

On-Line Nutrient Monitoring-Operator's Job Got Easier

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Presentation Outline

- Introduction
- Benefits of On-Line Monitoring
- Nitrogen Probes
 - NO_3^-
 - NH_4^+
- Phosphorous Analyzers,,
 - Ortho Phosphorous (Reactive Phosphorous)
 - Total Phosphorous
- Summary

Introduction

- ❑ Traditionally DO has been the main process control parameter for BNR of WWTP
- ❑ Lab analysis:
 - Take Time
 - Cannot resolve a problem until the results gathered
 - Labor intensive
- ❑ By the time the lab analysis is made it is usually too late to make a process adjustment.
- ❑ Real time N and P monitoring play increasingly important role.

Introduction

- ❑ Reliable on-line nutrient monitoring lead to
 - Real-time or near real-time conditions
 - Continuous monitoring
 - Quick Staff Response
 - Control aeration blower power
 - Adjustment of aeration control
 - Save Chemical cost for P removal
 - Early detection of any process upsets

Lab? Or On-line?



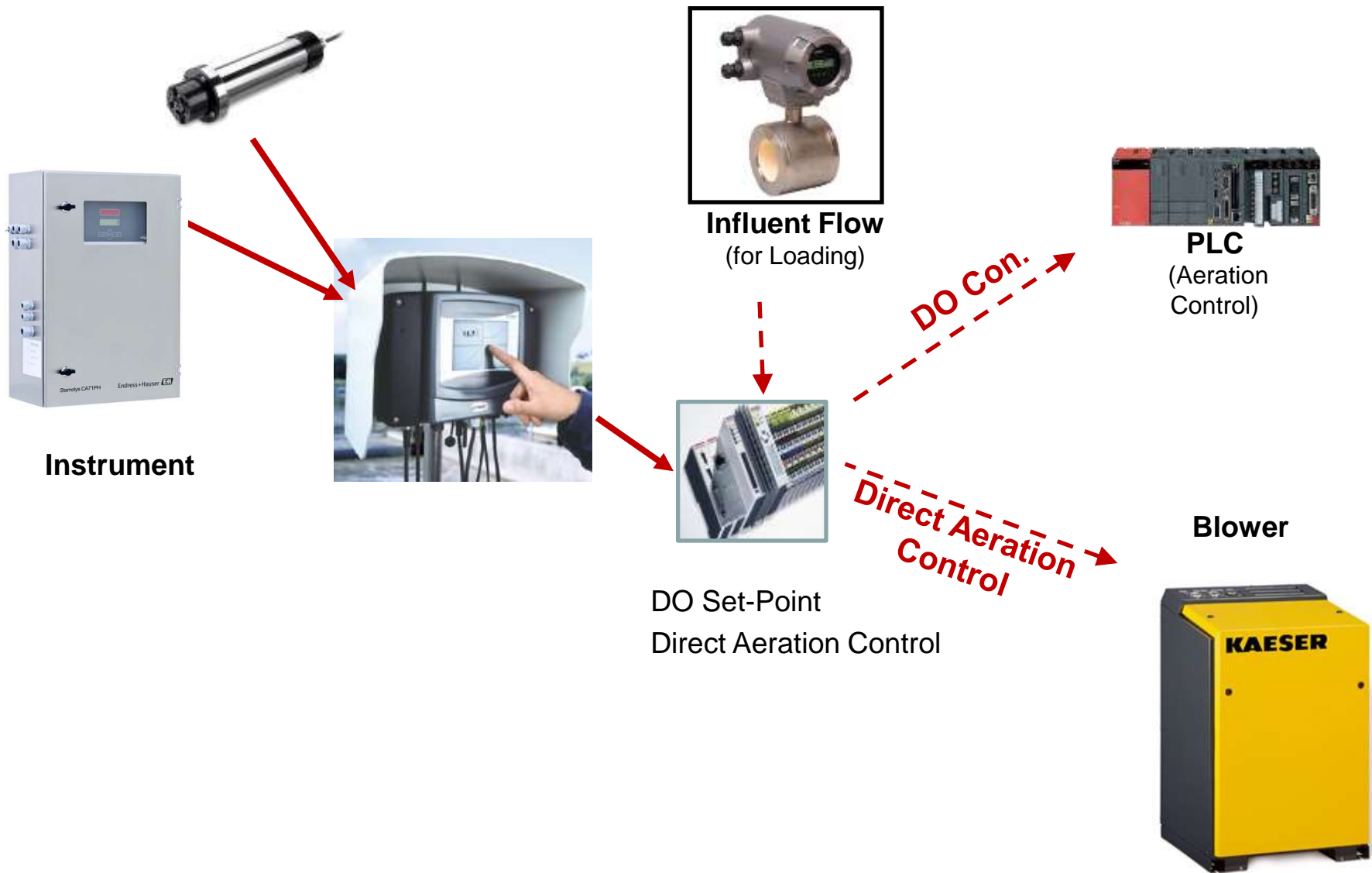
Benefits of Online Monitoring

- No Sample Preparation
- No Pumping and analyzer housing
- Reduce Staff Work Load
- Require Less Training
- Relatively Less Expensive
- Technology is more mature/proven
- Tighter TN/NH₄/TP discharge limits
- Comfort level for the Operator
- Verify process performance
- Operation cost saving: Chemical, Energy

Overview of Latest Probes

