You Can’t Improve What You Don’t Measure: Focusing on Key Operating Parameters

OWEA Plant Operations and Lab Workshop
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AKA: “Player to be Named Later”
Safety Moment – Speeding
What We’ll Cover Today

• Figuring out where to focus
• Find what the limits are
• What to measure
• How to track it
• Making decisions
What We’ll Cover Today

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Where to Focus While Driving a Car

- The Road
  - Surface conditions, markers
  - Turns, signs, construction
- Traffic
  - Other cars, pedestrians
- Your Vehicle
  - Speed, signaling, temperature, engine or brake sounds, visibility, dashboard warnings, fuel level
- Your Passengers
  - Conversations, screaming kids..
This is NOT focusing while in a car...
Where to Focus While Driving Your Plant

• Process control
  • Permit limits: disinfection, TSS, BOD, nutrients
  • Solids inventory: wasting, MLSS, SRT, F:M

• Safety
  • Recordable incidents, near misses, findings

• Staffing
  • Shift coverage, training, skills, conflicts

• Maintenance
  • Equipment online, backlog, emergency repairs, PM:CM ratio

• Costs
  • Chemicals, solids disposal, power, OT

• Customer Concerns
  • Odors, Backups, Overflows
This is NOT focusing while driving a plant...
What We’ll Cover Today

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What are the Limits of Your Car?

Tires

• Pressure
• Min Tread depth
• Application (all season, racing, off road)

Fuel

• Octane (87-100)
• Tank volume
• Distance between fills

Engine

• Shifting RPM and redline
• Coolant temps
• Oil change frequency – also applies to your plant...
What are the Limits of Your Plant?

**Permit Limits**
- Flow
- Effluent quality
- *Real limits*

**Maintenance Limits**
- Units online
- Critical spares
- PM intervals (oil changes...)
- Performance for key equipment

**Cost Limits**
- Annual budget
- Capital upgrades
- Line items you can control
What happens when you exceed limits in the car?

What happens when you exceed limits in the plant?
What happens when you exceed limits in the plant?
What We’ll Cover Today

• Figuring out where to focus
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Is this a car or a jet?! There is such a thing of too much monitoring...
What to Measure

• Measure so you can see where you are against the limits

• “Real time” is usually better for process control (not necessarily for compliance reporting – think about how you sample...)

• Don’t measure more than you need!

• Not all measures are by instrumentation or lab samples...boots on the ground
What to Measure

• Target what you want specifically
  • Flow
  • C, N, P, etc.
  • Solids
  • Air
  • Energy
  • Chemical use

• Process vs. Permit measures
  • Not the same...

• Representative measurements
  • Grab, vs. on-line vs. composite?
  • Location?
What We’ll Cover Today

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• Making decisions
Tracking Car Performance

- Gas mileage
- Dyno
- Data acquisition (OBDII)
- GPS or track telemetry
Tracking Plant Performance

- Power consumption at blowers
- Solids inventory under aeration
- Overtime hours by season
- Days since last safety incident
- Settling rates
- Chart recorders
Tracking Performance

- Post key metrics for plant staff to see
- Trend lines and graphs are easier to understand than tables of numbers
- “Old school” printouts are looked at more than SCADA screens (in some plants)
- Update at least weekly
- Vary the time duration – seasonal, weekly, monthly, annual, diurnal...
- Show the limits (upper and lower) if it applies
What We’ll Cover Today

• Figuring out where to focus
• Find what the limits are
• What to measure
• How to track it
• Making decisions
Not the best decision letting the 3 yr old drive...
Making Decisions

- Weekly plant team meetings (ops, lab, maint, etc)
- Use the data and charts
- Post objectives and decisions
- Operator or electronic log books
- Shorter and more frequent is usually better than long and occasional
- Are you running your plant, or is it running you?
Making Decisions

- Do you have enough data? Too much?
- Is it the right kind of data?
- Do you trust it?
Solids Inventory Management Example

Very common problem at a lot of plants. Why?

Depends on the plant...
Solids Inventory Management Example

- Is it a focus?
- What are the limits?
- What to measure?
- How to track it?
- Making decisions
Solids Inventory Management Example

Is it a focus?

- Solids inventory is a key process control point for activated sludge plants
Solids Inventory Management Example

What are the targeted process limits?

- State point (flux) curve on what the clarifiers can handle at permit flows for upper limit
- Nitrogen removal at low temperature for lower limit

![Graph showing solids concentration and flux relationship](image)

\[ y = -0.9809x + 10.729 \]
Solids Inventory Management Example

What to measure?

- Mixed liquor (mg/L)
- Settling rate (SVI)
- Wasting rate (gpm) and concentration (mg/L)
- Return rate (% or MGD) and concentration (mg/L)
- Temperature
- Influent loading (MGD, mg/L to find pounds of solids)
**Solids Inventory Management Example**

**How do I track it?**

- Online meters, SCADA
- Calculate SRT, monitor other parameters (SVI, 30 min set, F:M, etc.) note that some data may be historical only...
- Process control database, DMR
- Excel spreadsheets

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**SRT (days) = \[ \frac{\text{Solids Inventory (lbs)}}{\text{Solids Wasted (lbs/day)}} \]**
Solids Inventory Management Example

Making decisions

- Chart the trends – some of this might need long term history...
- Use the data – How?
- Run your plant! – Seems easy enough, right? It depends...do you have enough plant, information, etc. to run with?
Power Consumption Management Example

- Is it a focus?
- What are the limits?
- What to measure?
- How to track it?
- Making decisions
Power Consumption Management Example

• WWTPs are among the largest single sources of power consumption in most communities, and a big % of operating costs in the plant budget

Wastewater Unit Process Energy

- Aeration: 54%
- Lighting & Buildings: 8%
- Chlorination: 0%
- Dewatering: 4%
- Return Sludge: 10%
- Anaerobic Digestion: 14%
- Wastewater Pumping: 14%
- Screens: 0%
- Grit: 2%
- Clarifiers: 3%

Is it a focus?
**Power Consumption Management Example**

What are the limits?

- Total usage (kWh) of power
- One big motor start, even for a short time, can cost you thousands of dollars so an upper limit (kW) is a good idea!
- Rate tables for peak, shoulder, off-peak times

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### SDG&E PAT-1D, August 2014

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Power Consumption Management Example

What to measure?

- kW(demand)
- kWh (usage)
- What is running and when (SCADA or other methods)
- Flow and maybe loading
Power Consumption Management Example

How do I track it?

• Meters on MCCs or even big users (like blowers)
• Real time if possible!
• SCADA, or web applications
• Excel spreadsheets
Power Consumption Management Example

Making decisions

- Chart the trends
- Use the data
- Run your plant!
- Modify your plant? (i.e. identify capital improvements that reduce power – soft starts, VFDs, new motors, new processes, etc.)

**Traverse City Membrane Bioreactor Energy Usage**

- Chart the trends
- Use the data
- Run your plant!
- Modify your plant? (i.e. identify capital improvements that reduce power – soft starts, VFDs, new motors, new processes, etc.)
You Can’t Improve What You Don’t Measure!

- Figure out where to focus
- Find what the limits are
- Take measurements
- Track it
- Make decisions – just remember the answer may be “it depends”
Thank You!

Q & (hopefully) A

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