CHESAPEAKE

CHESAPEAKE WATER ENVIRONMENT ASSOCIATION

Activated Sludge Aeration Control Strategies

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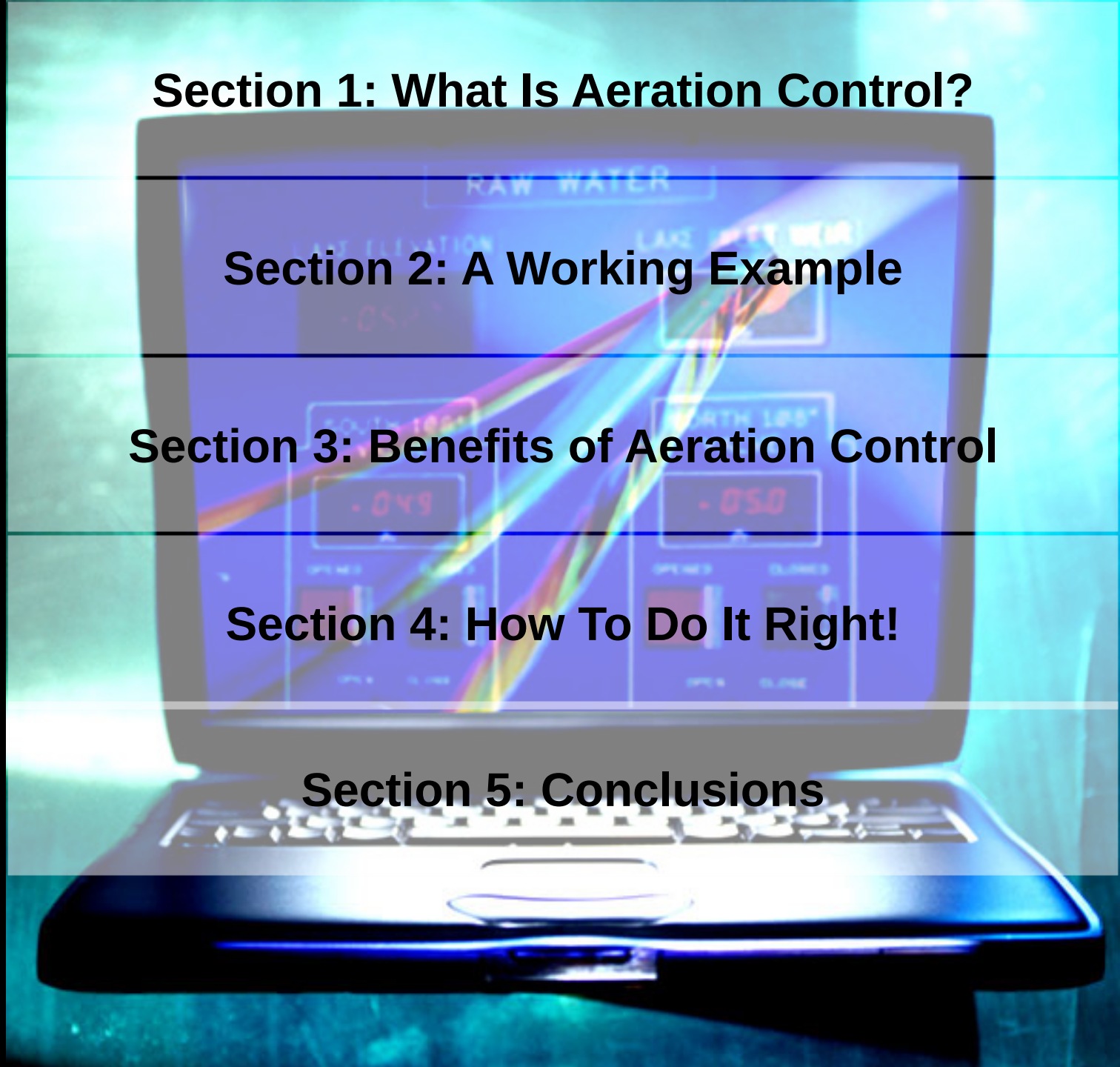
EMA, Inc.

EMA®

AGENDA



Section 1: What Is Aeration Control?

Section 2: A Working Example

Section 3: Benefits of Aeration Control

Section 4: How To Do It Right!

