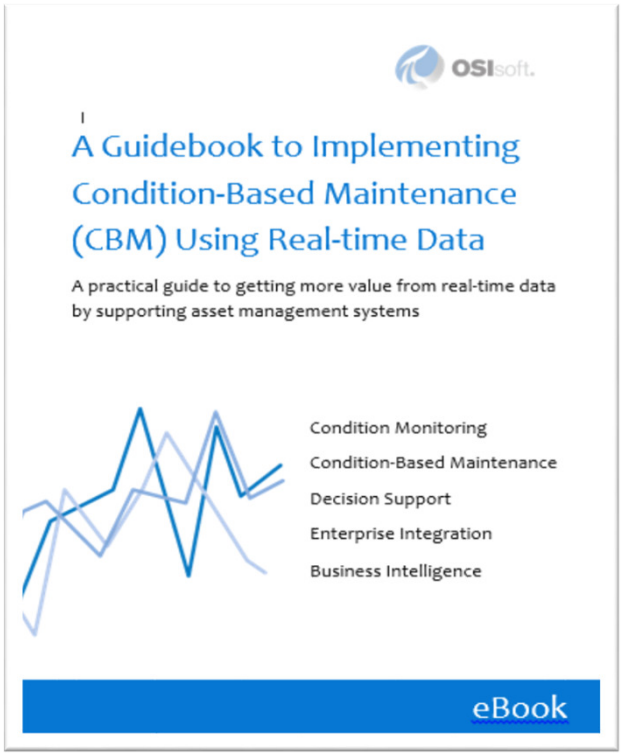
Asset Health in Real-Time

Presented by **Ales Soudek and Lance Fountaine**

CBM Prescriptive Guidance



Terms & Definitions

Implementation Guidance

PI System Overview for CBM

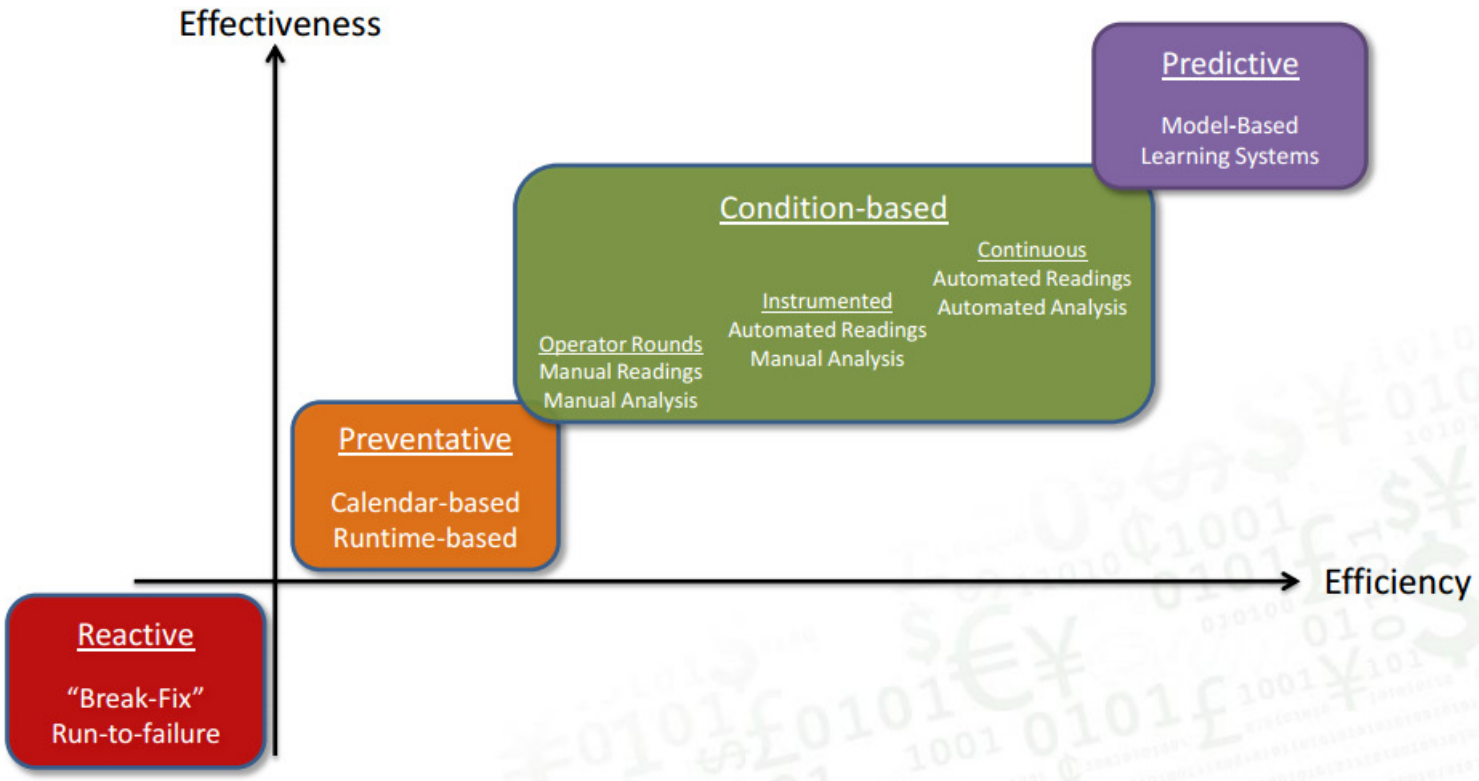
PI System Integration w/ CMMS

Enabling Opportunities

Solution Examples

Industry References

Condition Monitoring is an Effective Maintenance Strategy



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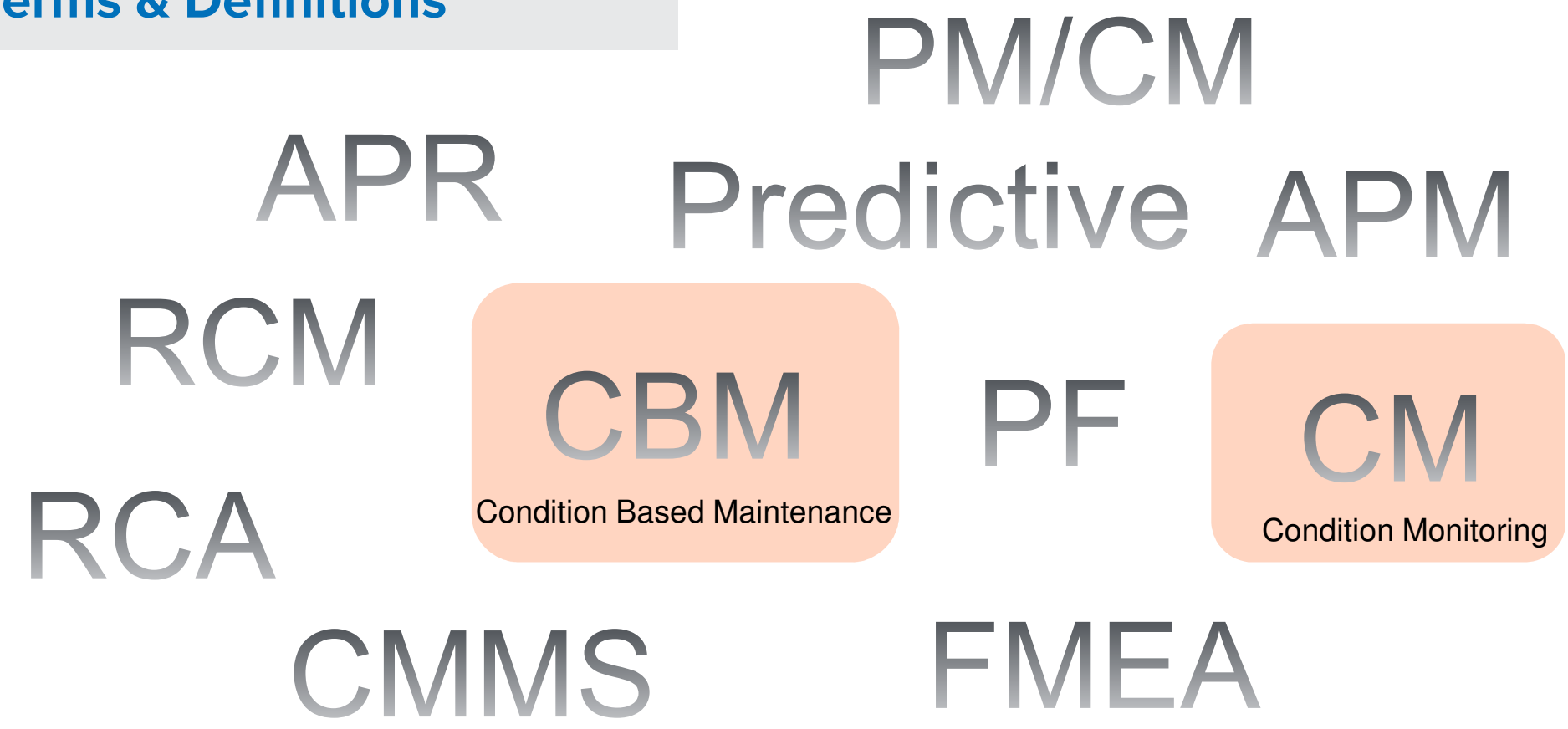
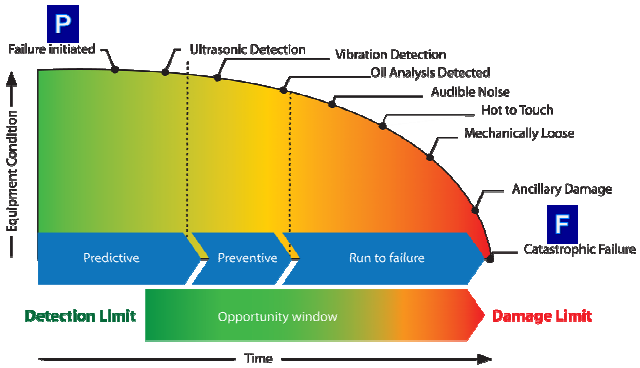


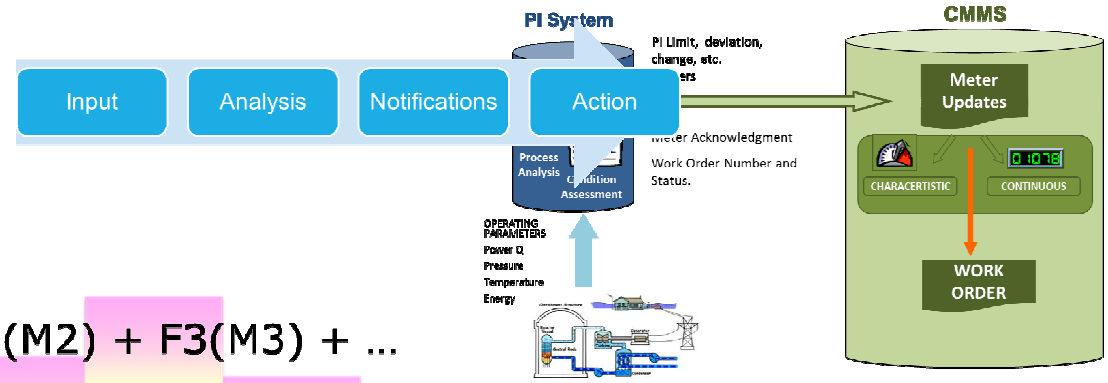
Four Methodologies all possible with the PI System

CBM means different things to different people

- Incipient Failure Detection
- Condition Monitoring
- Condition Assessment
- CBM Preventive Maintenance

How This All Fits Together





$$CA = F1(M1) + F2(M2) + F3(M3) + \ldots$$

Condition Assessment & Criticality Determination

CBM Driving Factors

- Continued expectations of improvements in reliability and availability – despite reductions in staff & expertise
- Lack of comprehensive asset maintenance strategy – most if not all PM work is calendar-based (overly conservative)
- Complexities in data systems implemented as point solutions
- Aging asset profiles – asset life extensions
- Take advantage of existing systems
- RCA usually identifies failure mode – why not alert before the fact?

