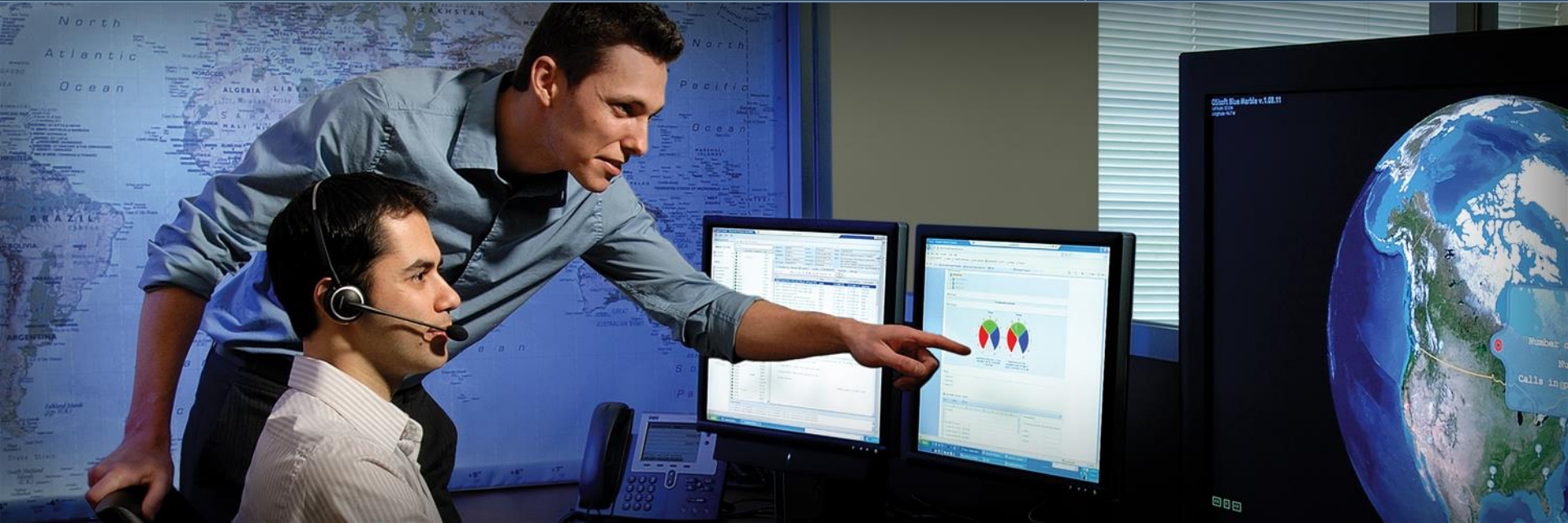Regional Seminar Series
Cincinnati

Improving Boiler Water Chemistry

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American Electric Power

October 7, 2009

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The Challenge: Making Boiler Water Chemistry a Priority

"We use the PI system to monitor and track the water chemistry at our power plants to drive a culture of continuous improvement for Boiler Water Chemistry."

*- Doug Hubbard, Manager – Generation Chemistry Standards and Control*

Mountaineer Water Chemistry
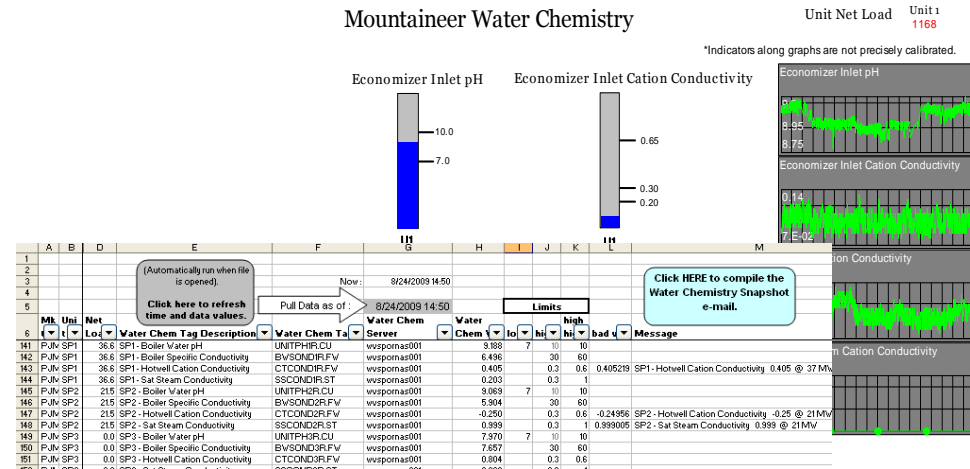
Customer Business Challenge	Solution	Customer Results / Benefits
• Reduce Tube Leak Outages Caused By Poor Water Quality	• Use PI-ProcessBook to Monitor Real Time Water Chemistry	• Benchmarking Process Provides Assessment of Each Unit's Chemistry Program
• Benchmark Water Quality Performance For All Boilers in Fleet	• Use PI-DataLink to Report and Track Water Quality Performance	• Alerts Reduce Duration of Abnormal Chemistry Events
• Drive A Culture of Continuous Improvement for Boiler Water Chemistry	• Use PI-Notifications to Alert on Abnormal Operating Conditions	• Automated Reporting Eliminates Manual Data Entry

AEP – Who We Are – By Assets
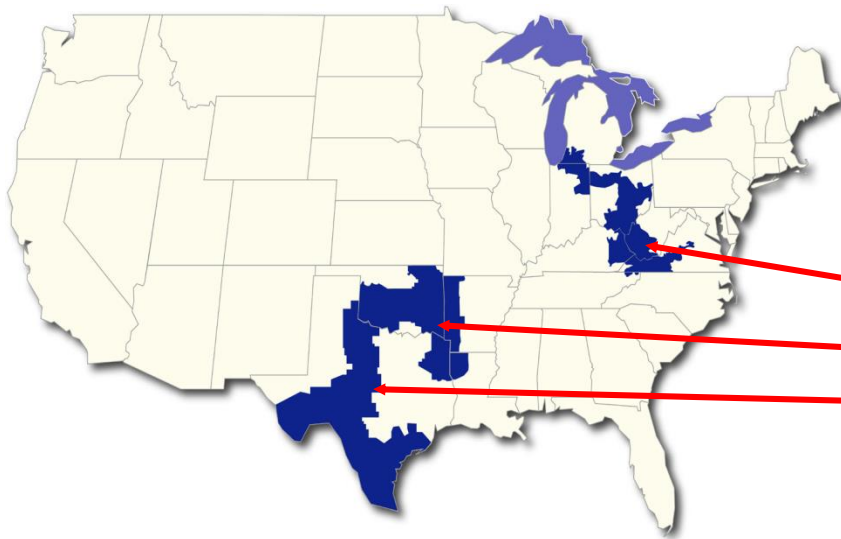
- **One of the largest U.S. electricity generators (~ 38,000 MWs) with a significant cost advantage in many of our market areas**

- **Largest consumer of coal in the Western Hemisphere**

- **Operations within four RTO's**
  - **PJM**
  - **SPP**
  - **ERCOT**
  - **MISO**

- **A leading consumer of natural gas**

- **Major wind power purchaser/reseller**

- **39,000 miles of transmission**

- **186,000 miles of distribution**

- **Coal transportation**
  - **7,000 railcars**
  - **2,230 barges and 53 towboats**

- **5 million customers**

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PI History – Where Have We Been
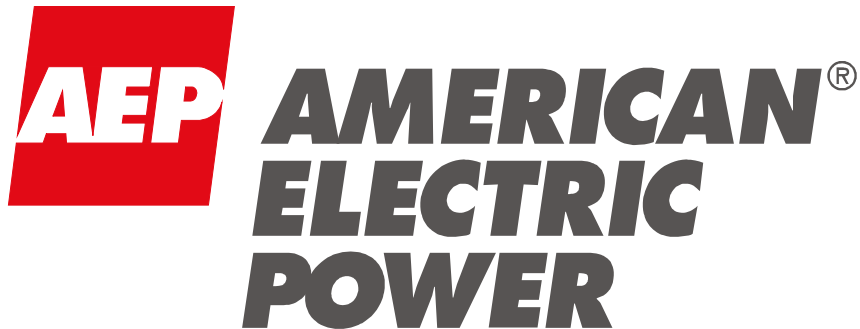
- AEP began installing PI servers in 1993
- Five servers installed between 1993 – 1998
    - Conesville 5, Conesville 6, Conesville 4, Sporn 5, Muskingum 5
- Bank License 40,000 Tags (1998)
- Corporate PI server installed in 1999
- Most plant PI servers installed after 1999
- Plant's Question - How Do You Justify PI?
- AEP "All you can Eat" Contract 2004
- Current Contract 2007-2009

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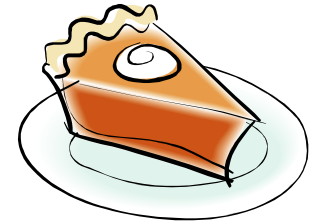
- ## Servers
  - 4 Corporate PI Servers (HA)
  - 49 Plant PI Servers (Several HA)
  - 2 Plant Simulator PI Servers
  - 3 Transmission PI Servers
  - 2 IT Monitor PI Servers
  - 60 Total PI Servers
- ## PI Tags
  - AEP total tag usage is about ~ 770,000 tags
  - Plant PI servers have over 460,000 Tags
    - Plants server tag counts range from 75 tags to over 70,000 tags
  - Corporate PI server has over 100,000 tags
  - IT Monitor server has over 100,000 tags
  - Transmission PI servers have over 50,000 tags
- ## Processbooks
  - More than 1200 Installed

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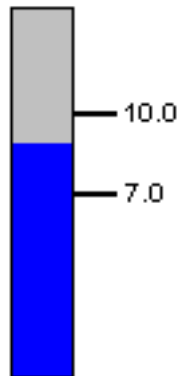
The Cost of Leaks

- Tube failures are a major source of forced outages
- Costs include
  - Cost of repair
  - Cost of start-up
  - Cost of lost production
- Monitoring water chemistry can help protect steam generator from corrosion and deposition.
  - Deposition (solid contaminant build-up) can be detected by monitoring hotwell condensate conductivity
  - Corrosion (loss of metal or pitting) can be prevented by avoiding water pH below 7.0
- Goal: Zero chemistry-related tube failures

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OSIsoft.

Mountaineer Water Chemistry

Unit Net Load   Unit 1
1273

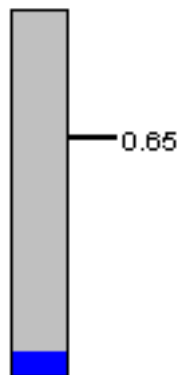*Indicators along graphs are not precisely calibrated.

Economizer Inlet pH
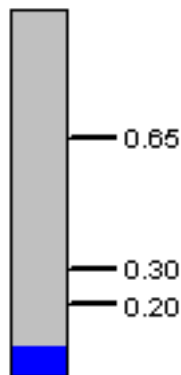
— 10.0

— 7.0

U1

Economizer Inlet Cation Conductivity

— 0.65

— 0.30
— 0.20

U1

Hotwell Cation Conductivity

— 0.65

U1

Main Steam Cation Conductivity

— 0.65

— 0.30
— 0.20

U1

Economizer Inlet pH

9.05

8.75

Economizer Inlet Cation Conductivity

0.2

0.1

0

Hotwell cation Conductivity

0.2

0.1

0

Main Steam Cation Conductivity

0.2

0.1

0

- *Excel VBA refreshes PI Points, compiles error messages, and creates e-mail in Lotus Notes.*
- *Saves 10-15 minutes every morning*
- *Enables simultaneous snapshot*
- *Automation eliminates typos and provides consistent phrasing*
- *Can run on a timer*

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PI-DataLink for Quarterly Benchmarking

- Engineering tracks quarterly water chemistry parameters to measure continuous improvement
- Report originally compiled through manual process of collecting data from plant personnel
- Process was revised in mid-2008 to use PI data extensively
- Use PI data to track key conductivity values and when cycle chemistry analyzers are out of service

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- Tracks conductivity values while unit is online

- When values increase into specified levels the amount of time is recorded and converted to a score

The limits for each analyzer and level are shown below:

Analyzer	Level 1 Hours	Level 2 Hours	Level 3 Hours
Boiler Specific Conductivity (umho)	30.0 - 35.0	> 35.0 - 40.0	> 40.0
Hotwell Cation Conductivity (umho)	0.30 - 0.35	>0.35 - 0.40	> 0.40
Saturated Steam Cation Conductivity (umho)	0.25 - 0.30	>0.30 - 0.35	> 0.35

The scored hours that the analyzers are in each level are shown below

Analyzer	Level 1 Hours	Level 2 Hours	Level 3 Hours	Points
Boiler Specific Conductivity (umho)	0	0	0	0
Hotwell Cation Conductivity (umho)	12	7	4	38
Saturated Steam Cation Conductivity (umho)	46	2	4	62

PI-DataLink for Tracking Analyzer Status

- PI data is used to determine if any analyzers were out of service while unit was online
- Amount of time analyzer is out of service is recorded and converted to a score

Sample	Analyzer	Out of Service Hours	Total Unit In Service Hours	% Out of Service	Score
Econ Inlet	pH	0	1808	0	0
	Specific Conductivity	0	1808	0	0
	Cation Conductivity	0	1808	0	0
	Dissolved Oxygen	0	1808	0	0
Deaerator Inlet	Dissolved Oxygen	0	1808	0	0
Cleanup Effluent	Cation Conductivity	0	1808	0	0
	Sodium	1800	1808	100	3
	Silica	120	1808	7	1
HP Heater Drain	Dissolved Oxygen	0	1808	0	0
Hotwell	Cation Conductivity	0	1808	0	0
	Specific Conductivity	0	1808	0	0
	Sodium	0	1808	0	0
Main Steam	Cation Conductivity	4	1808	0	0
	Specific Conductivity	0	1808	0	0

Total Score: 4

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- If key chemistry parameters step outside a certain range, immediately send text messages to engineer and plant process supervisor

- Key parameters include pH level and conductivity measurements

- Enables faster response to critical conditions

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Clear Benefits of Using PI System

- Data collection has become faster and more consistent
  - One day per plant x 20 plants → One day for all
  - Consistent process across fleet
- Problems are identified instantly… rather than a day or two after the fact
  - Reduces problem severity
  - Helps avoid some tube leaks
  - Extends boiler tube life
- Enables key indicators to be monitored 24/7
- Helps engineering communicate the importance of water chemistry and highlight areas for improvement

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Moving Forward

- Intent moving forward is to use PI to track more parameters along with conductivity values

- Develop a benchmarking program for our Gas-powered Combined Cycle Units

- Develop further displays that can be used by employees with limited plant/engineering experience

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Thank you

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