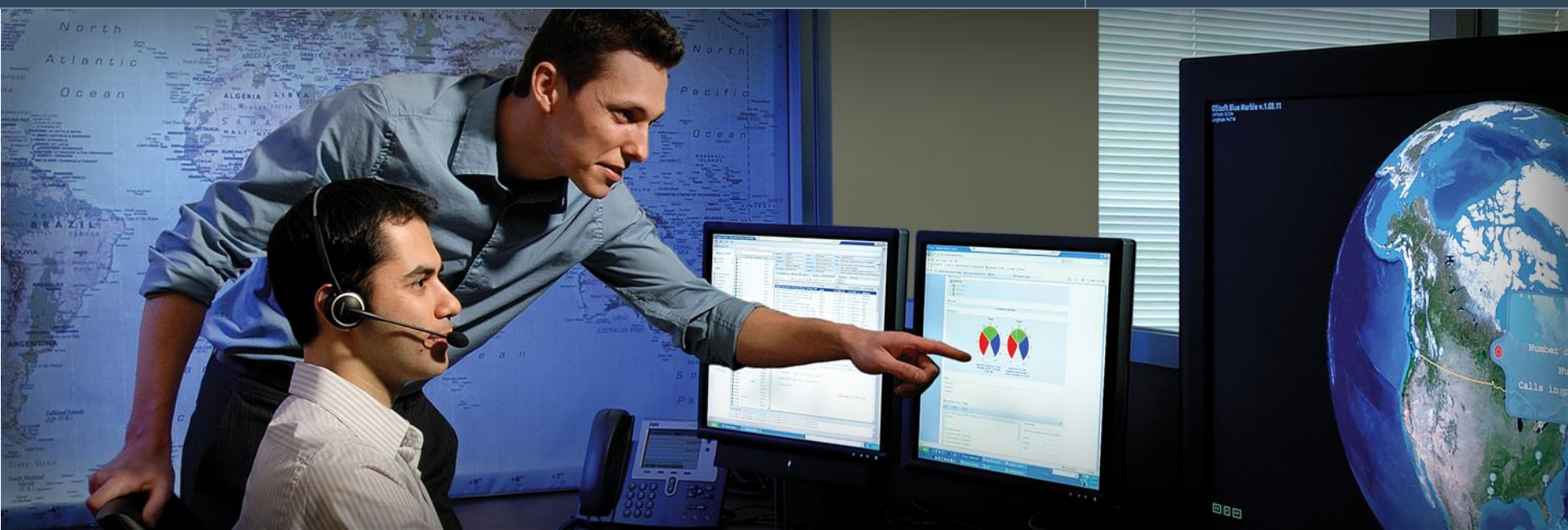




## Regional Seminar Series Chevy Chase, MD



### PI System's Role in Maintenance - Longview Power Use Case with IBM Maximo

Scott Larson, Longview Power

Gopal GopalKrishnan, P.E., OSIsoft, LLC

November 11, 2010

Empowering Business in Real Time.

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- PI System's role in asset maintenance
- About GenPower (Longview site)
- Use cases for PI System to Maintenance integration
  - Usage-based strategies
  - Condition-based strategies
  - Visual integration (operations and maintenance data in context)
- Q & A