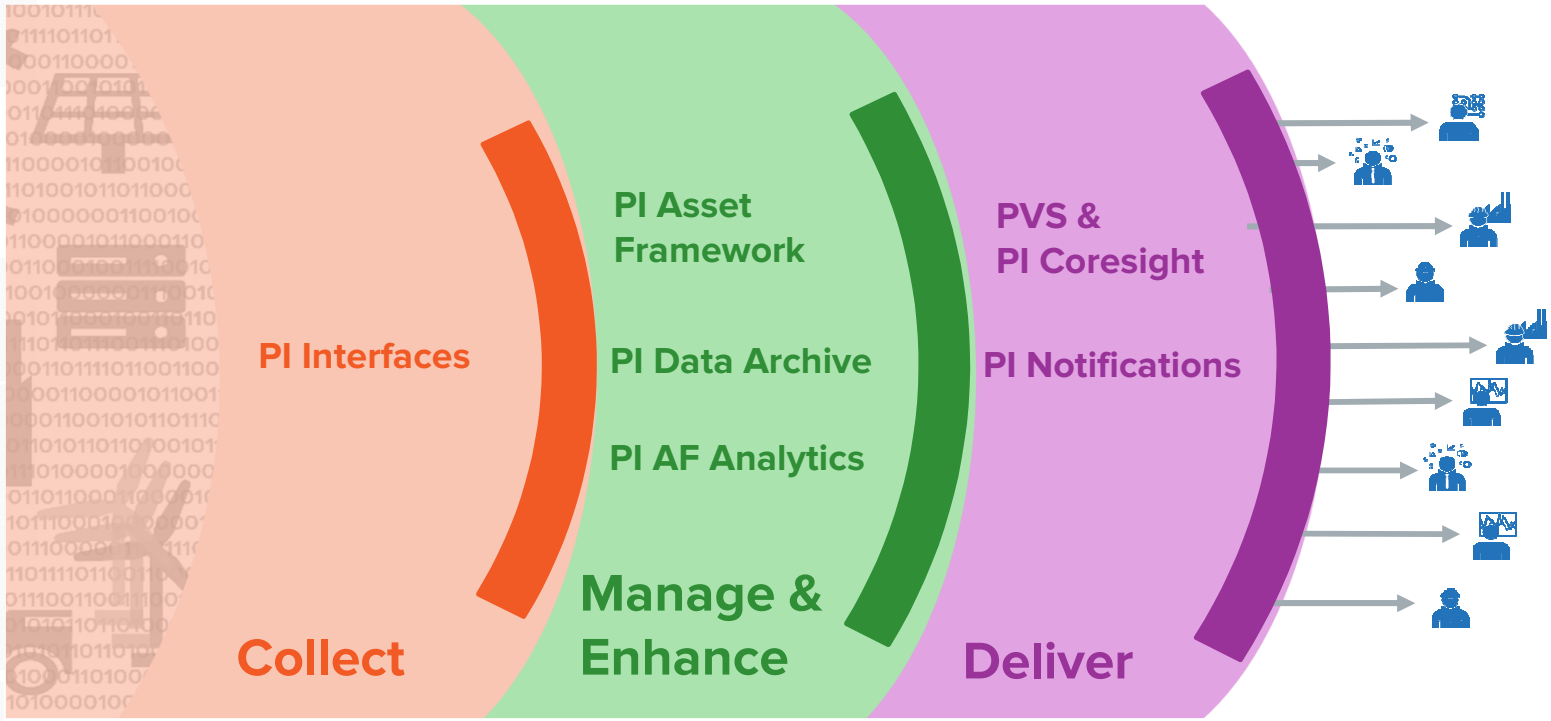
Challenges to Implementation

- Organizational
  - May require significant initial setup and maintenance
  - May have significant organizational impact to move away from calendar-based maintenance
  - There is no one solution for all asset types
- Technical
  - Correlation of data in disparate systems
  - Aligning equipment/asset hierarchies to data points
  - Visualization in a meaningful, accessible fashion