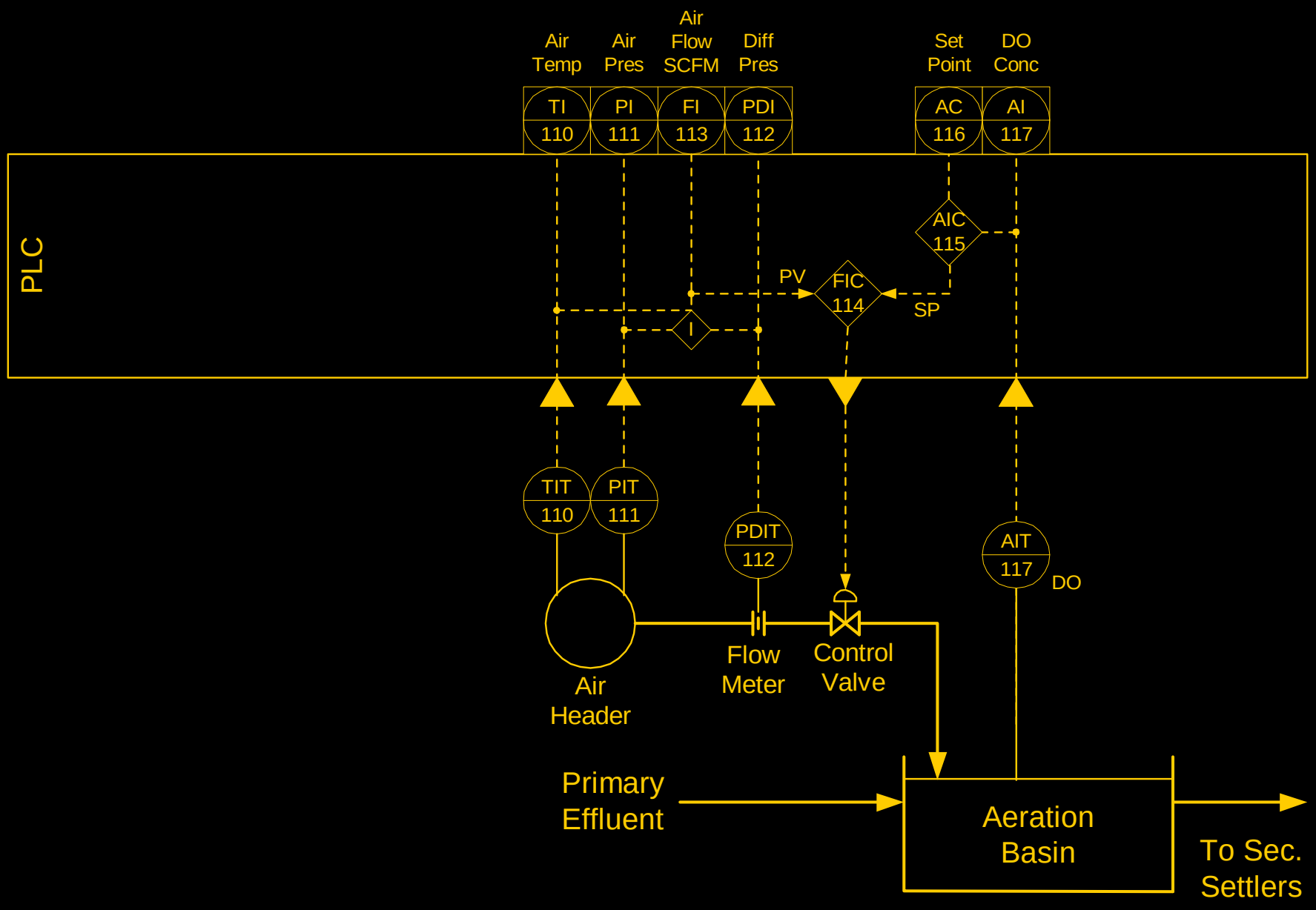
Section 5: Conclusions

SECTION 1

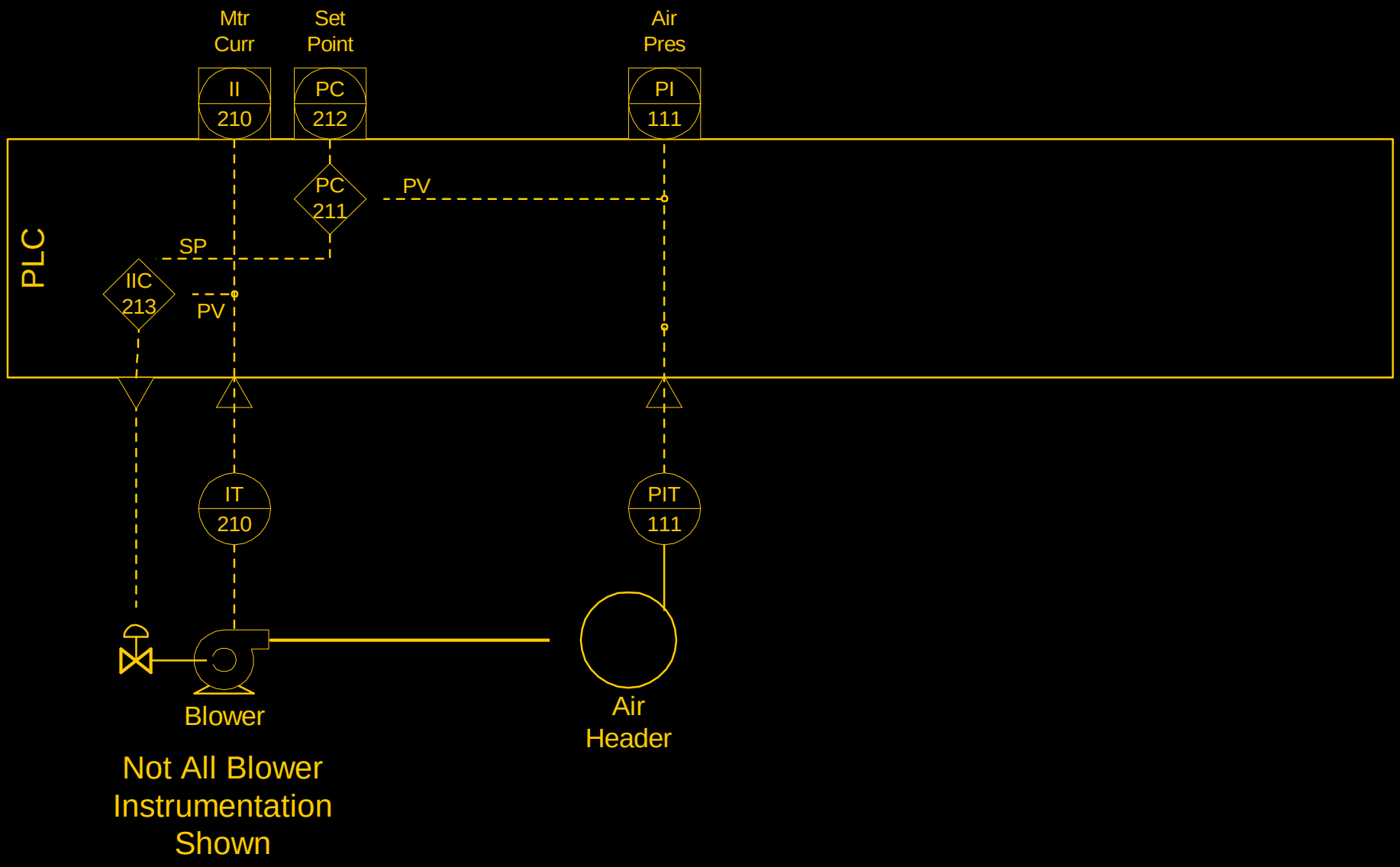
Section 1: What Is Aeration Control

Two Main Components of Aeration Control

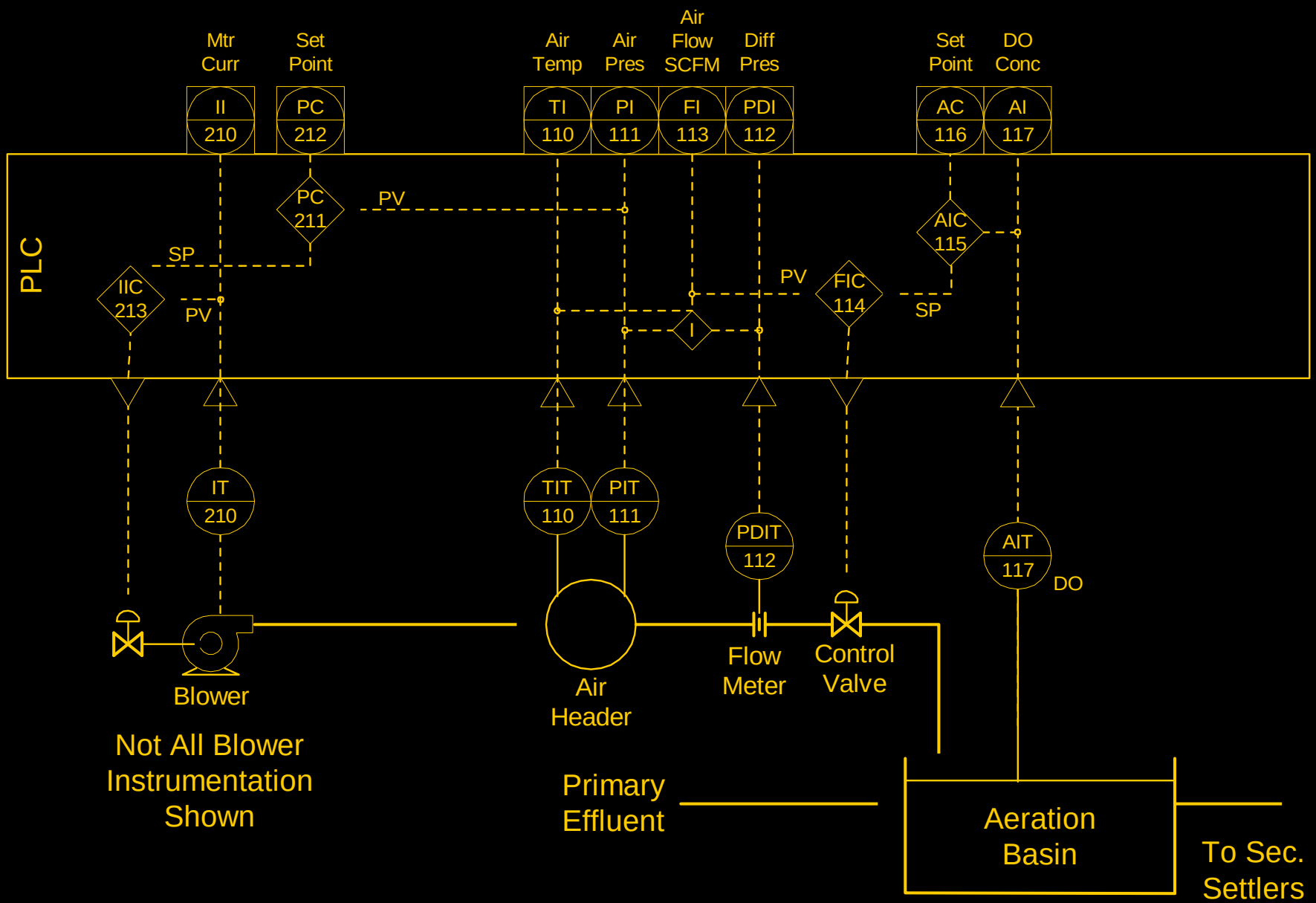
1. Air Distribution Control – **Distribution of the Correct Amount of Air to Each Aeration Basin**
2. Air Production Control – **Production of the Right Amount of Air – at Minimal Cost (Minimum Header Pressure)**
3. Advanced Control