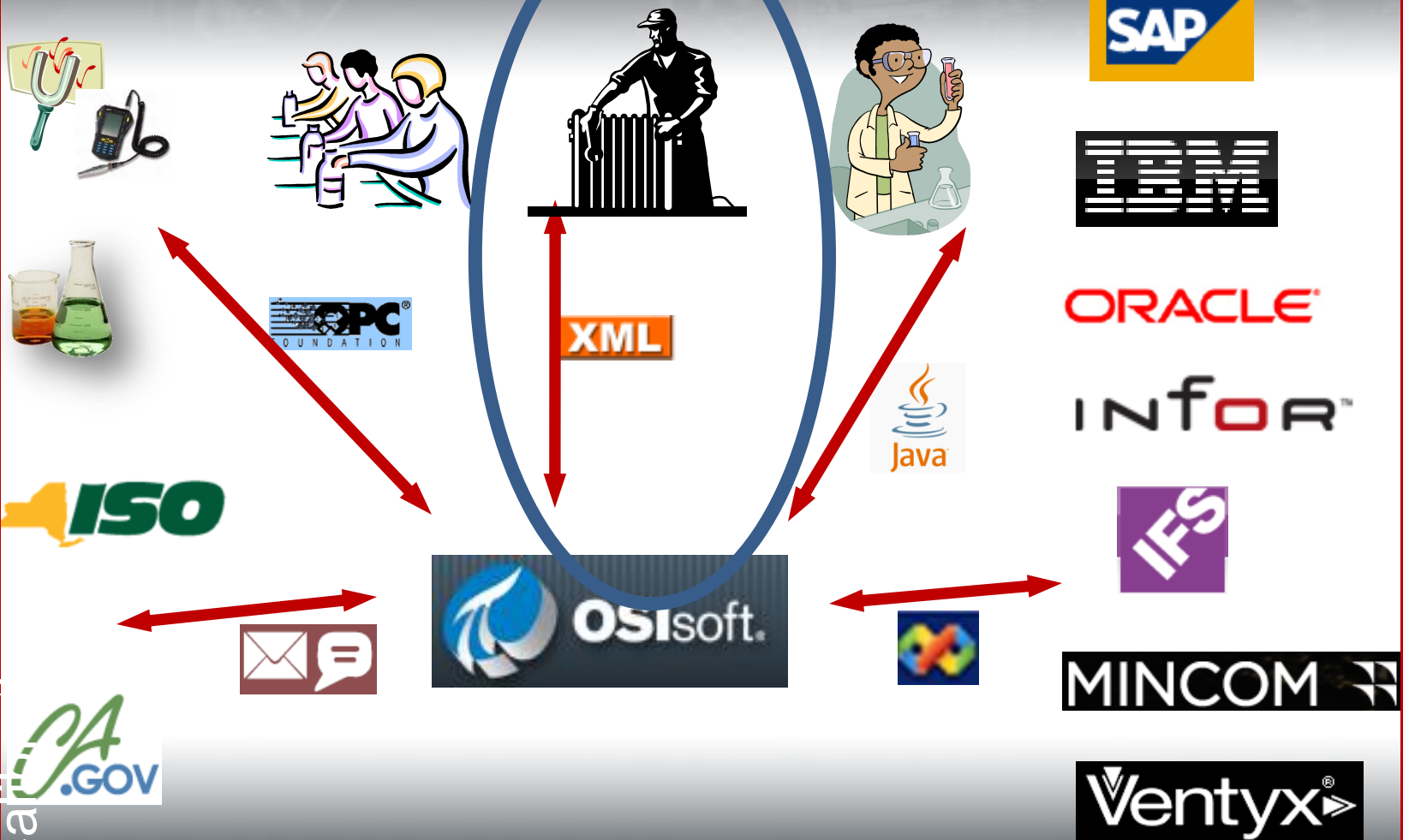


# Enterprise and Business Integration

Production Maintenance Quality

Compliance Reporting Lab

Cal  
CA  
.GOV



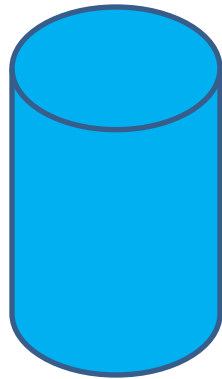
ERP and Asset Management

# Equipment Operations & Maintenance



## Operations

Data + Events  
History

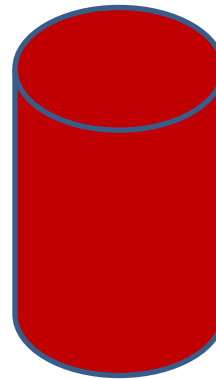


PI System

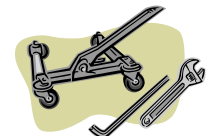
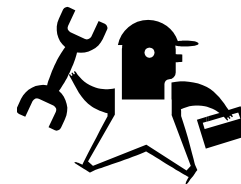


## Maintenance

Data + Events  
History



Maximo



# Operations data (PI System)'s role in Maintenance business process



- Evaluate maintenance strategies using actual operations data
  - and quantify savings
  - before deployment
    - Migrate from calendar to usage based maintenance ←
    - Migrate from reactive to condition-based and predictive strategies ←
- Operations data as a proxy for condition-monitoring and for maintenance alerts
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  - PI System Table PI WebParts to display Maximo data in context





# GenPower - Longview



- 695 MW, supercritical pulverized coal (SCPC technology)
- Siemens Benson turbine, heat rate 8728 Btu/Kwh
- Commissioning and start-up around Summer 2011
- Coal available directly from the mine (mine-mouth operation)
- PJM inter-connection