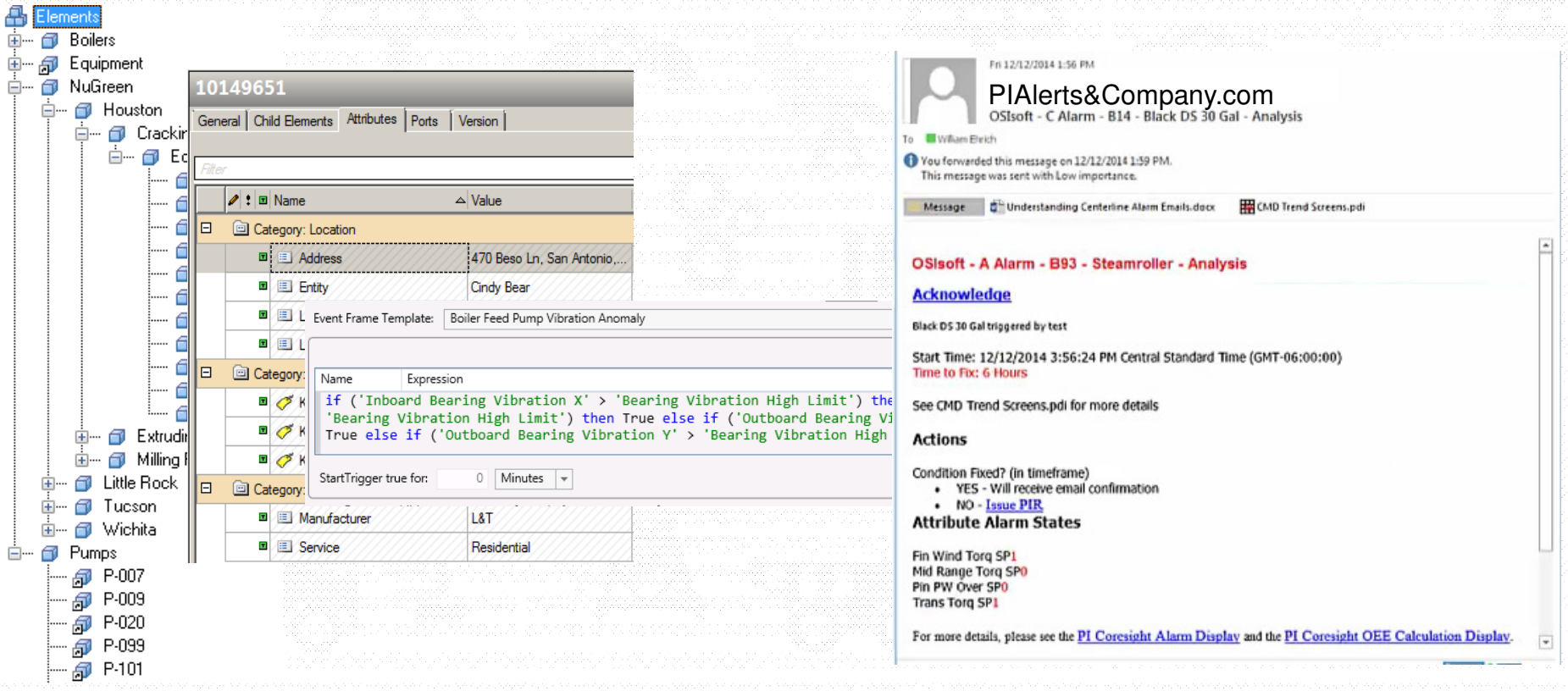
CBM & the PI System

The 6 Steps of CBM *with the* PI System

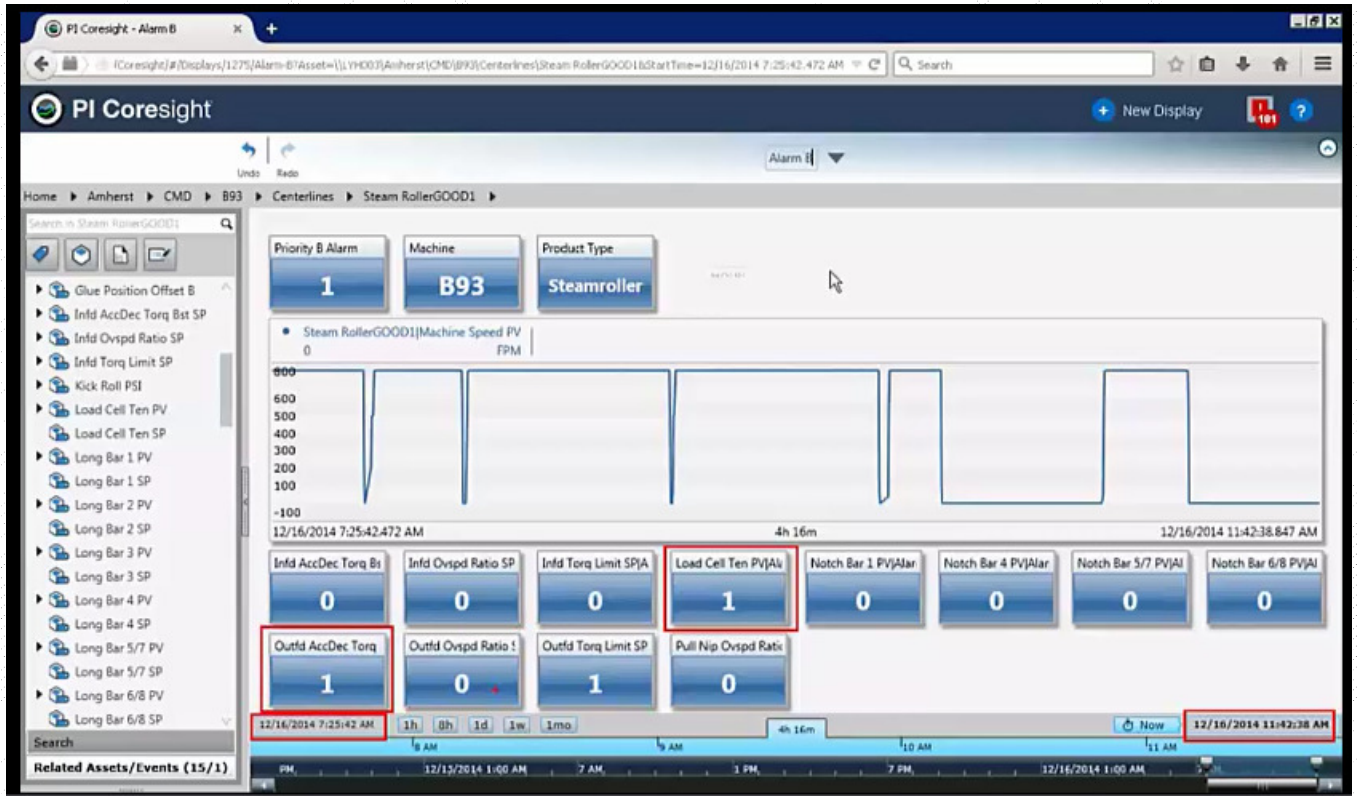
1. Connect to relevant sources
2. Collect and archive data
3. Assign context (asset based)
4. Execute condition monitoring logic
5. Visualize real-time conditions
6. Alert & notify