- New optics, new measurement procedure
- Reagent-free online measurement
- Maintenance-free, without wear parts
- High-Tech materials used in Probes
- No need to “recalibrate” the sensor to account for aging
- No consumable or replacement parts
- 3 – 5 year Standard warranty

How Does It Work?



Applications?

- Control Aeration
- Control Alum/ FeCl_2 Dosing for Chem-P Removal
- Control Bio-P Process
- Control External Carbon Source
- Control Sludge Wasting
- Real Time Process Monitoring

Where to Monitor?



On-Line Monitoring @ a WWTP



Aeration:
D.O., Ammonium,
Nitrate, TSS, pH

IQ Sensor NEY 2020 XT
Influent:
pH, Conductivity, Ammonium,
COD, TOC, DDC, BOD, SAC

Back-up Terminal
Final Settling:
Nitrogen, Turbidity, TSS,
pH, Sludge Blanket Level



Optical Probes

Based upon principle that nitrates and nitrates absorb certain wavelengths of light (spectrophotometer)

Advantages:

- No electrodes to replace
- Continuous ultrasonic Self cleaning

Disadvantages:

- Cost more than ISE
- No ammonia measurement



ISE Probes

Based upon principle that electrodes generate a mV output proportional to compound of interest

Advantages:

- Low cost
- Measure ammonium and nitrate in one probe

Disadvantages

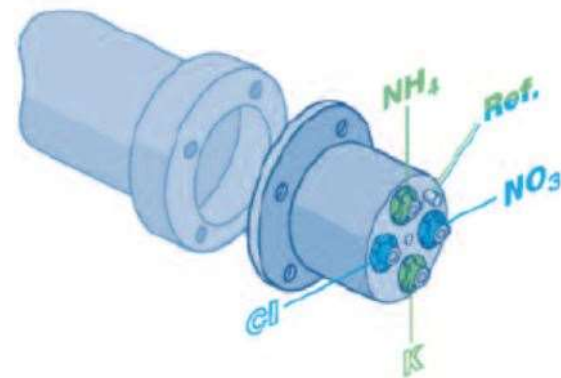
- Requires cleaning (manual or air)
- Requires replacement electrodes (6 months to year)

ISE Probe

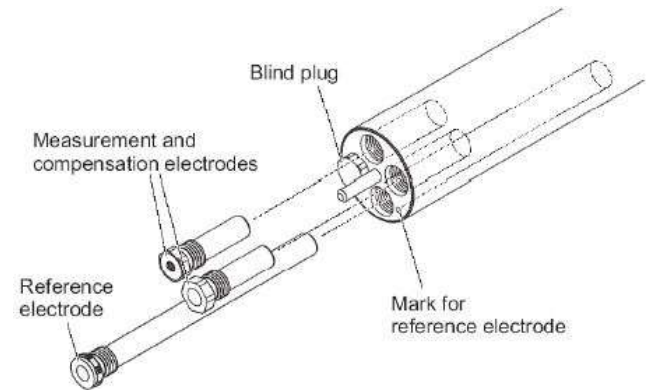


Four Electrodes:

1. Reference
2. NH_4
3. NO_3
4. K or Cl (Interference)



Interferences (ISE)



NH_4^+ Interference mainly by Potassium ions:

- 10 mg/L Potassium \rightarrow 0.7 mg/L NH_4^+ Increase
- 50 mg/L Potassium \rightarrow 3.4 mg/L NH_4^+ Increase

NO_3^- Interference mainly by Chloride ions:

- 100 mg/L Chloride \rightarrow 0.7 mg/L NO_3^- Increase
- 500 mg/L Chloride \rightarrow 3.6 mg/L NO_3^- Increase

Probes are designed to take into these interferences

NO₃ Probe - NITRATAX_{sc} (HACH)

- Reagent Free UV Method
- Measuring Range
 - 0.1 to 100 mg/L NO₃
- Self Cleaning Wiper
- Measurement Interval
 - 1 to 5 minutes
(user-selectable)



NO₃ Probe - NitraVis[®] 700 IQ Sensor (WTW)



NH₄ Sensor - AISEsc (HACH)

- NH₄⁺ Ion Selective Electrode
- 0.2 - 1000 mg/L NH₄-N
- Accuracy: +/- 5%
- Air Blast cleaning system available
- Change cartridge semi-annually
- Regular re-calibration

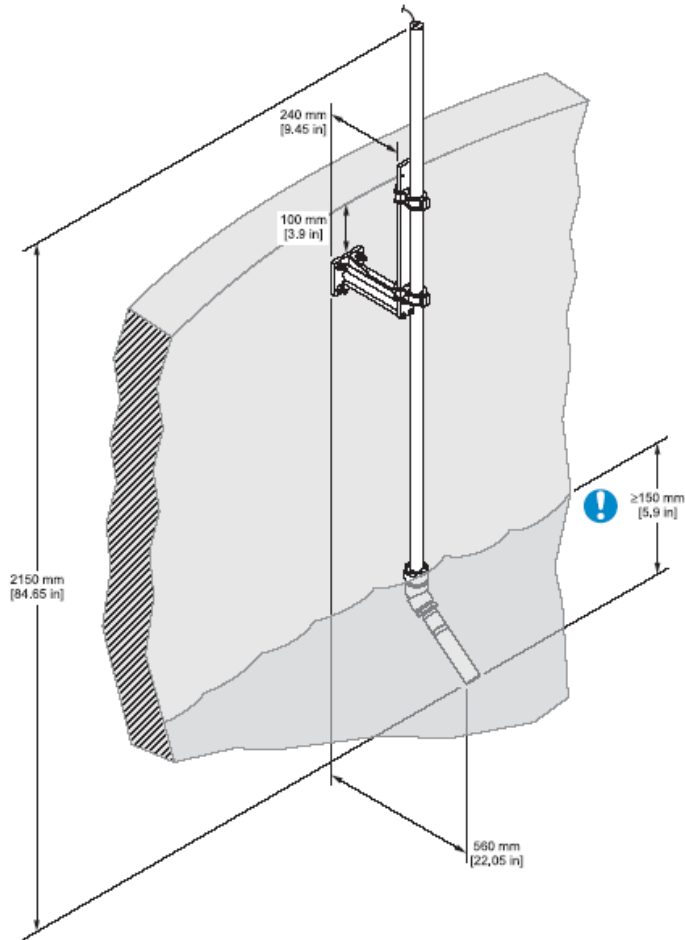


NH₄ Sensor - ammonolyser (SCAN)