<http://www.genpower.net/longview/>



# Operations data (PI)'s role in Maintenance business process



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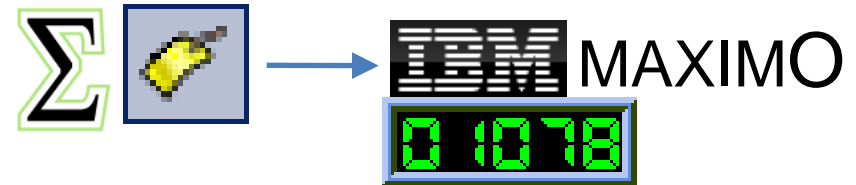


# Usage-based maintenance

- Maintenance task
  - Usage based instead of calendar



- Implementation
  - Machine run-hours using PI System Totalizer Tag
  - Totalizer Tag value sent to Maximo CONTINUOUS Meter





# Can PI System generate this XML?



```
C:\Users\gopa\Documents\Customer\GenPower\OSITAG_LVP.xml - Windows Internet Explorer
C:\Users\gopa\Documents\Customer\Ge
Google
File Edit View Favorites Tools Help
Favorites Suggested Sites Web Slice Gallery
C:\Users\gopa\Documents\Customer\GenPo...
<?xml version="1.0" encoding="UTF-8" ?>
- <SyncLVP_OSITAG xmlns="http://www.ibm.com/maximo"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" creationDateTime="2010-
  08-26T13:24:05-04:00" transLanguage="EN" baseLanguage="EN"
  messageID="12390400479682333" maximoVersion="7 1 20091208-1415 V7116-173"
  event="0">
- <LVP_OSITAGSet>
- <LVP_OSITAG action="AddChange">
  <CURVALUE>09900</CURVALUE>
  <DCSNAME>NONE</DCSNAME>
  <DESCRIPTION>Test Tag 5</DESCRIPTION>
  <LASTTIMESTAMP>Aug 26 2010 2:15PM</LASTTIMESTAMP>
  <LVP_OSITAGID>5</LVP_OSITAGID>
  <NOLASTREADING>0</NOLASTREADING>
  <ORGID>GENPOWER</ORGID>
  <QUALITY>GOOD</QUALITY>
  <SITEID>LONGVIEW</SITEID>
  <TAG>TestTag5</TAG>
</LVP_OSITAG>
</LVP_OSITAGSet>
</SyncLVP_OSITAG>
```