Monitoring Asset Conditions

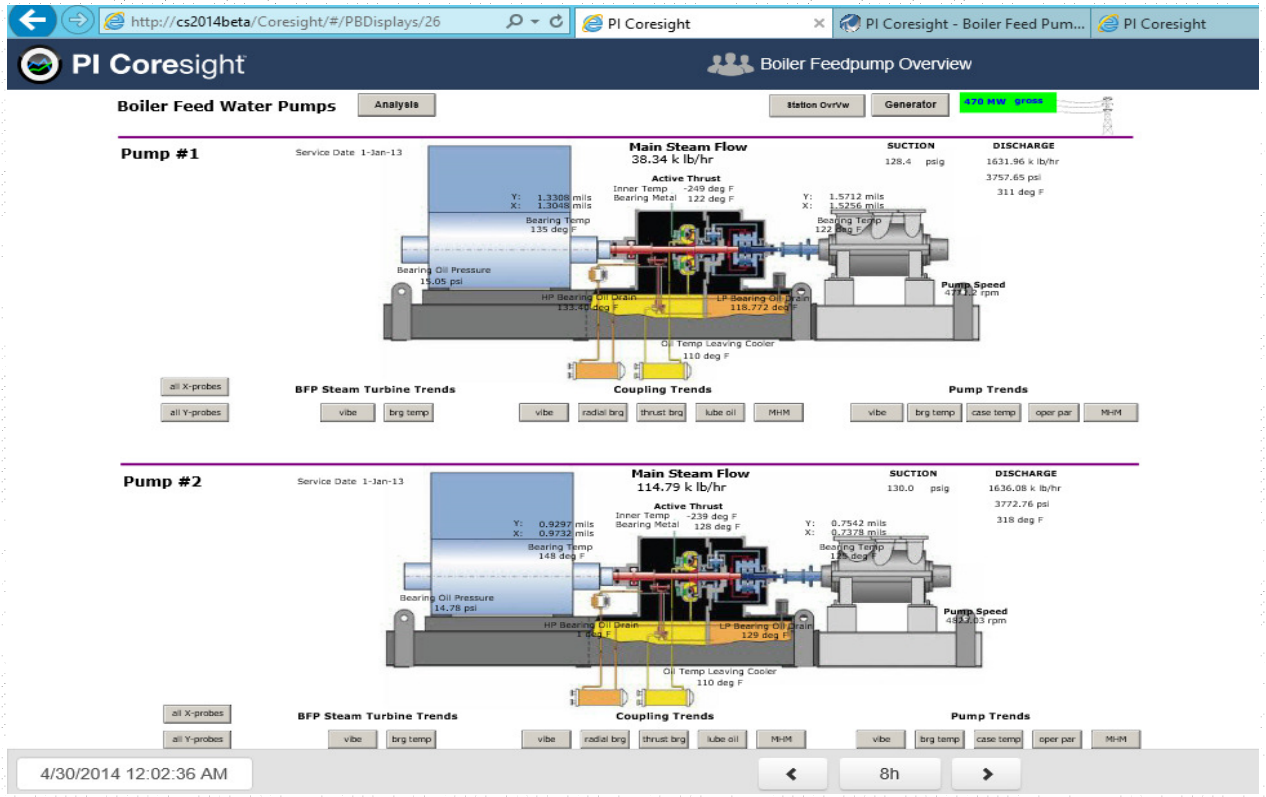


Intuitive Analysis of an Event



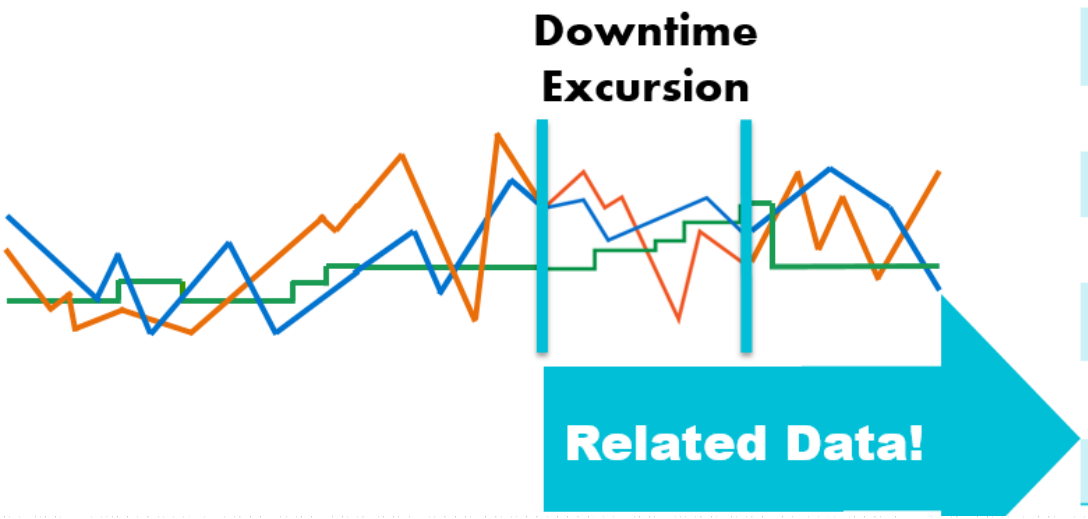
Dashboards & Watchlists

And Drill Into Asset Specific Monitoring Displays



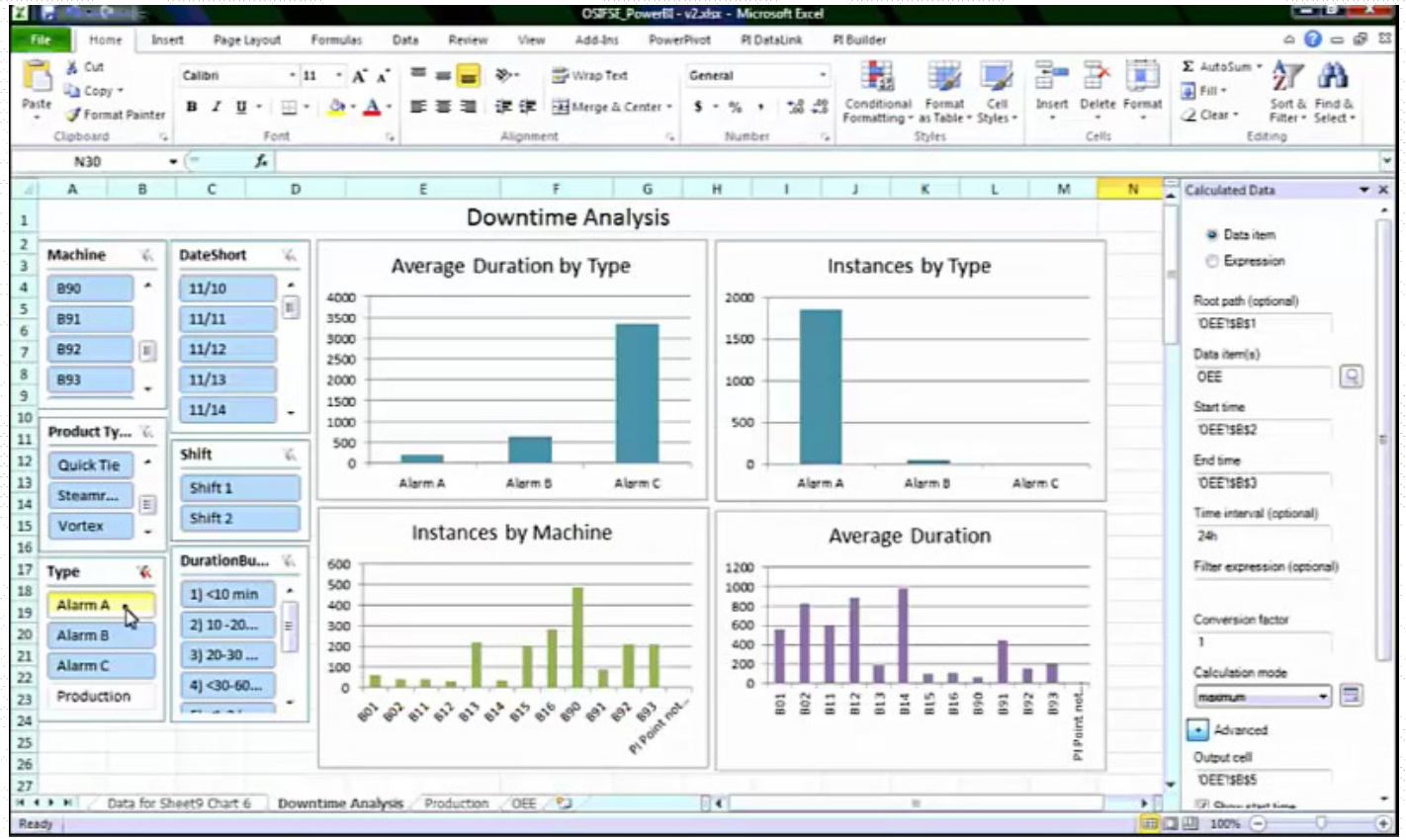
Event Frames

PI Event Frames automatically bookmarks PI time series data so that it's more meaningful to