AERATION SYSTEM P&ID – Air Distribution



AERATION SYSTEM P&ID – Air Production



AERATION SYSTEM P&ID

Components of an Aeration Control System

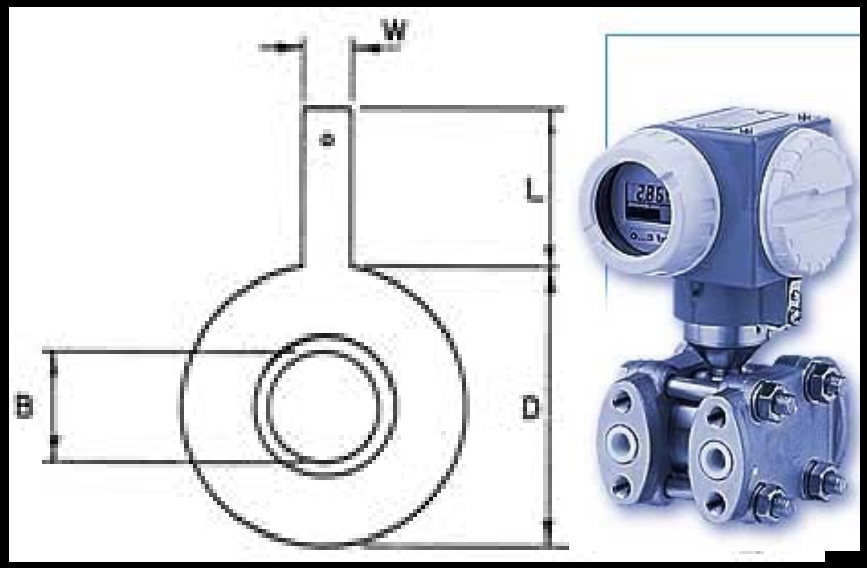
- **Dissolved Oxygen Analyzers**
  - Instrumentation Testing Association
    - Performance Report
    - Maintenance Report

Components of an Aeration Control System

- **Dissolved Oxygen Analyzers**
- **Air Flow Meters**
  - Vortex Shedding

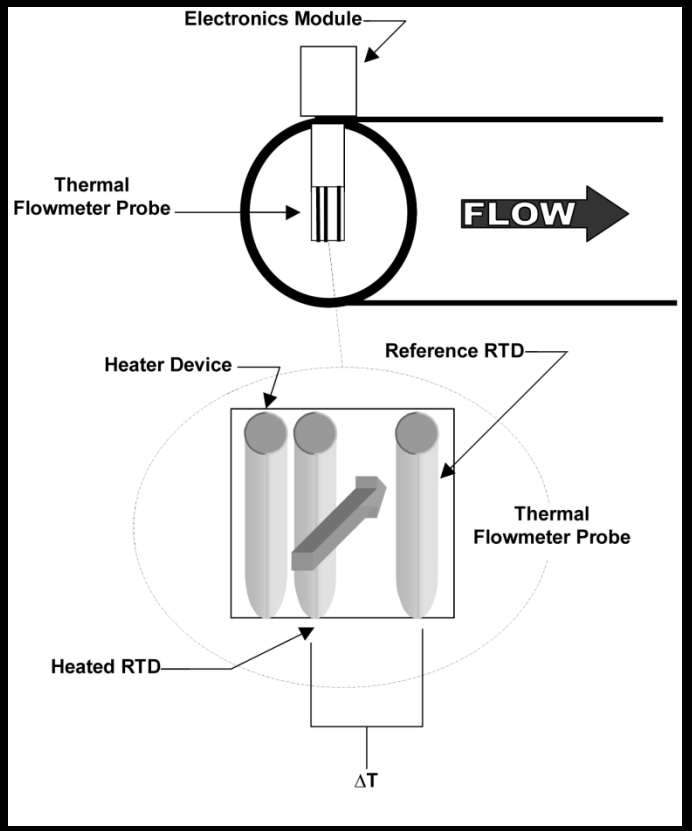
Components of an Aeration Control System

- **Dissolved Oxygen Analyzers**
- **Air Flow Meters**
  - Vortex Shedding
  - Orifice Plates



Components of an Aeration Control System

- **Dissolved Oxygen Analyzers**
- **Air Flow Meters**
  - Vortex Shedding
  - Orifice Plates
  - Thermal Mass

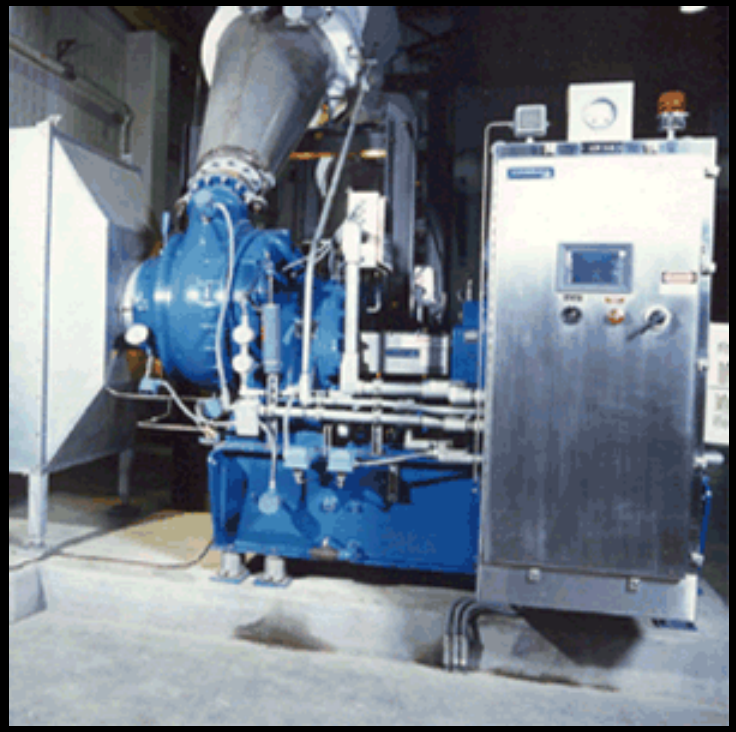


Components of an Aeration Control System

- Dissolved Oxygen Analyzers
- Air Flow Meters
- Control Valves and Actuators

Components of an Aeration Control System

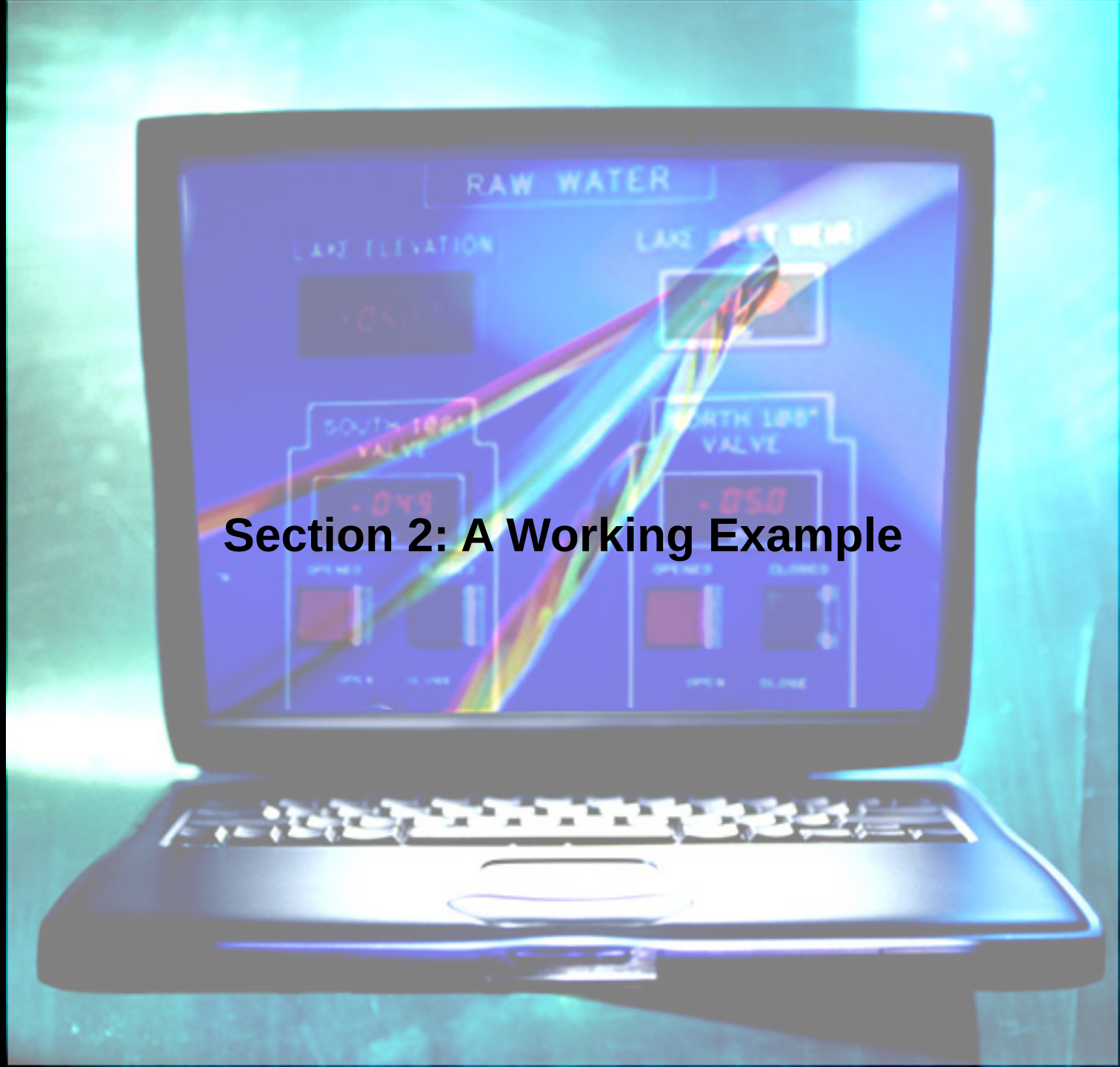
- Dissolved Oxygen Analyzers
- Air Flow Meters
- Control Valves and Actuators
- Blowers



Advanced Control Strategies

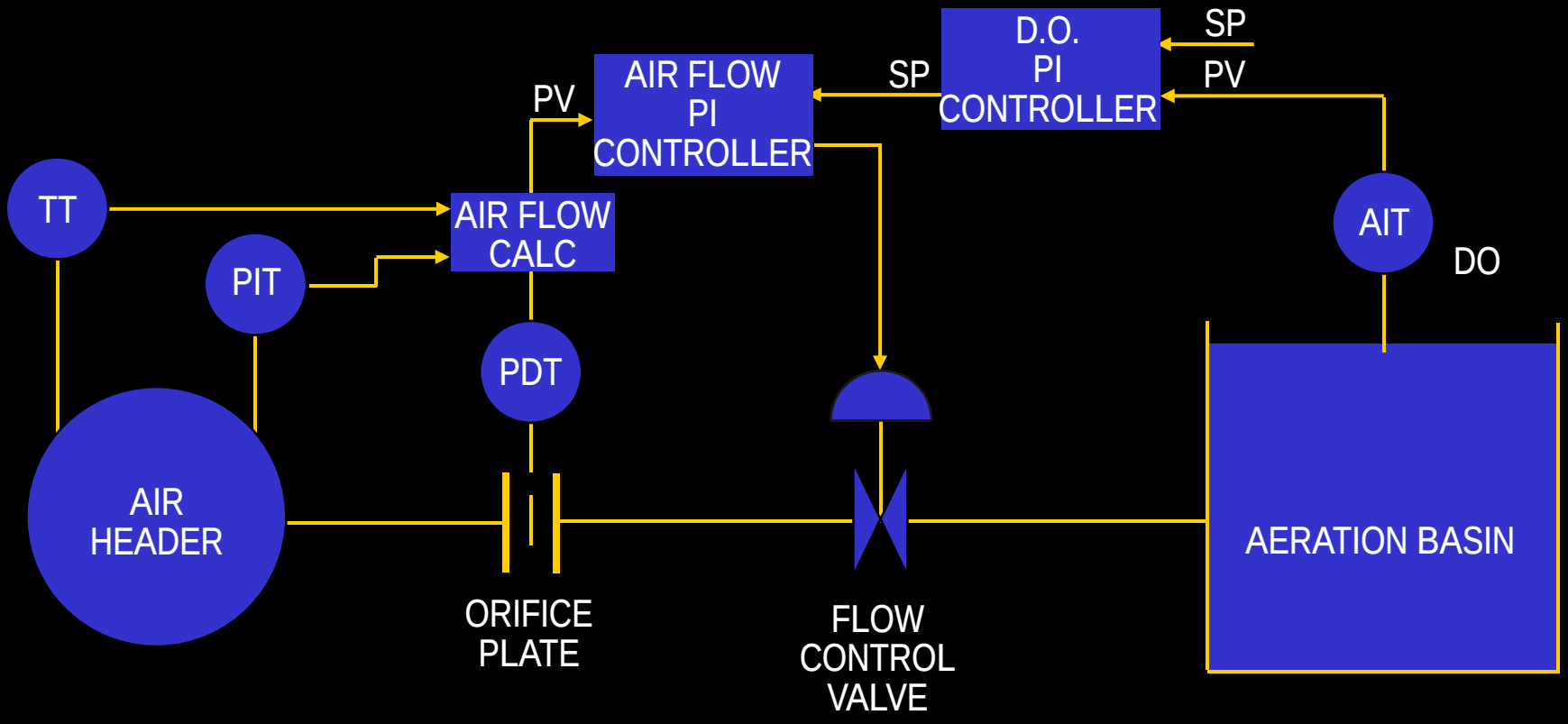
- Load Shedding
- Load Shifting - Time of Day Setpoints
- Minimum/Maximum Air Flow Rates
- Periodic Air Purges
- Power Fail Start-Up Procedures
- Protect Against Blower Surge
- Use of Effluent Ammonia