<CURVALUE>9900</...>

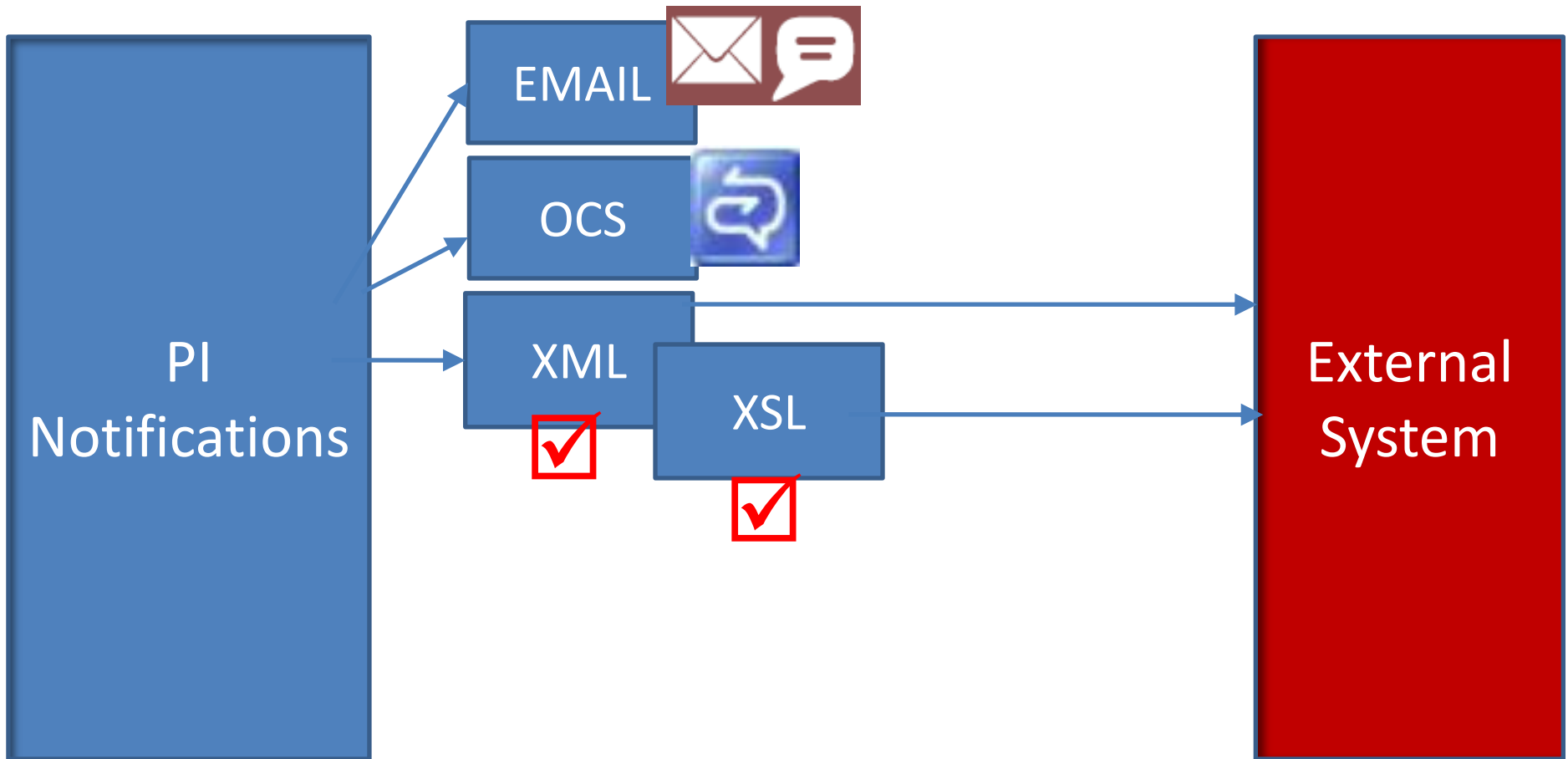
<LASTTIMESTAMP>2010-08-26T13:10:00Z

<QUALITY>GOOD</...>

<TAG>TestTag5</...>

Maximo consultant - Can PI System generate this XML?

# XML Data Flow



XML Delivery Channel (PI Notif. toolkit – vCampus)

PI Notifications

→ XML



→ jms queue - IBM Websphere

→ Maximo



# XML File from PI Notifications

```
- <Notification>
  <item name="NotificationName" type="Standard">Meter Test 1</item>
  <item name="NotificationDescription" type="Standard">Maximo Meter Test Notification</item>
  <item name="NotificationState" type="Standard">OutsideControl</item>
  <item name="StartTime" type="Standard">9/10/2010 11:52:46 AM</item>
  <item name="EndTime" type="Standard">1/1/1970 12:00:00 AM</item>
  <item name="TriggerTime" type="Standard">2010-09-10T15:55:24Z</item>
  <item name="Priority" type="Standard">Normal</item>
  <item name="Target" type="Standard">\\SRV-GP-LVPI01\Configuration\Maximo Meter</item>
  <item name="State" type="Standard">OutsideControl</item>
  <item name="NotificationInstanceID" type="Standard">4</item>
  <item name="NotificationUniqueID" type="Standard">9bb3ea4d-757f-421f-9b31-b32e93082cfd</item>
  <item name="\\SRV-GP-LVPI01\Configuration\Maximo Meter|TestMeter" type="TriggerInput">29</item>
  <item name="\\SRV-GP-LVPI01\Configuration\Maximo Meter|Location" type="AFAttribute">10ANA</item>
  <item name="\\SRV-GP-LVPI01\Configuration\Maximo Meter|Meter" type="AFAttribute">METER1</item>
  <item name="\\SRV-GP-LVPI01\Configuration\Maximo Meter|SiteID" type="AFAttribute">LONGVIEW</item>
</Notification>
```

XML Delivery Channel (PI Notif. toolkit – vCampus)

Hyperlink launches the demo only during a live session

[Demo](#)

# Operations data (PI System)'s role in Maintenance business process



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# Validating usage based maintenance- Pulverizer

Maintenance: 160 PM hours per pulverizer per year; 16 pulverizers per site, 6 sites