engineers and business users, AND easier for them to find, analyze and report on.



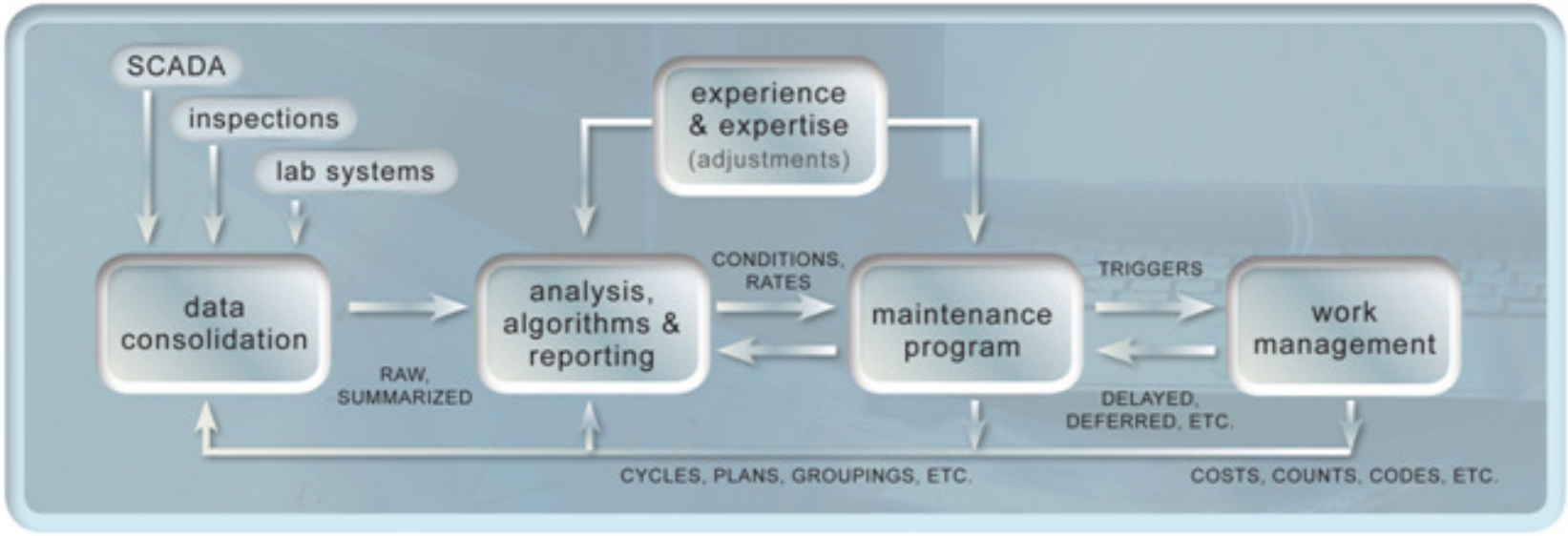
Event Attribute	Value
Name	Ex 20121215-0002
Start	15-Dec-2012 10:35:02
End	15-Dec-2012 10:47:26
Duration	12 min, 24 sec
Asset	Boiler-352
Excursion Type	High Violation
Fuel Gas Flow.Avg	37.12 k sft3/h
Fuel.Start	823.48 k sft3/ton
myPIKPI.Max	47.19 bbl/d