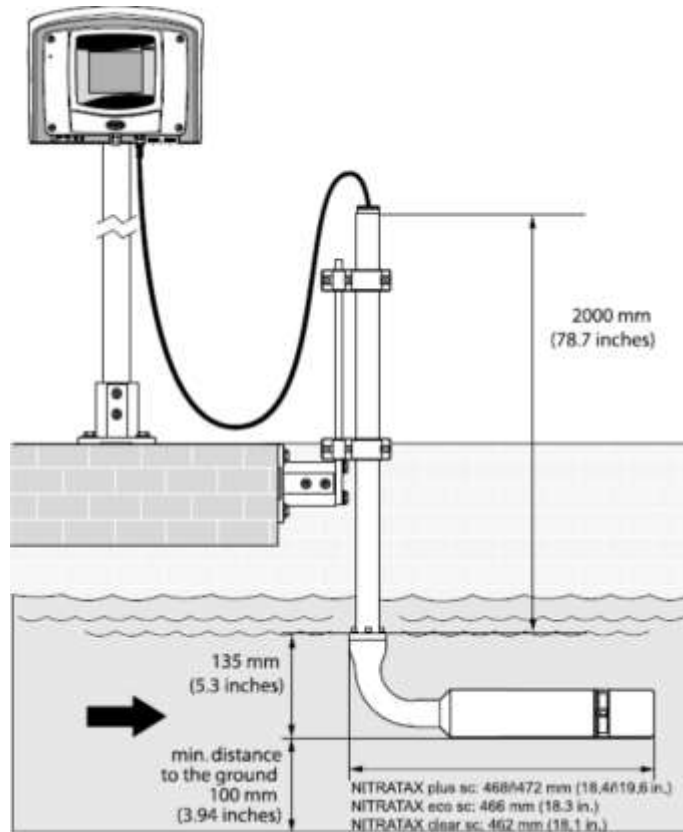
- Multiparameter Probe
- Standard: temperature, ammonium
- Additional: potassium, nitrate, pH, fluorine available
- Plug & Measure on site
- Storage of Lab Calibration
- Made in Austria



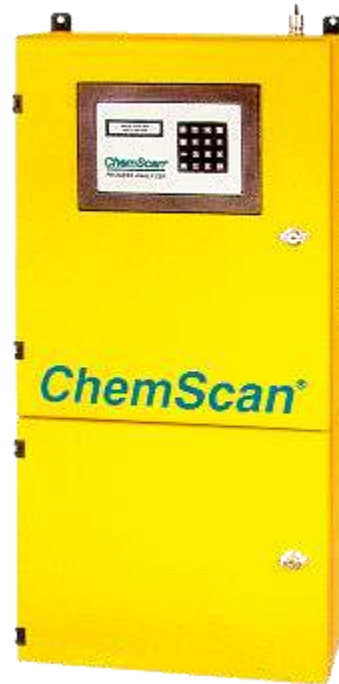
Vertical or 45° or Horizontal?



Vertical or 45° or Horizontal?



NO₃/NH₄/Phosphate - UV 4100 (ChemScan)



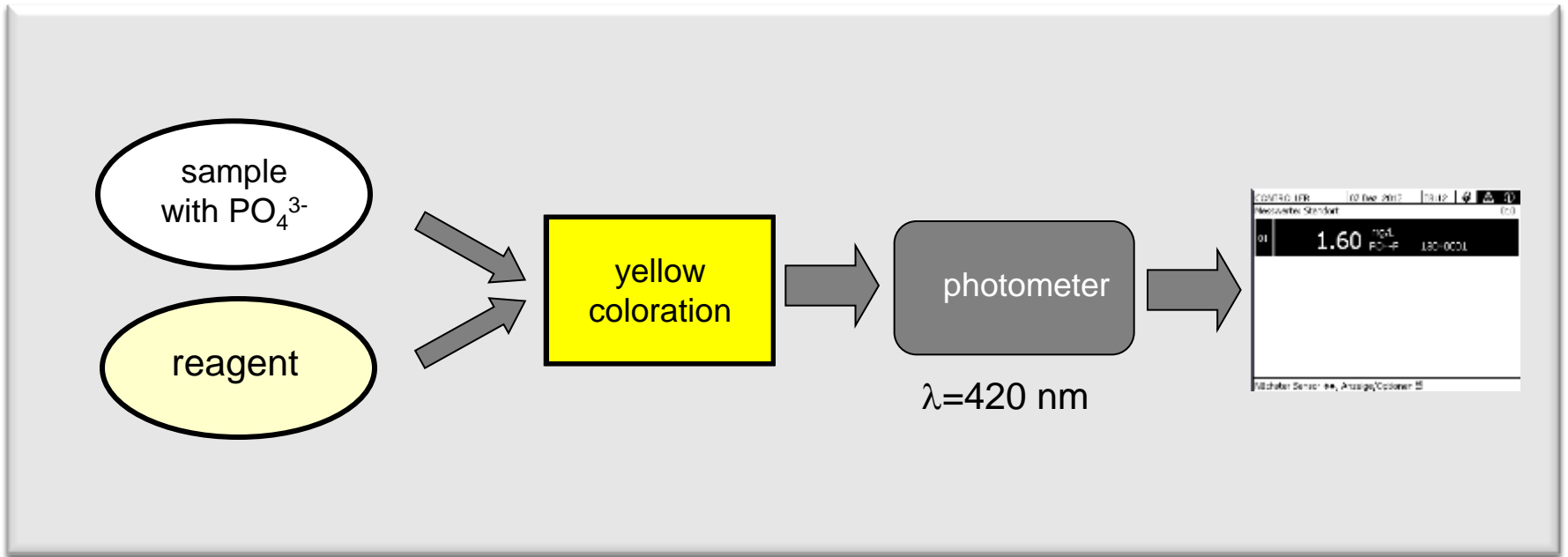
- Ammonia
- Nitrate - Nitrite
- Phosphate
- Chlorine (Free, Total)

Analyzers

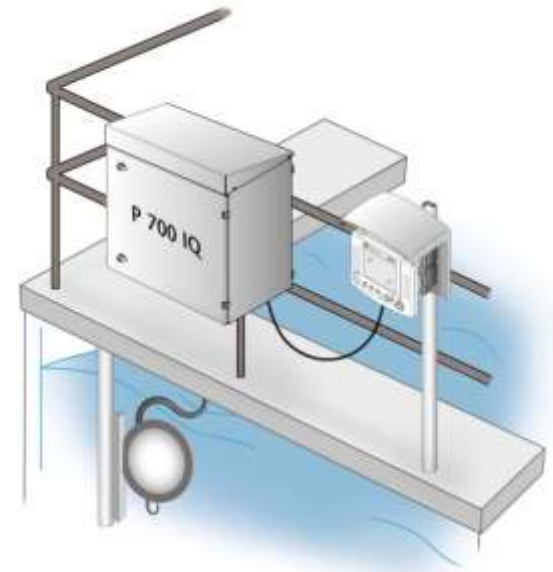
- Low reagent consumption
- Suitable for outdoors
- Automatic calibration
- Integrated permeate pump
- Filter module
- Cost – acquisition & operating



Analyzer: Ortho-Phosphate Measurement



Analyzer Cabinet Design



Orthophosphate Analyzers

- Automatic calibration and self-cleaning
- Free selectable measuring, cleaning and calibration intervals
- Measured value storage using integrated data logger



**Stamolys CA71PH (Endress + Hauser)
Made in Switzerland**

Total Phosphorus Analyzers

- Automatic two-point calibration
- Low-maintenance
- Blue method: highly accurate in lower measuring range
- Yellow method: optimized for high measuring ranges



**Spectron CA72TP (Endress + Hauser)
Made in Switzerland**

Orthophosphate Analyzers



- Colorimetric Method
- 0.05 – 15 mg/L PO₄-P (Low Range)
- 1 – 50 mg/L PO₄-P (High Range)
- 5 minutes Response time
- 5-120 minutes Measurement Interval
- +/- 2% Accuracy
- Change reagents 3 – 6 months

PHOSPHAX sc (HACH)
Made in Germany

Orthophosphate Analyzers



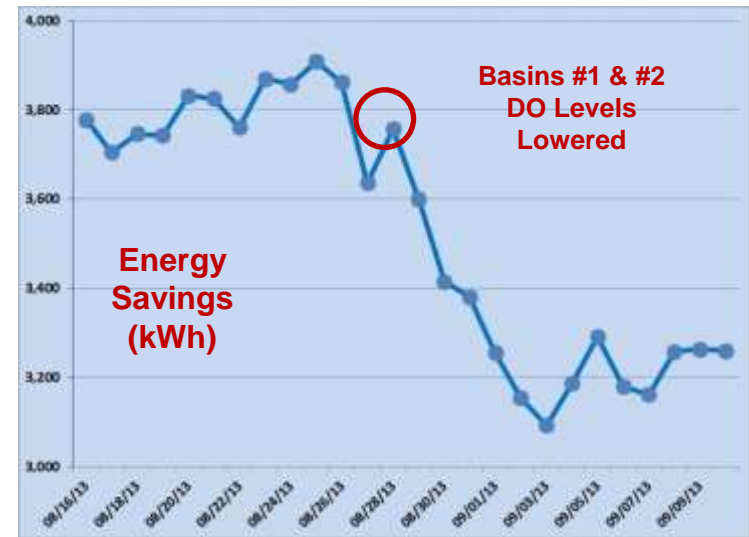
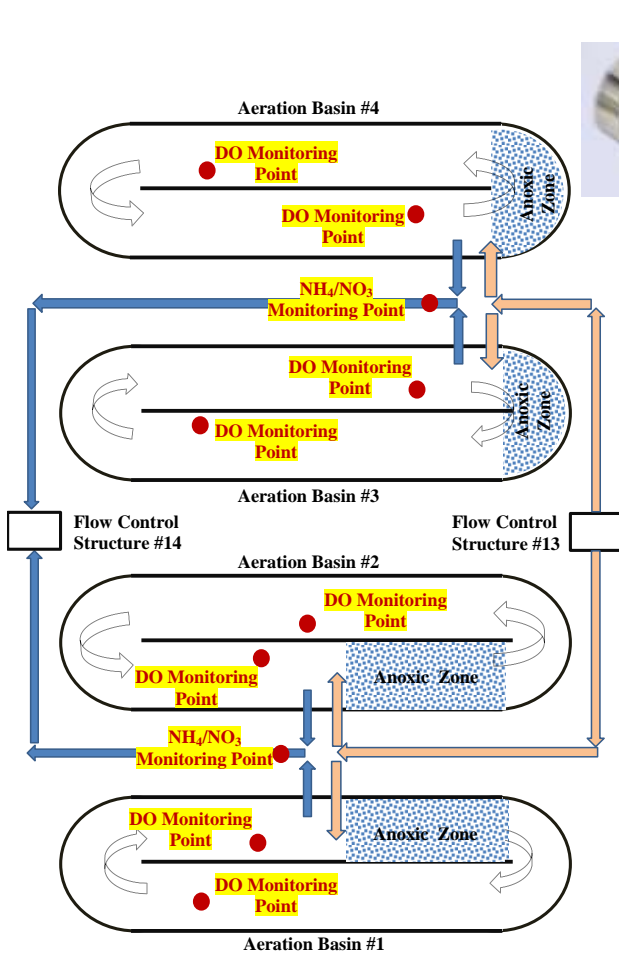
- Continuous background compensation
- Continuous operation
- Intermittent Operation
- Feedback control of chemical phosphate precipitation

TresCon® OP 210 (WTW)
Made in Denmark

On-Line Nutrient Monitoring Manufacturers

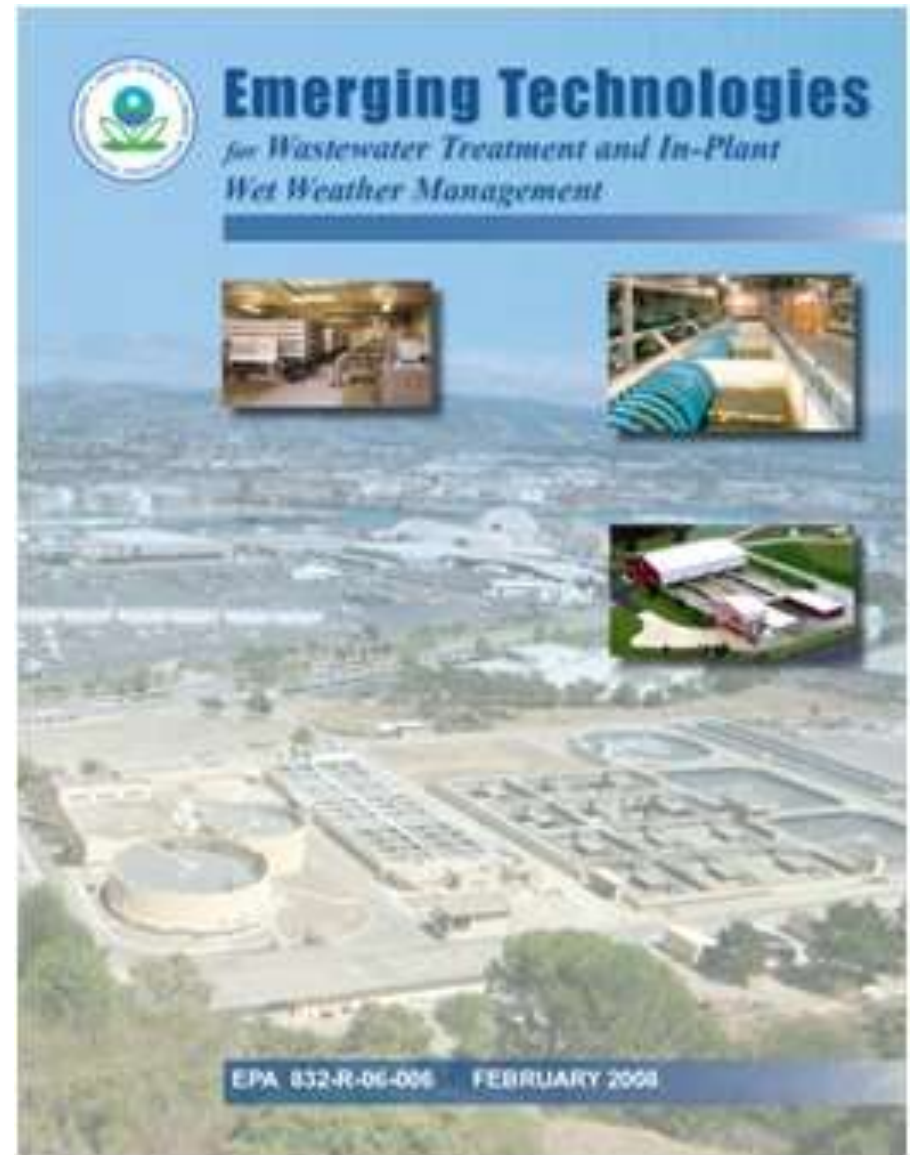


Energy Audit: Hutchinson WWTP, KS (8.3 MGD)



- Basins 1 and 2 utilize jet aeration, each with a 50 HP motive pump for circulation. Air is supplied by 4 x 100 HP Lamson single speed blowers. Air output is adjusted by throttling the inlet valve.
- Basins 3 and 4 were constructed with fine-bubble diffused aeration. 5 x 125 HP Lamson blowers are available

Emerging Technologies for Wastewater Treatment & Wet Weather Management



Summary

- ❑ As WWT is becoming more and more regulated, gone are the days of simply taking “snap shot” grab samples and making daily changes to the process.
- ❑ Advanced treatment becoming more and more common within the industry to control certain nutrients -- needs constant monitoring to ensure compliance.

On-line Nutrient Monitoring:

- ❑ Provided operations staff with important real-time information for process adjustments.
- ❑ Allowed for enhanced nitrogen and phosphorous removal
- ❑ Make operator job easier and create a more economical effluent.



Thank You! Questions?

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