SECTION 2



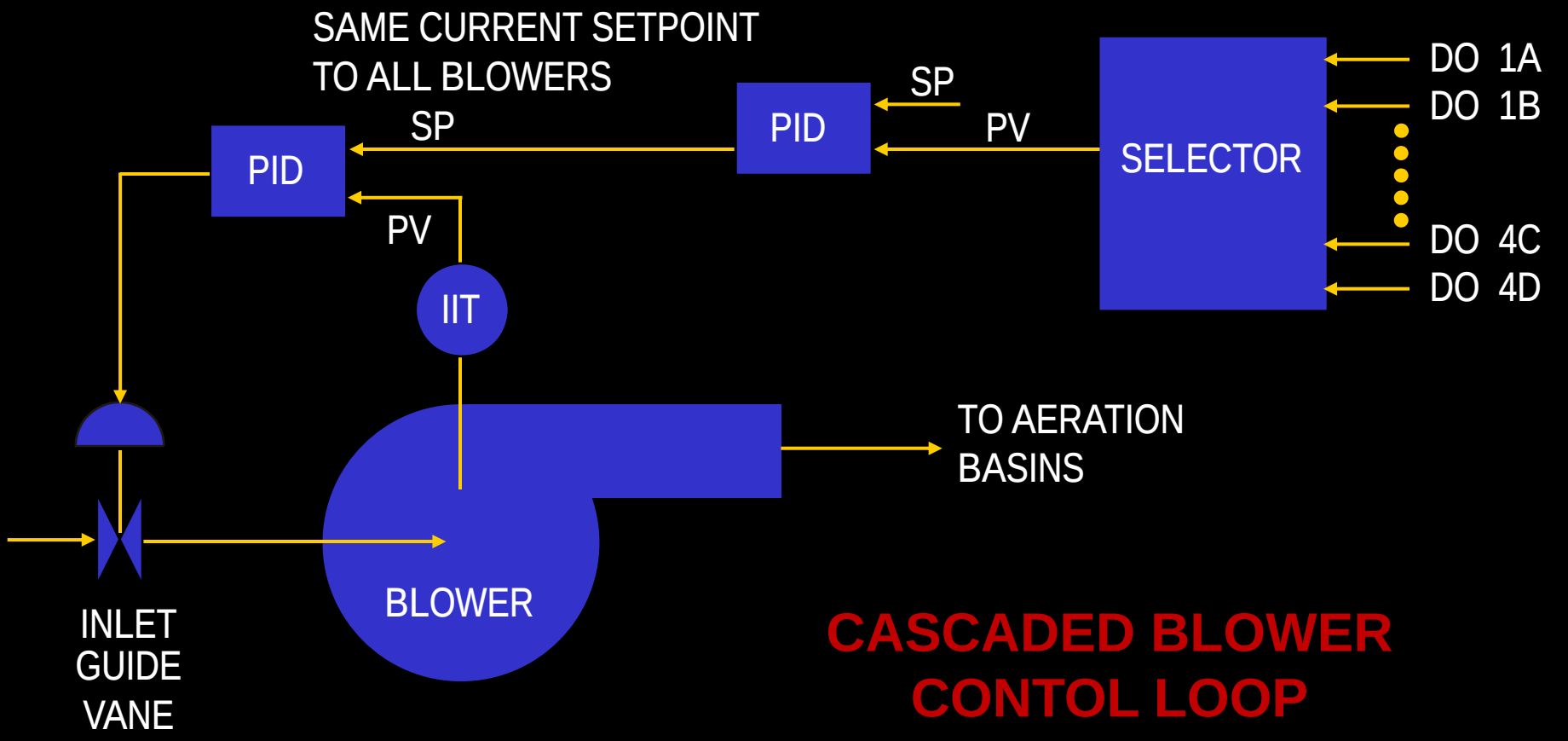
Section 2: A Working Example

Houston's Sims South WWTP Air Distribution Control



CASCADED DISSOLVED OXYGEN CONTROL LOOP

Houston's Sims South WWTP Air Production Control

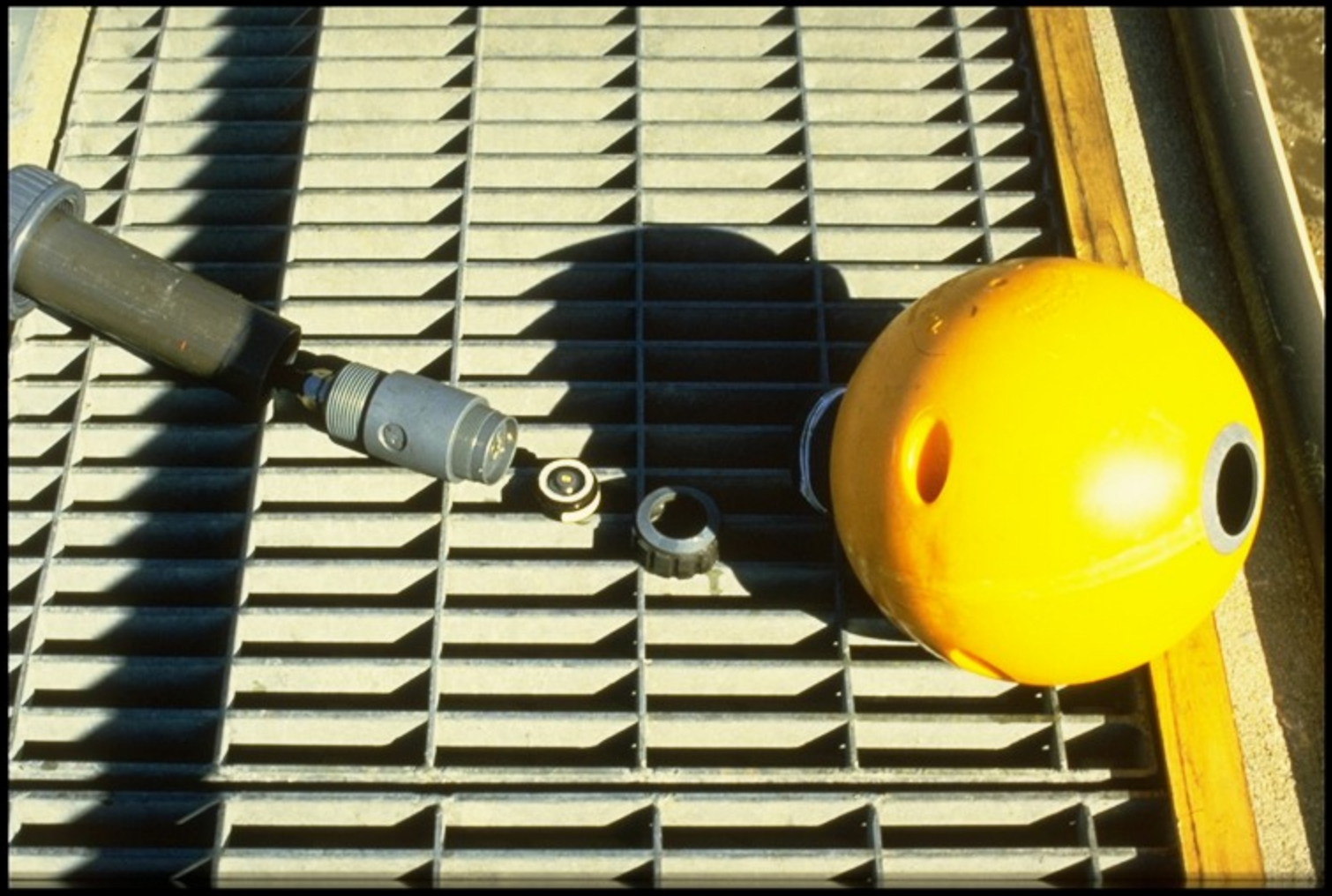


Orifice Plate Used For Air Flow

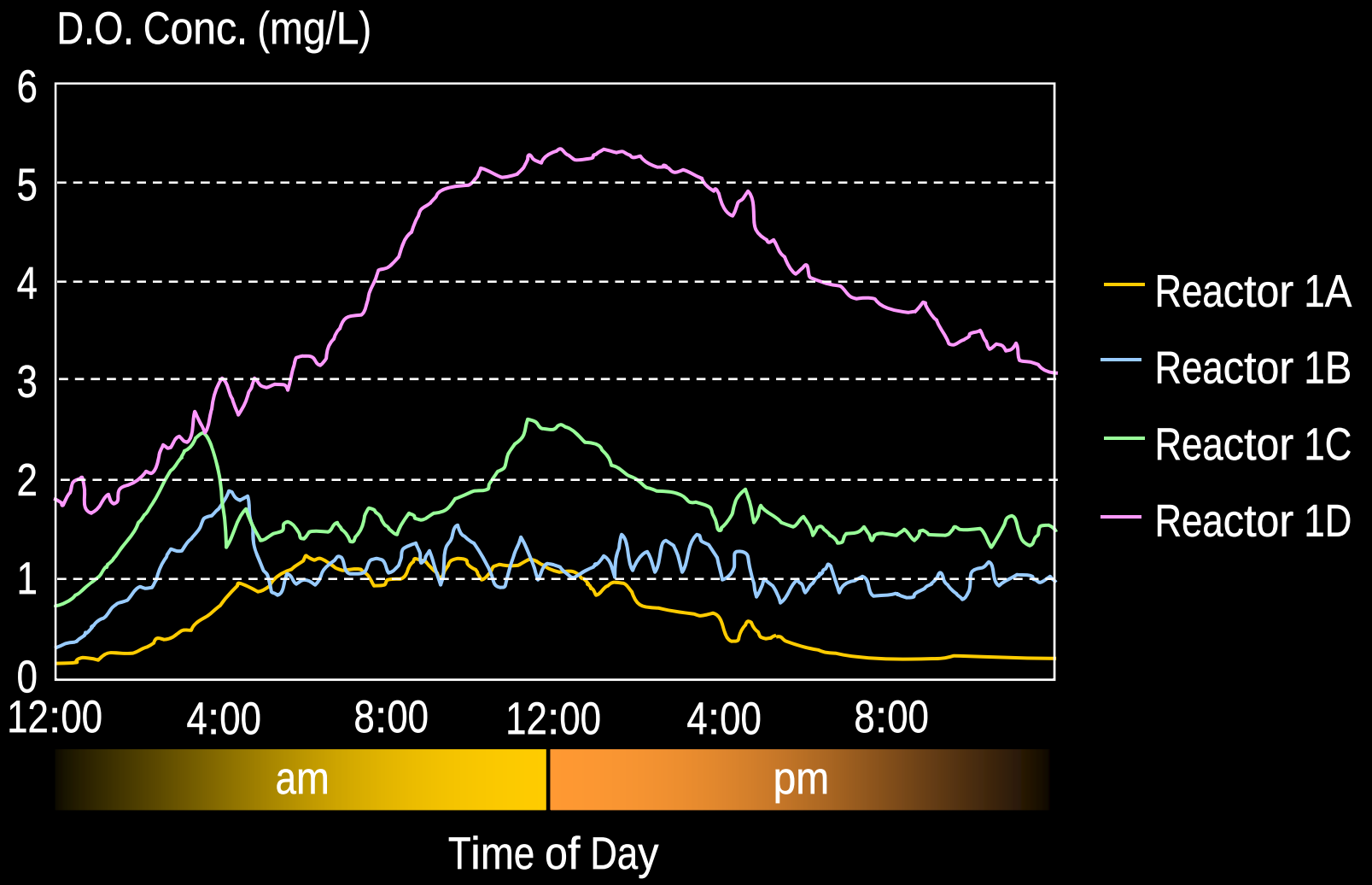
Used Pneumatic Actuators

Unique DO Probe Mounting Minimizes Maintenance Time

Disposable DO Cartridge Provides Accurate Data



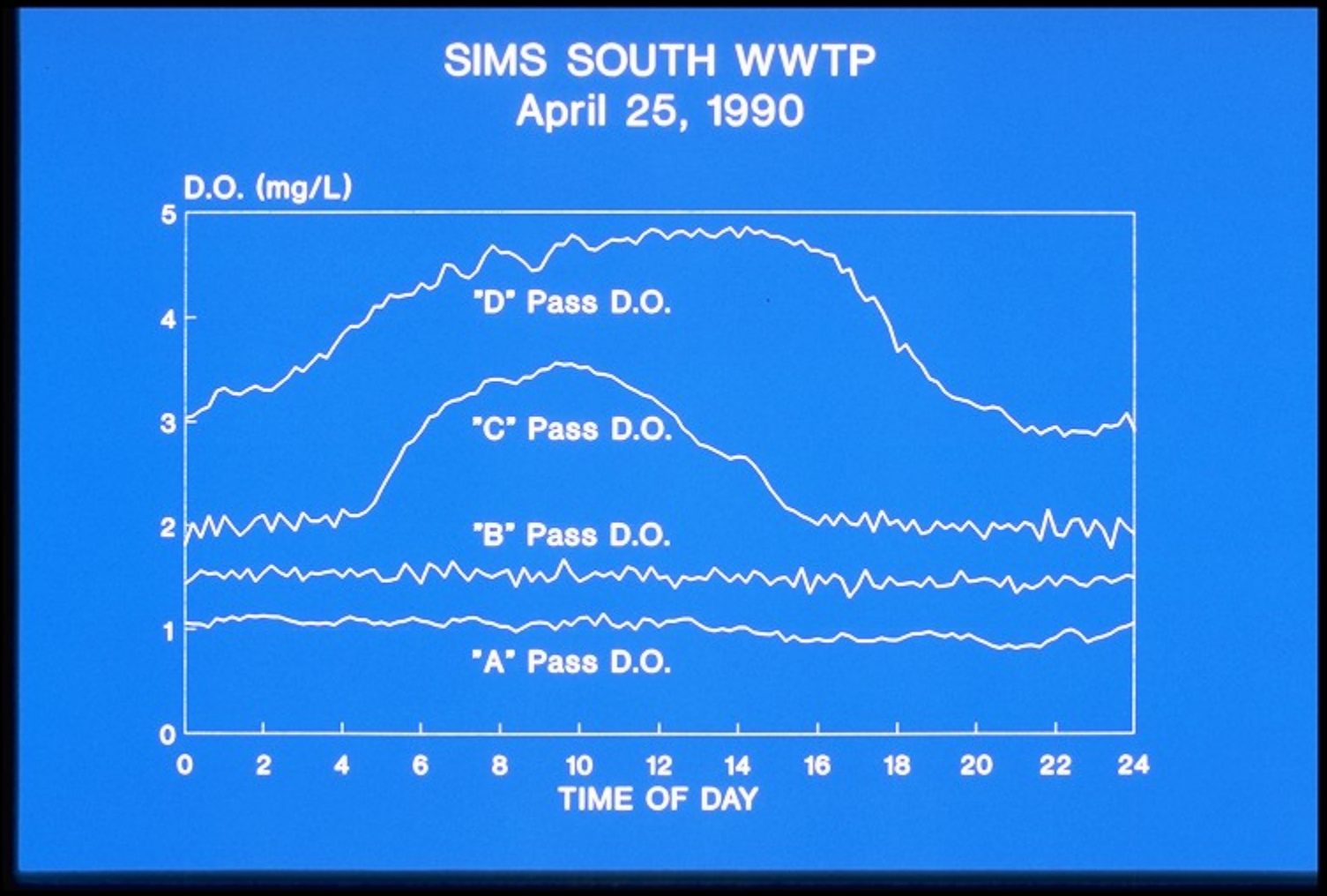
DO Control With Minimum and Maximum Air Flow Limits