Assess Events over Time



It's a Journey not a Destination

- Get started!
- Continue to improve
- Continue to tie the process together
- Get more from existing data & systems



Enterprise Data Access Solution

Freeport-McMoran

"We have real time monitoring in place to prevent catastrophic failure. For example, If a haul truck engine cylinder kit failure is not addressed, it can cause catastrophic failure of the engine resulting in a $180,000 core value loss."

Robert Catron, Program Manager/Business Solutions Architect

CHALLENGES	SOLUTION	RESULTS
Constant pressure to decrease maintenance costs Increase their equipment health 15+ data historians across the globe, managed independently	Asset-based analytics for looking at the operational data and notice of problems in real-time Publishing displays on the web and mobile devices for more timely and easier response	Data-based platform for improving asset management Real-time analytic capabilities via the web and mobile devices

How Did Freeport-McMoRan Deliver a Solution?

- Solution: Using Business Objects, connected to our machine data, we created a daily report that prioritizes trucks by their cylinder health.

FREEPORT-McMoRAN COPPER & GOLD

Sierrita Engine Oil Filter Differential Pressure

12/7/2013 12:00:00 PM - 12/8/2013 12:00:00 PM

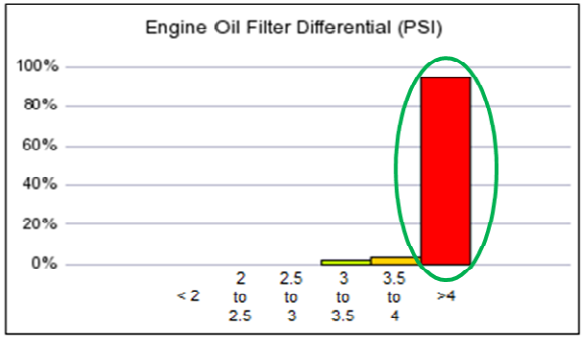
12/9/13 8:55 AM

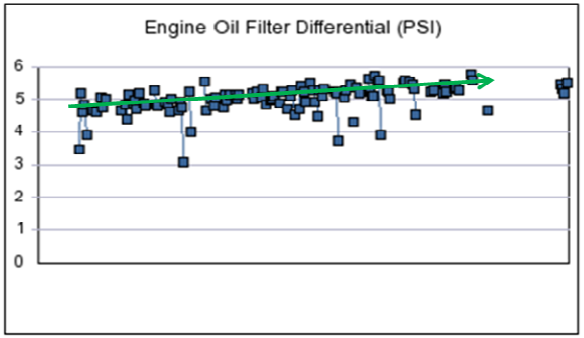
057353

Truck	Fleet	Max Eng Oil Filter Differential Pressure	Avg Eng Oil Filter Differential Pressure	Average Engine Oil Pressure	Sample Count
T062	CAT 793D	5.76	5.01	64.21	114
T063	CAT 793D	5.44	2.69	60.49	7
T036	CAT 793B	4.81	3.81	70.14	85
T034	CAT 793B	4.49	3.6	65.11	90
T073	CAT 793D	3.92	3.4		

This is a summary of all Haul Trucks sorted by Engine Oil Pressure descending, allowing us to quickly identify equipment with a possible cylinder problem.

T062 **CAT 793D**





Sample Count: 114

Supporting the summary with detail, I can see the sample distribution and trend…validating the issue and indicating action should be taken

Based on the above maintenance would be scheduled and the Cylinder Kit replaced.

Mobile Equipment Event Synthesis

Syncrude

"Mining equipment uptime is a key factor in operating efficiency. Optimized preventive maintenance programs and just-in-time intervention are key to minimizing major component failures requiring days or weeks to repair."

Kyle Gogolinski, Sr. Technical Lead

Type	Name	Calculation Complexity
General Monitoring	Out of Wireless Range	Minor
	Acquisition Offline	Minor
Power Train Management	Torque Convertor Overheat	Minor
Lubrication Management	Auto-lubrication Frequency	Minor
Engine Management	Throttle Position Condition	Minor
	Turbo Failure	Minor
	Injector Failure	Minor
	Engine Oil Dilution	Minor
	Coolant Temp Delta	Minor
Steering/Braking Management	Service Brake Applied at Speed	Minor
	Brake Overheat	Minor
	Steering Pumps Cycle	Major
	Braking Pumps Cycle	Major
Frame Management	Improper Strut Charge	Minor
	Strut Deflation	Minor
	Airborne	Minor
	Side Load	Minor
	Front Load	Minor
	Structural Force	Major
	Abusive Dumping	Minor
	Abusive Loading	Minor

CHALLENGES

Transform reactive, time intensive forensic data reviews into automated, near real-time event synthesis and creation

Enable the next level of mining equipment efficiency in a harsh operating environment.

