NALCO

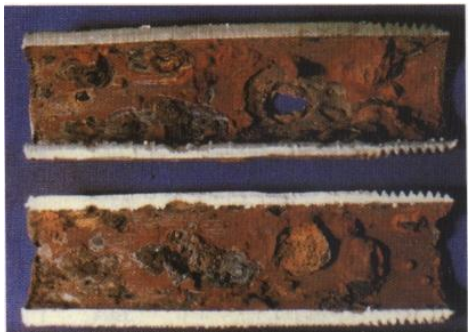
Essential Expertise for Water, Energy and Air SM

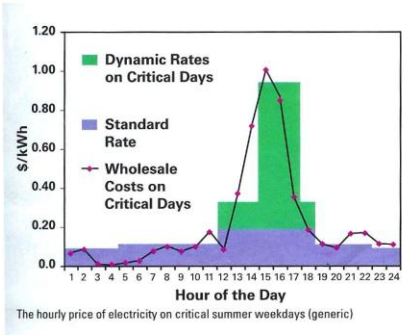
Monitoring & Control of Feedwater Corrosivity Using 3D TRASAR Boiler Technology

Topics

- Why monitor and control feedwater corrosivity?
- Is control possible?
- What control achieves
- What control delivers

Why monitor or control feedwater corrosivity?





Iron Deposits

- Reduced heat transfer
- Reduced tube life
- Excessive or unplanned cleaning costs
- Slow ramping

Flow Accelerated Corrosion (FAC)

- Safety concerns
- Premature system failure
- Unscheduled downtime

Slow Ramping

- Lower availability
- Increased costs
- Decreased revenues

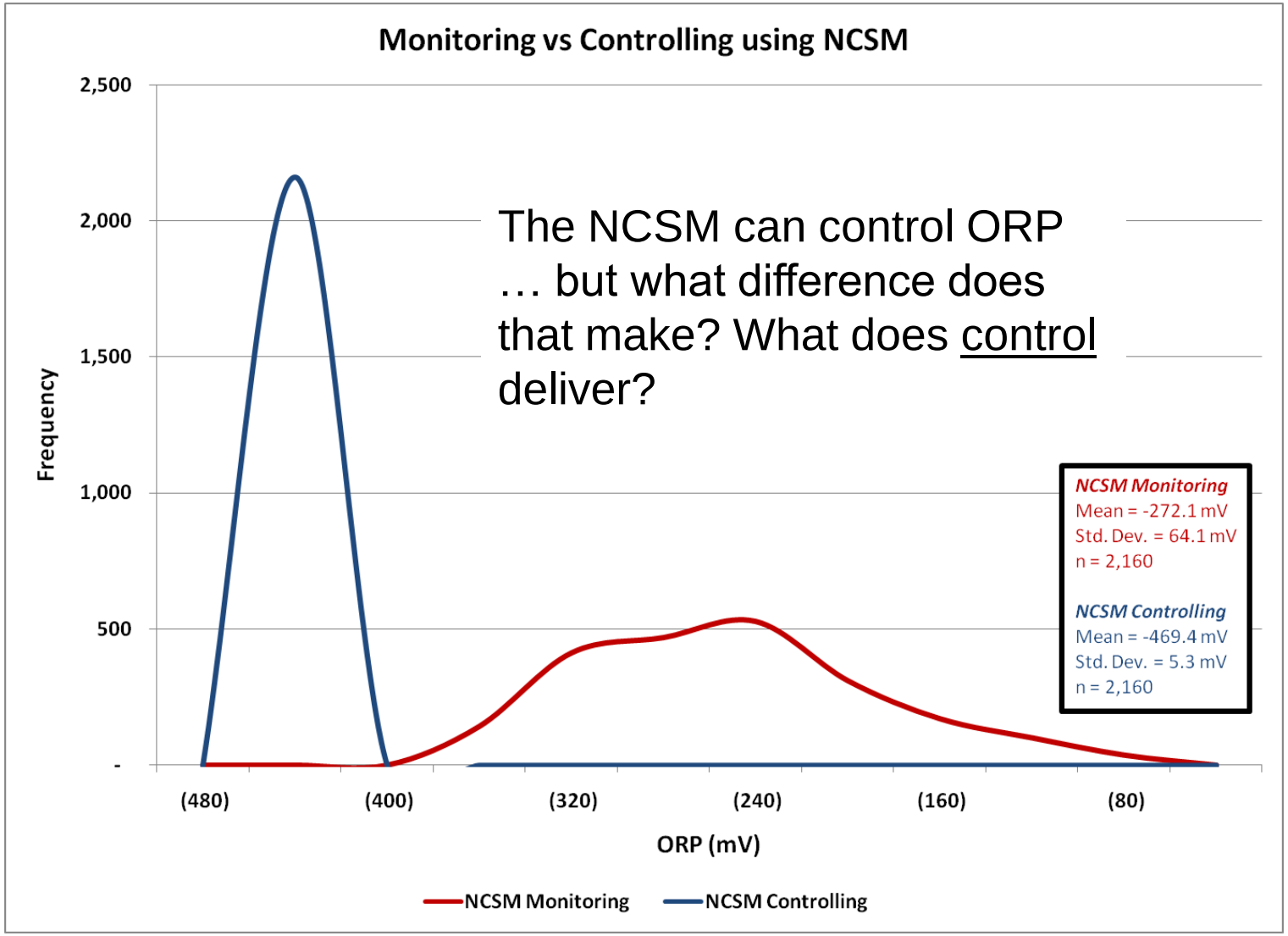
Current state of feedwater monitoring and control