SECTION 3

Section 3: Benefits of Aeration Control

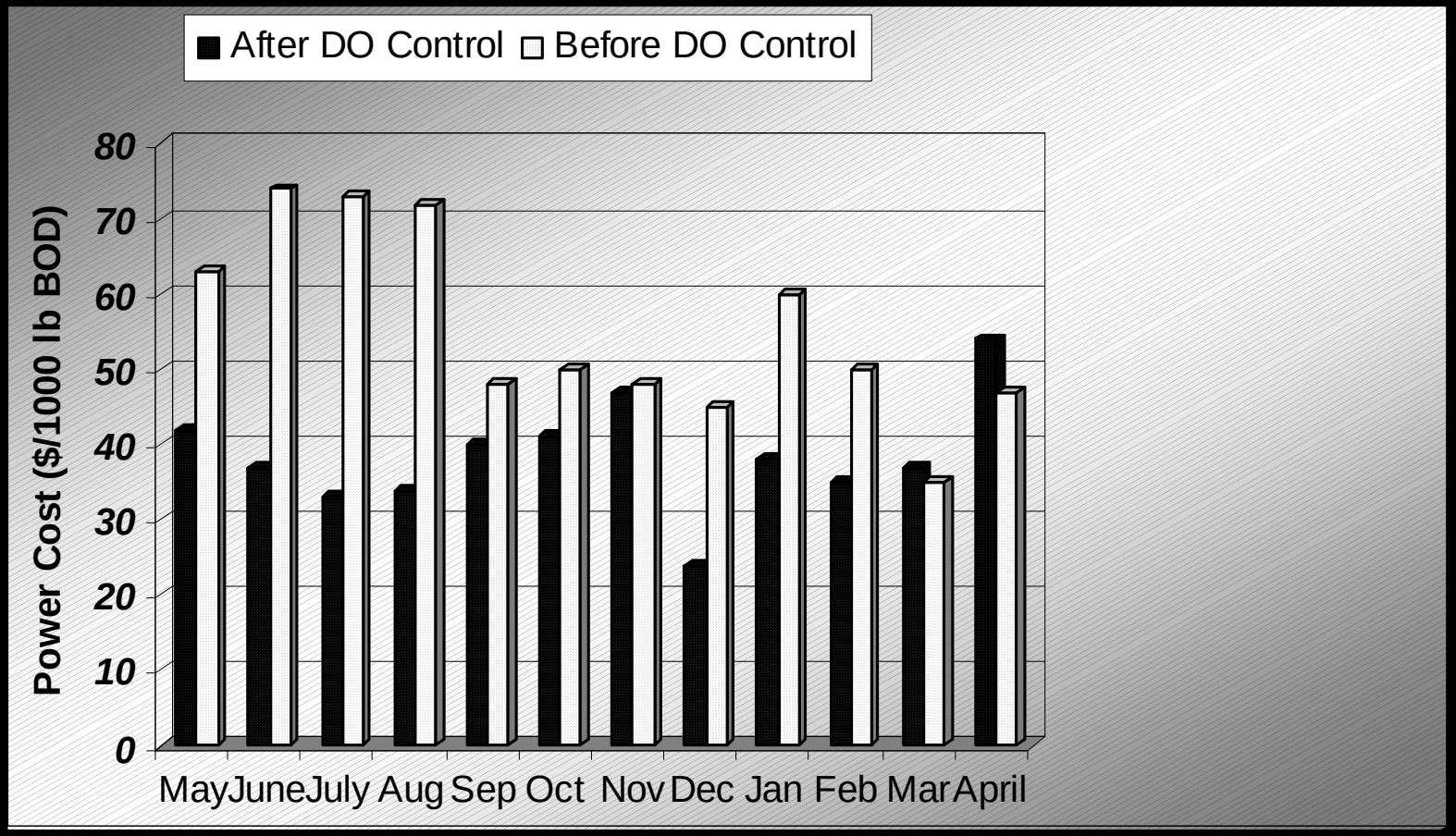
Consistent Process Performance



Aeration Control Saves Labor

- **Fewer Manual DO Readings**
- **No Adjustments of Blowers**
- **No Balancing of Air Between Tanks**
- **Less Process Sampling Needed**

Aeration Control Saves 30%



SECTION 4

Section 4: How To Do It Right!

How To Do It Right!

- Conceive The Right Project
- Design Correctly
- Implement Fully
- Maintenance Wisely

Conceive The Right Project

- **Develop a Consensus on the Automation Philosophy**
  - Designers
  - Operations
  - Maintenance
- **Degree of Automation**
- **Automatic Blower Starts and Stops**
- **Develop SOPs Based on Automation**

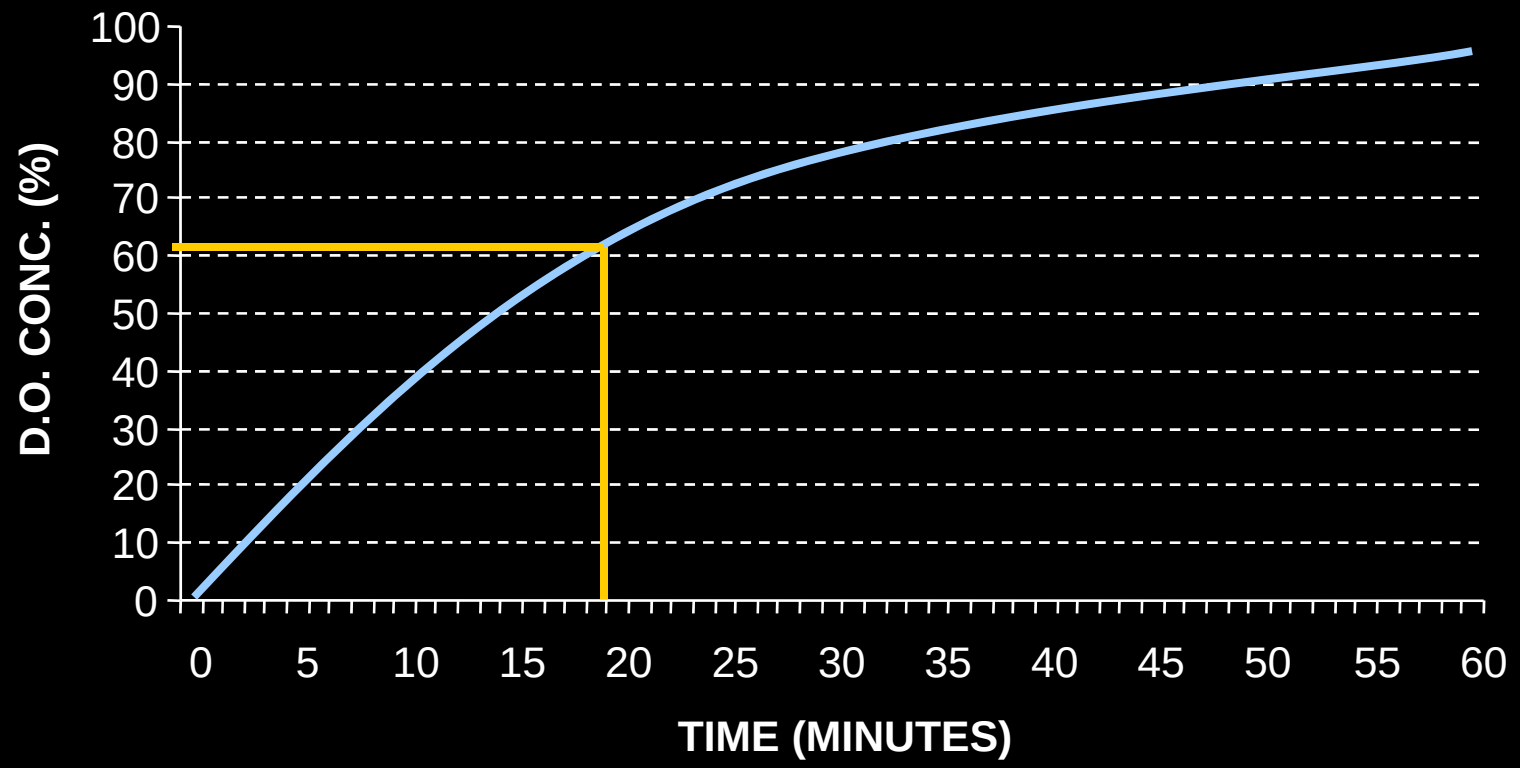
Design Correctly

- **Size Components Correctly for Anticipated Loads**
  - Don’t Size for 20 Years Into the Future
- **Select Instruments and Control Elements Appropriate for the Service**
    - Instrumentation Testing Association (www.instrument.org)
    - Instrument Society of America (www.ISA.org)