SOLUTION

Implement an operational data-based solution using PI to improve maintenance for the fleet of heavy haulers

OSIsoft workshop to kick-start pilot project

RESULTS

Highly scalable solution with fully validated events generated in a fraction of the time

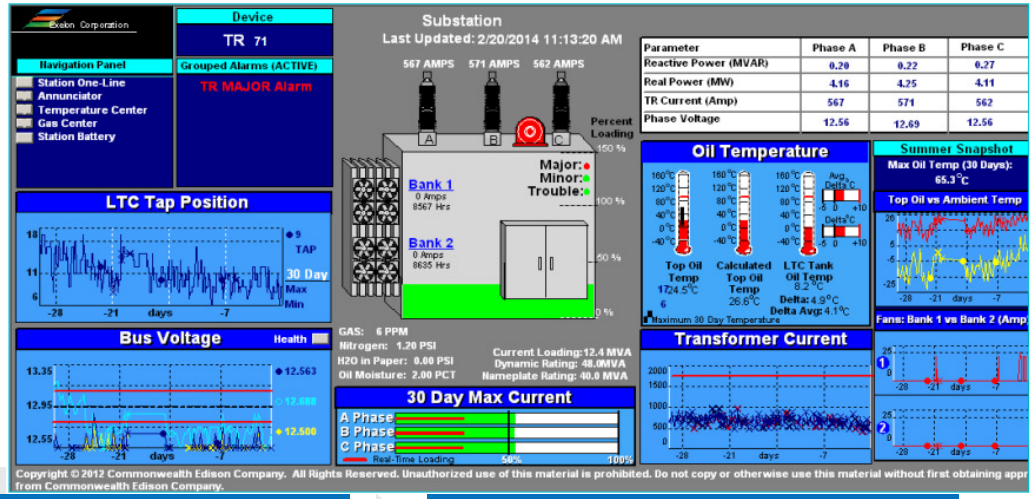
Step-change in equipment maintenance efficiency – near real-time notification

Asset Monitoring

ComEd

"Now with the surfacing of Analytics and Data Visualization, it has become easier to monitor health of the assets, diagnose and predict problems, and assist the company with prioritizing and planning the maintenance needs."

John Juna, Principal Engineer, Real-time Analysis

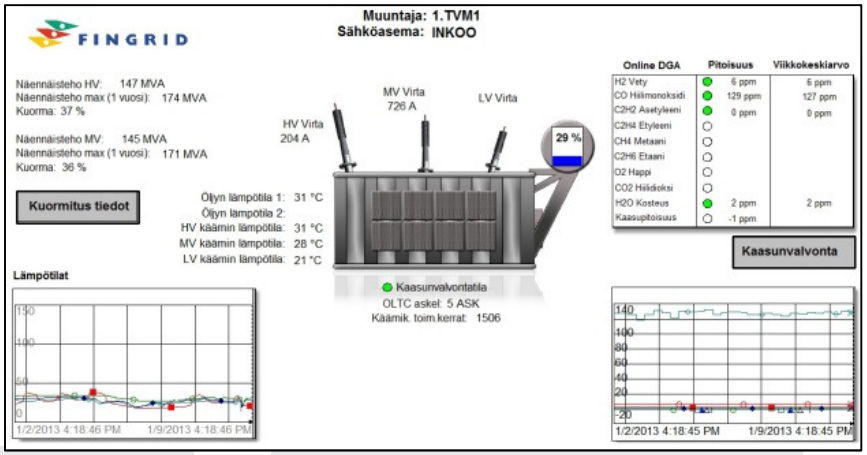


CHALLENGES	SOLUTION	RESULTS
Challenge to deal with hundreds of assets for which information needs to be organized.	Detailed asset models for Substations to improve Data Visualization.	Immediately spot problem areas.
Typical SCADA displays have been built by operators, not necessarily for planning engineers.	Customize color-coded dashboards. Click hot symbols to quickly navigate to specific information.	Engineers are certain that vital equipment is being monitored around the clock.
Need to visualize overall health but also drill to details.	Track run-time hours of equipment (e.g. fan banks).	Implements standardization across Substations within ComEd.
		Smarter expenditures with condition-based maintenance.

Asset Monitoring

Fingrid

Juha Mertanen, Adviser, Grid Management



CHALLENGES

Use real time data outside the restricted and protected SCADA environment.

Get early warnings before they become a problem for operators.

Combine real time data and meta data to get the full picture.

SOLUTION

Create template based asset hierarchy in PI AF to be the source / single point of contact for getting data from the PI System.

Set up template based PI Notifications for all equipment.

Visualize in PI ProcessBook displays.

RESULTS

Value and support for the asset management personnel with fast data visualization, comparison possibilities and status information.

Detected two transformer faults and several SF6 leaks.

Optimize timing of maintenance and replacement investments.

Condition-Based Maintenance

PowerStream

"There is a constant pressure to do more with less; improve reliability and availability. In order to achieve this, the same information needs to be made available in multiple systems."

John McClean, Powerstream Inc

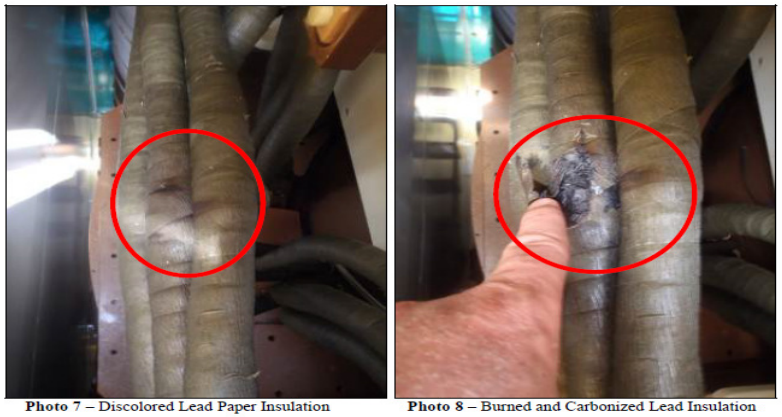


Photo 7 – Discolored Lead Paper Insulation

Photo 8 – Burned and Carbonized Lead Insulation

CHALLENGES

Provide and utilize Operational data outside of SCADA

SOLUTION

SCADA to PI connectivity.

Integrated PI System to CMMS.

Monitor system demand, station performance, as well as data from transformers (condition, DGA, oil temperature, tap changer, etc) and circuit breakers (status and SF6 status)

RESULTS

Real-time information to those who need it.

Innovation stimulant.

Increased equipment monitoring and alerting.

Prevented a $2 million failure with a $100K repair by catching abnormal gassing events.

Improving Pot Health Analysis

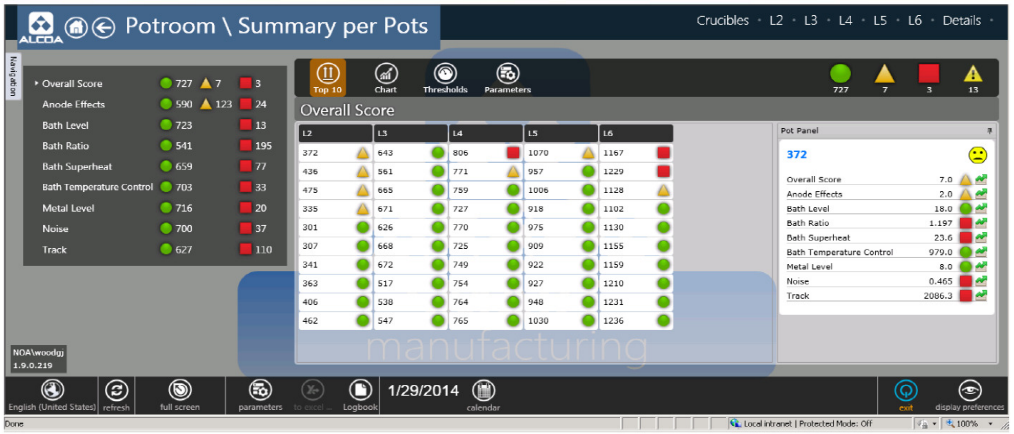
Alcoa

"We've standardized the data and turned a massive amount of it into exactly the information that our operators want to see, sometimes summarizing it down to one or two numbers for very quick decision-making."