- Routine (and frequent) wet chemistry monitoring in accordance with ASME or other guidelines.
- Online monitoring of conductivity, temperature, pH, maybe dissolved O_2 and/or room temperature ORP.
- Adjustments to chemical treatments in a reactive fashion, based on test results.
- The assumption: if feedwater chemistry is maintained in accordance with the guidelines, failures will not occur.

Current State

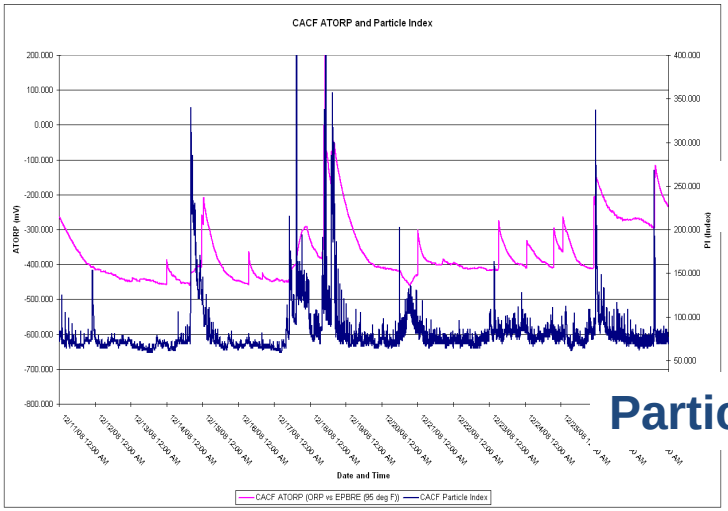
- Consistency and diligence have been rewarded with good results.
  - Most plants have operated for long periods of time without significant problems.
- Better results are possible.
  - Wet chemistry misses upsets and operational changes.
  - Reaction times can be slow.
  - Key parameters are still missed.
  - Current practices are time consuming.
- Better results are worth the effort.
  - Gaining control delivers better results and helps power plants meet their goals.

Better control is possible



Correlation between control and iron generation

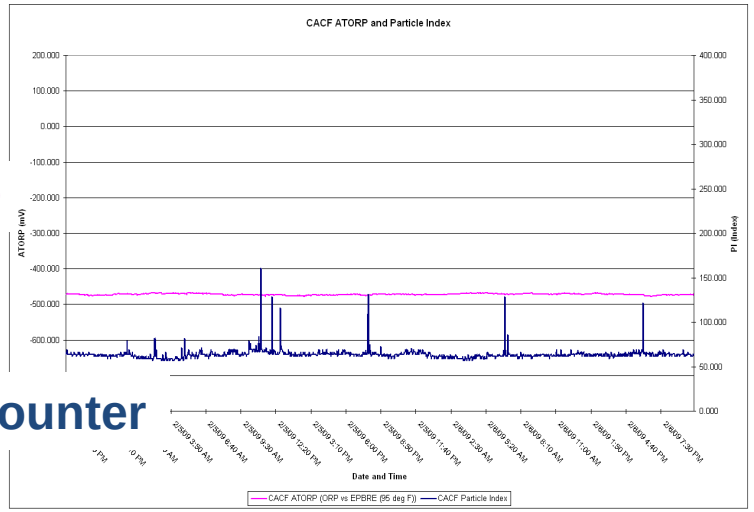
Before NCSM



ORP

Particle Counter

After NCSM



ORP measurements made with the NCSM correlate tightly with measurements made with a particle counter.

NCSM-based control of scavenger feed delivers less variability and less corrosion product generation.

The value of reducing iron generation

We can control ORP…and control of ORP delivers less corrosion product … and so what…?

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Electric Utility Uses 3D TRASAR® Boiler Technology to Reduce Start-Up Time up to 75%

Cost Implications of Start-Up Delays:

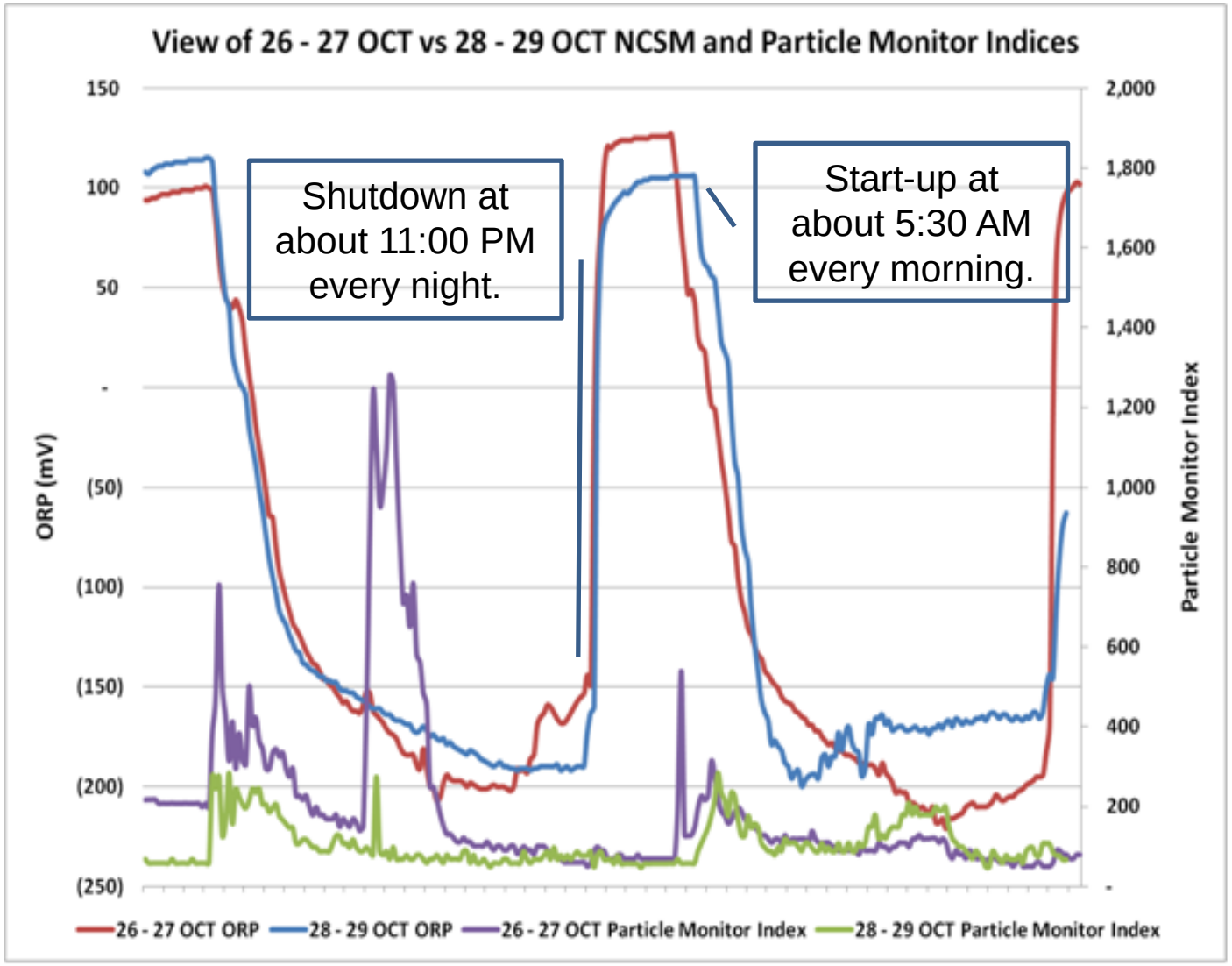
- Lost revenue because generating capacity is not available and another power plant must make up the difference
- Higher labor costs associated with overtime labor
- Higher operating costs because turbines and boilers are not operating at peak efficiency under low-load conditions

- Arizona Electric Power Cooperative, Apache Station, Cochise, AZ
  - 557 MW, coal-fired plant
- Reduced routine start-up time by up to 75%
- The customer has reduced his operating costs by up to $1 million per outage event.

Is the situation at AEPCO unique?

- AEPCO cycles more than most coal plants
  - …but coal plants – and gas plants – are cycling more today than in the past.
- AEPCO had longer silica holds than a lot of plants
  - …but a lot of plants have chemistry holds of some kind.
- AEPCO is not unique in the economic value 3D TRASAR Boiler Technology delivered.
  - Every plant wants higher availability
  - Every plant wants to avoid chemical cleaning
  - Every plant wants to minimize boiler deposition
  - Every plant wants to meet their generating goals, consistently and at the lowest possible cost.

What about combined cycle plants?



Material Condition Matters

- Combined cycle plants are bought and sold frequently.
- Prior to sale, material condition is assessed as part of the due diligence.
  - A well-maintained plant sells for more than a poorly-maintained one.
  - Documentation is often key to this determination.
- Operating companies provide their services to the owners and the price they charge is impacted by material condition.
  - A well-maintained plant requires fewer people (lower costs), which improves financial performance.