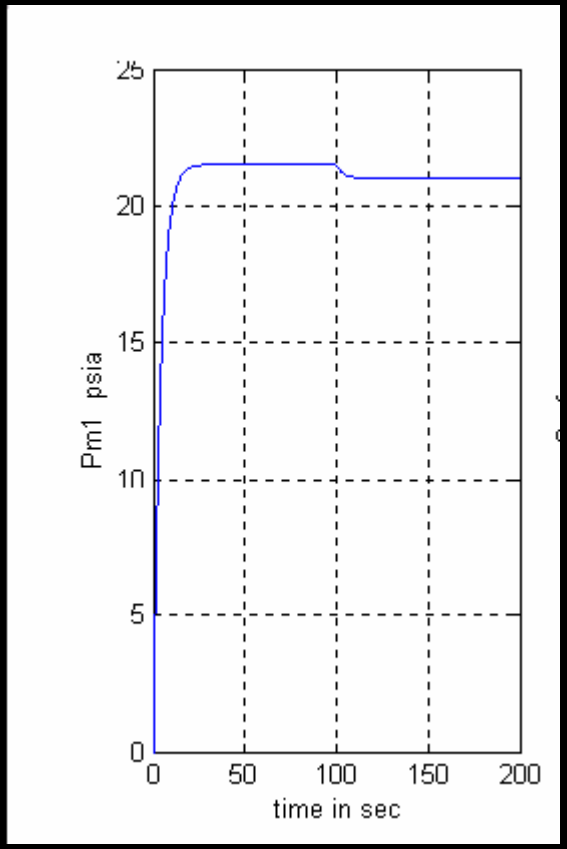
Implement Fully

- Matching Control Strategy with Physical Characteristics
- Tuning of Control Loops (K_P, K_I, K_D)
- Timing of Control Loops

D.O. Has a Time Constant of 15 to 20 Minutes



Header Pressure Has a Time Constant of 3 to 5 Seconds

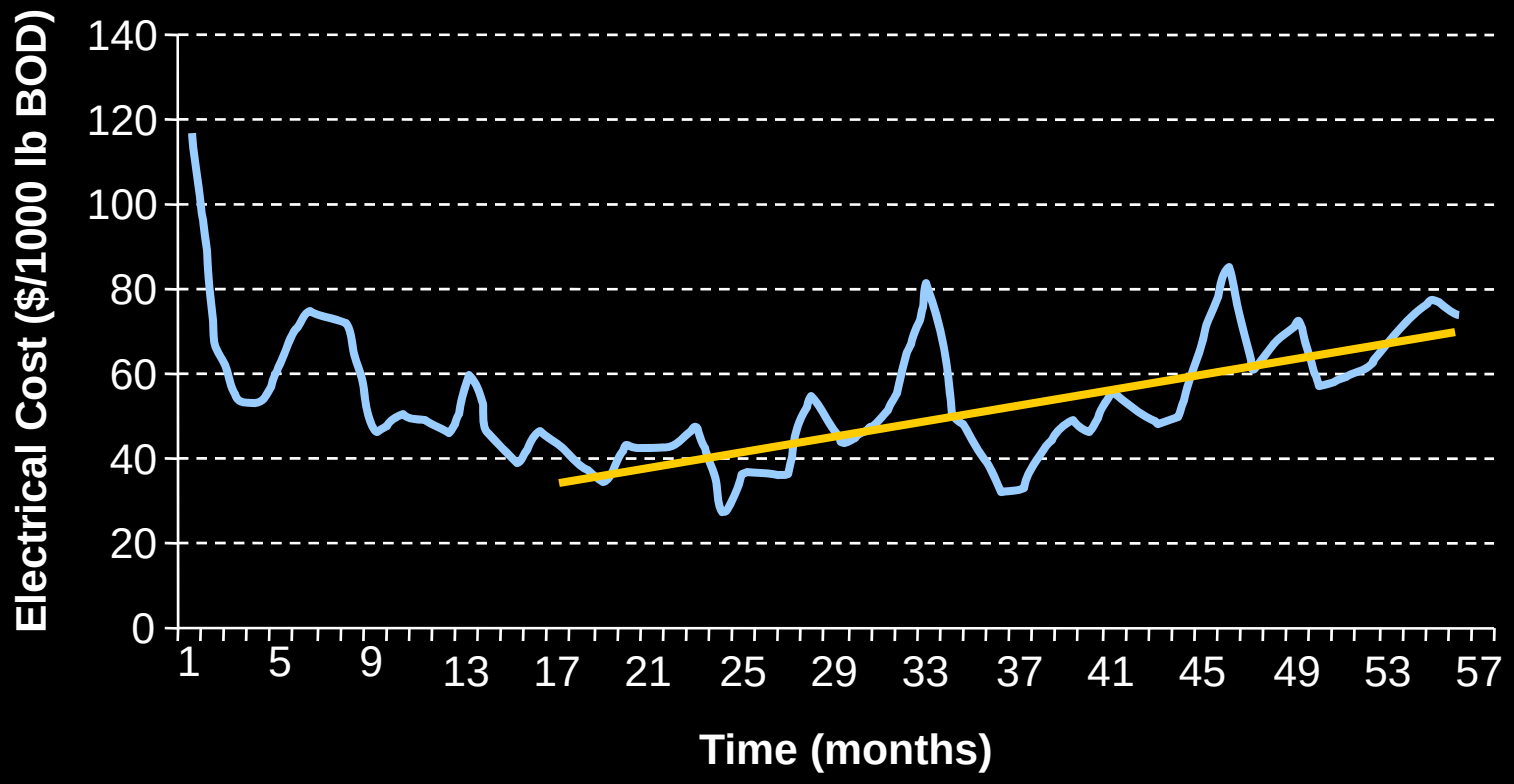


From Ekster and Wang (2004)

Maintain Wisely

- **Set Up Instrument Calibration Program Based on Performance**
- **Quality Control Charts ate Useful**

System Performance Can Decrease Due to Aging

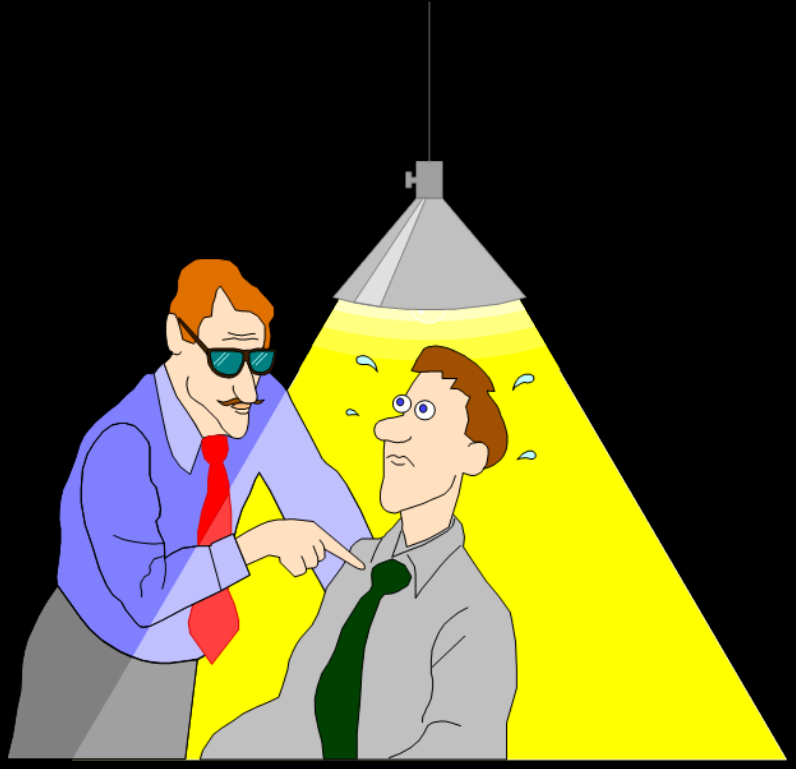


SECTION 5

Section 5: Conclusions

The Use Aeration Control Provides BIG Benefits

- **Consistent Process Performance**
- **Saves Labor**
- **Saves Power**



Questions?

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