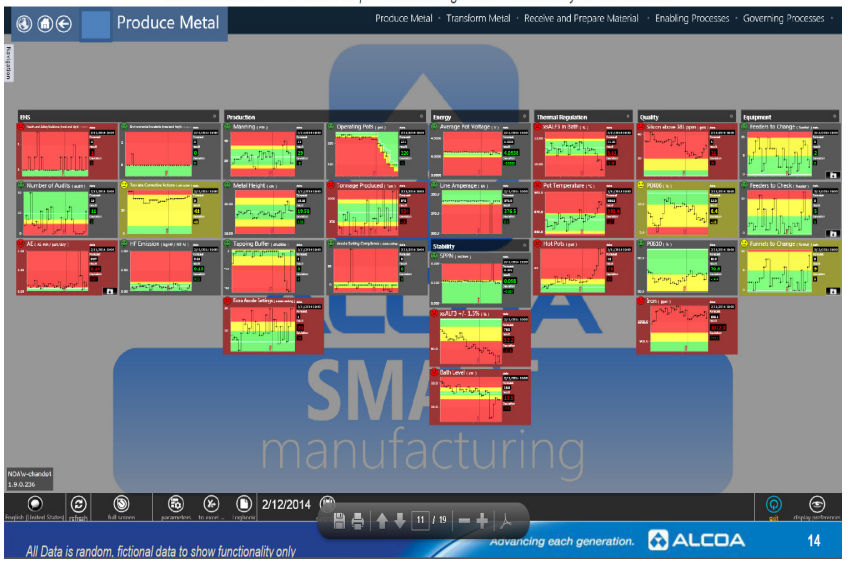
Geff Wood, Director, Manufacturing Systems and Process Control, Alcoa

CHALLENGES	SOLUTION	RESULTS
Silos of data/information	Implemented a single data infrastructure based on PI for use in the Smelter	Improve OEE
Lack of time to do analysis		Improve control of the process
Large number of pots (more than 300). The real challenge is to minimize pot to pot variability	Developed standards for data and usage.	All plants using same data model as base
	Implemented tools for analysis and improvement	

Examples of How Alcoa is Managing to Improve Pot Health



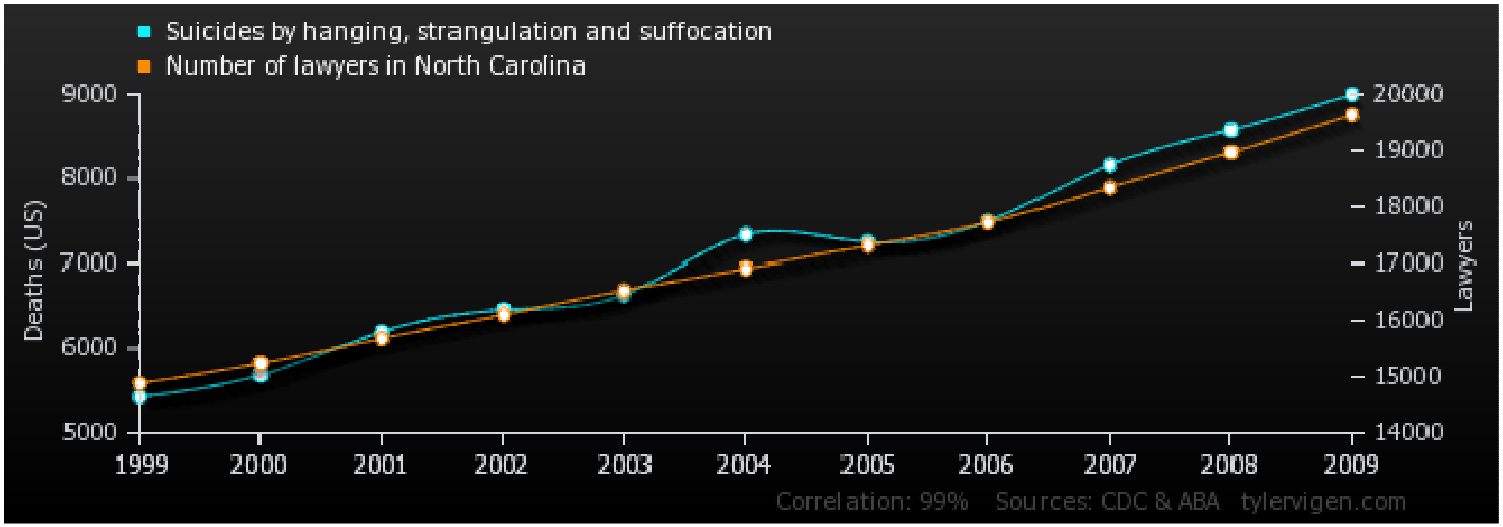
Drill Downs same format for all plants enforcing Alcoa Business Systems standards



How OSIsoft Can Help

- Prescriptive Guidance
- EA Services
- Workshops
- Customer Presentations
- PI Square
- Partners (products, services, partnerships)

Big Data – Parting Thoughts



Correlation: 0.993796

Correlation Doesn't Mean Causation

Contact Information

Lance Fountaine
email@company.com
Industry Principal
OSIsoft

Ales Soudek
asoudek@osisoft.com
Global Solutions Group
OSIsoft

Questions

Please wait for the **microphone** before asking your questions

State your **name & company**

Please don't forget to…

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The Power of Data
DECISION READY IN REAL-TIME

Evaluation Form (Seminar Location - Date)

Name:_____ **Company:** _____

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Quality and content of the presentations	Poor	Good	Excellent	N/A
Welcome	○	○	○	○
The Journey To Real-Time Operational Intelligence	○	○	○	○
The Power of Connection	○	○	○	○
Tank Level Management System	○	○	○	○
Using the PI System to Aid in Troubleshooting Operational Aspects of Oil and Gas Well Drilling and Completion	○	○	○	○
Unleash your Infrastructure	○	○	○	○
Information on the Spot	○	○	○	○
Wrap-up/Seminar Conclusion	○	○	○	○
Quality and organization of the seminar				
Choice of date	○	○	○	○
Time allowed for lunch/breaks	○	○	○	○
Choice of presentations	○	○	○	○
Pace and time allowed for the presentations	○	○	○	○

감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado