ppm

Summary

Water In

Source Water



Water Out

Quality Effluent

Efficient, Effective

Proactive, Predictive

Data-Driven Decision

- **Treatment Processes**
- **Water as Ingredient**
- **Utility Water**

You don’t know what you don’t measure.

If you don’t measure it, how can you control it?

You can’t CONTROL what you don’t MONITOR!

QUESTIONS?

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THANK YOU!

www.sieversinstruments.com