Actual run hours: 80% based on PI System data, implies a 20% savings

Projected savings: 480+ PM hours (approx. \$25,000 at \$50/hr) per year per site

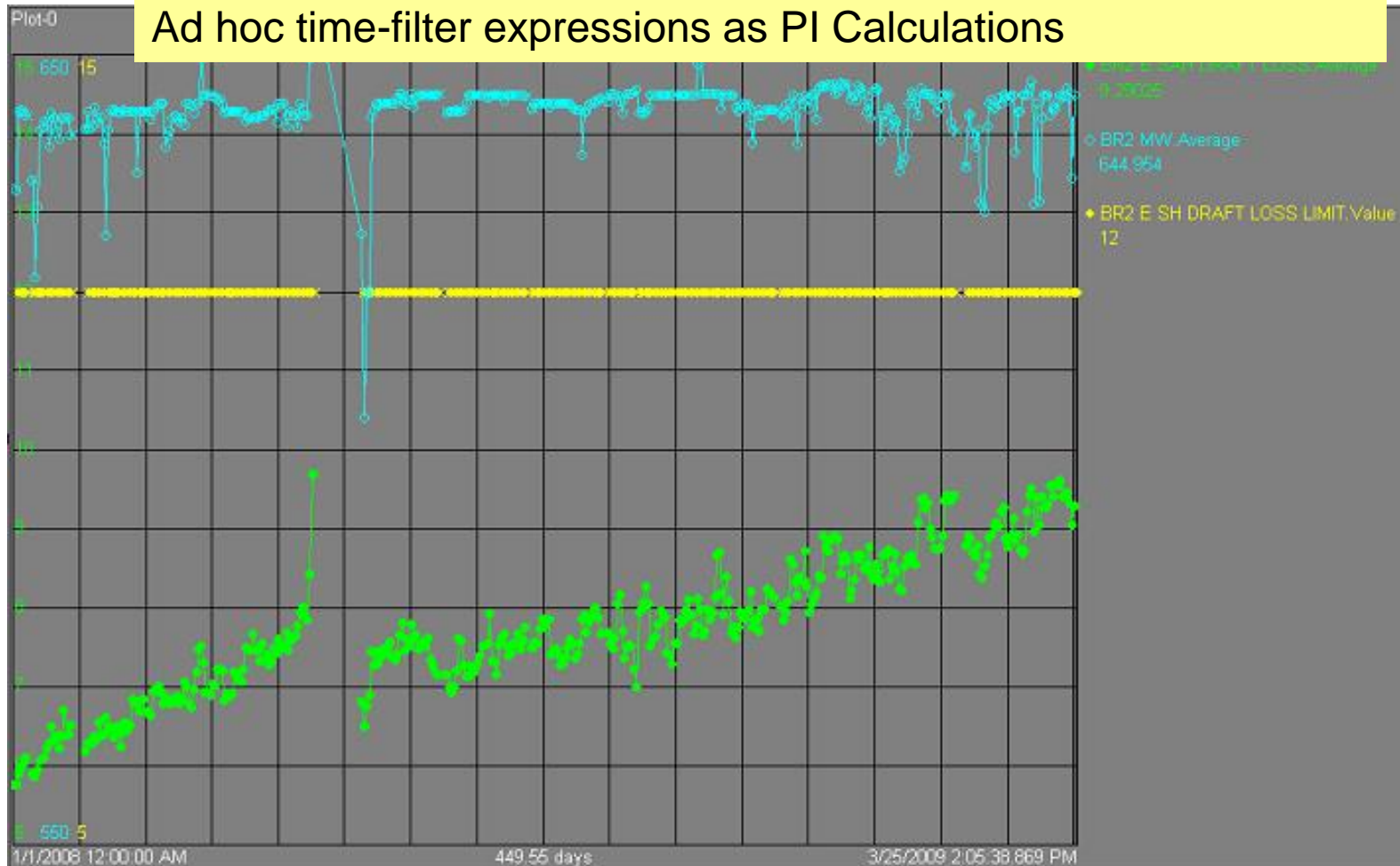
PI TAG		DELIMITER FOR RUNNING OR NOT		Frequency	DATE	DATE	VARIABLE	PM GENERATED	variable by					
2M1009:AMP	02M1009	'2M1009:AMP'>10	>10				299.35	USE EXCEL AND MANUAL COUNT TO FIND OUT WHEN A PULVERIZER IS ABOUT TO HAVE RUN 4000 HOURS	82.0%					
2M1010:AMP	02M1010	'2M1010:AMP'>10	>10				273.68	USE EXCEL AND MANUAL COUNT TO FIND OUT WHEN A PULVERIZER IS ABOUT TO HAVE RUN 4000 HOURS	75.0%					
2M1011:AMP	02M1011	'2M1011:AMP'>10	>10				189.36	USE EXCEL AND MANUAL COUNT TO FIND OUT WHEN A PULVERIZER IS ABOUT TO HAVE RUN 4000 HOURS	51.9%					
2M1012:AMP	02M1012	'2M1012:A	PMNUM	pm desc			FR	FREQUENT	CRAF	LAB	CREWID	JPNUM	jp descri	
			10001951	YELLOW MILL COAL PULVERIZER LUBE OIL PUMP(01P100			2 MONTHS		OPER		1 OPS1	20003380	MILL CO	
			10002250	YELLOW COAL MILL DAMPER OIL CHANGES. OUTAGE OF			1 YEARS		OPER		6 OPS5	20058889	COAL M	
			10002544	YELLOW COAL PULVERIZER, CLEAN AFTER 6000 HR. INS			6 MONTHS		OPER		2 OPS6	20003425	COAL P	
2M1013:AMP	02M1013	'2M1013:A	10002680	CALIBRATE MOTOR CURRENT INDICATION (PERIODIC) 4			4 YEARS		ENG		2 PERT	20038712	CALIBR	
			10002812	YELLOW COAL MILL DRIVE GEAR GREASING SEMI-ANNU			6 MONTHS		OPER		0.5 OPS5	20058888	COAL M	
			10004420	YELLOW COAL MILL 6000 HR LUBRICATION, OUTAGE OPI			3 MONTHS		OPER		4 OPS5	20058891	COAL M	
			10005953	YELLOW COAL MILL DAMPER LUBE CHECKS, QUARTERL			3 MONTHS		OPER		2 OPS5	20058887	COAL M	
2M1014:AMP	02M1014	'2M1014:A	20014282	OBTAIN OIL SAMPLES FROM ALL WEST SIDE COAL MILLS			0 MONTHS		OPER		1 OPS1	21042975	COAL M	
			20014293	ROD OUT WITH BRUSH AND BLOW BACK PITOT TUBES I			0 DAYS		TECHI		2 INST	20002673	ROD OL	
			20014295	COAL MILL DAMPER LUBE CHECKS			3 MONTHS		OPER		2 OPS1	20058887	COAL M	
			20014296	COAL MILL, 6000 HR LUBRICATION			2 YEARS		OPER		4 OPS5	20058896	GRAY C	
1M1007_AMP	01M1007	'1M1007_A	20014297	OBTAIN 1 120CC OIL SAMPLE FROM SAMPLE TAPS AT OIL			0 MONTHS		OPER		1 OPS1	21000063	TAKE OI	
			20014298	OBTAIN 1 120CC OIL SAMPLE FROM THRUST BEARING O			0 MONTHS		OPER		1 OPS1	21000063	TAKE OI	
			20012436	Perform full spectrum vibration monitoring. Establish baseline			1 MONTHS		ENG		1 MPDM	21000061	VIBRATI	
			20012437	Perform thermographic inspection.			3 MONTHS		ENG		1 MPDM	21000066	THERMC	
1M1008_AMP	01M1008	'1M1008_A	20012438	OPERATIONS - COAL MILL, 6000 HR LUBRICATION, OUTA			8 MONTHS		OPER		1 OPS1	21007394	OPERA	
			20012441	OPERATIONS: GREASE LUBE OIL PUMP BEARINGS.			5 YEARS		OPER		1 OPS1	21007375	OPERA	
			20010570	Perform full spectrum vibration monitoring. Establish baseline			1 MONTHS		ENG		1 MPDM	21000061	VIBRATI	
			20010571	Perform thermographic inspection.			1 MONTHS		ENG		1 MPDM	21000066	THERMC	
1M1009_AMP	01M1009	'1M1009_A	20010572	OPERATIONS: COAL MILL DRIVE GEAR GREASING, GREA			6 MONTHS		OPER		1 OPS1	21007455	OPERA	
			20010537	TES GROUP: PERFORM CRACKED ROTOR CHECK. MO			1 YEARS		ENG		4 PERT	21007412	TES GR	
			20010556	OPERATIONS: CHANGE OIL IN MILL MOTOR BEARINGS, C			2 YEARS		OPER		1 OPS1	21007082	CHANGE	
			20010557	FUTURE: MAINTAIN EXTRA MILL MOTOR ON SITE IN STOP			1 YEARS		CSUPV		0 WHSE	21007459	FUTURE	
Empower			20010558	OBTAIN 1 120CC OIL SAMPLE FROM THRUST BEARING O			0 YEARS		OPER		1 OPS1	21000063	TAKE OI	
			20010573	Perform Motor circuit evaluation. Establish action levels. Trend			1 YEARS		ENG		4 PERT	21000050	MOTOR	
			20010574	PERT: CALIBRATE MOTOR CURRENT INDICATION (PERIC			4 YEARS		TECHI		4 PERT	21000055	CALIBR	
			20010575	Perform full spectrum vibration monitoring. Establish baseline			1 MONTHS		ENG		1 MPDM	21000061	VIBRATI	
			20010576	Perform thermographic inspection.			3 MONTHS		ENG		1 MPDM	21000066	THERMC	
			20010577	OBTAIN OIL SAMPLES, YELLOW COAL MILL MOTOR			0 YEARS		OPER		1 OPS1	21000063	TAKE OI	
			20010578											
			20010579											

# Condition-based maintenance - Secondary air heater plugging - Coal power plant



Air heater tube plugging causes DeltaP (green line) to increase over several months and is a trigger for maintenance

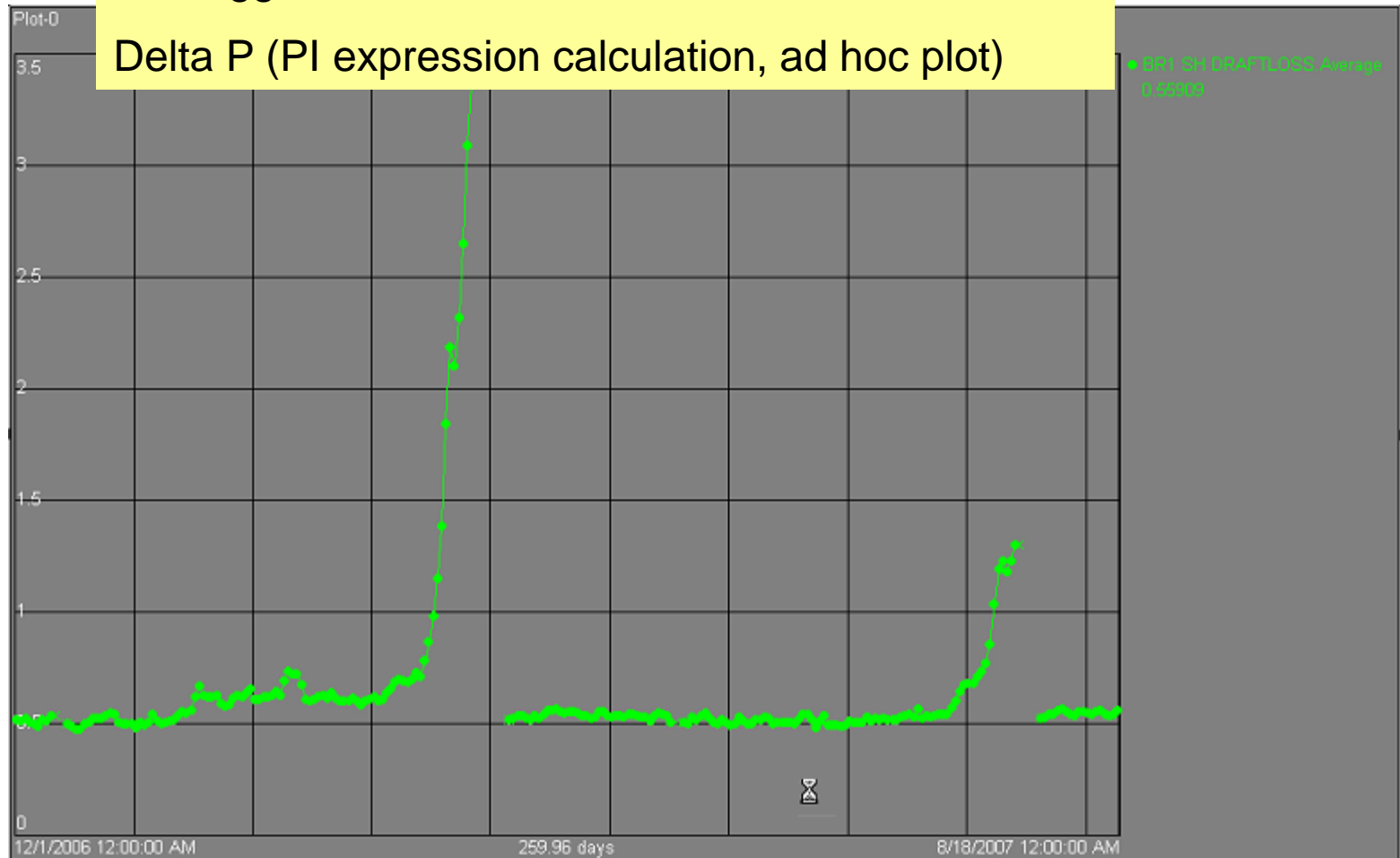
Ad hoc time-filter expressions as PI Calculations



# Boiler (convection) tubes plugging

Rapid rate of change of Delta P over several days is a trigger for maintenance

Delta P (PI expression calculation, ad hoc plot)



# Instrument drift - O2 analyzer

Based on redundant dual sensors

Delta approx. zero is GOOD

Delta drifting from zero is NOT GOOD



# Operations data (PI)'s role in Maintenance business process

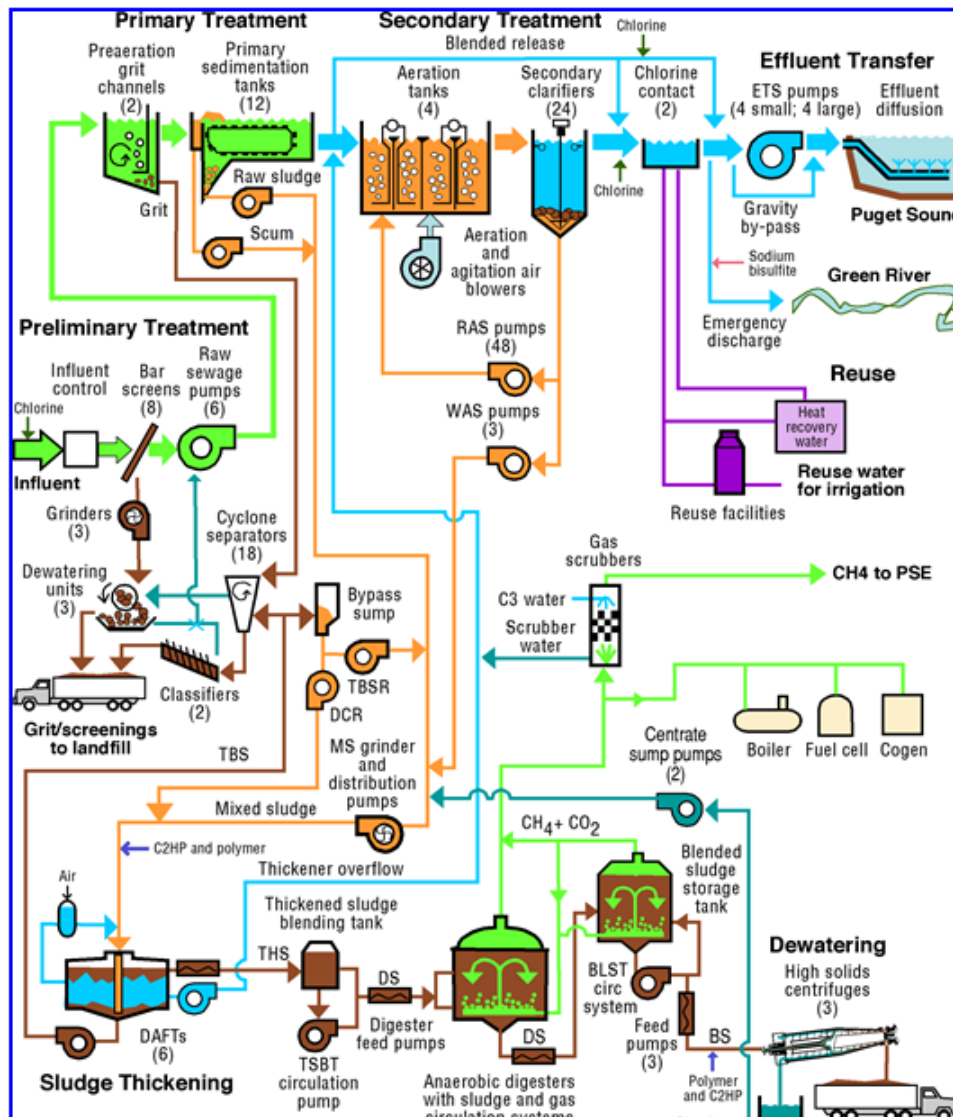


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# PI System as a Maintenance Tool - King County Wastewater Treatment



When process parameters go outside their limits, the Process Analysts alert Maintenance personnel that “something” is wrong with the equipment.

<http://www.osisoft.com/Template/item-abstract.aspx?id=4653&type=events&cid=1673&year=2009&industry=All&event=611>

Process parameters as a proxy for maintenance alerts



# Asset Health Score - Load Tap Changer

Address <http://inpwkdev29/Asset%20Management2/WebPages/LtcCA-ActionSummaryNewByPG.aspx>

Home Documents and Lists Create Site Settings Help

**PSEG** LTC CA-Action New Summary Report By Peer Group

Select a Peer Group then Click Show Peer Group Button

VACUUM Show Peer Group CA Results

Content Editor We

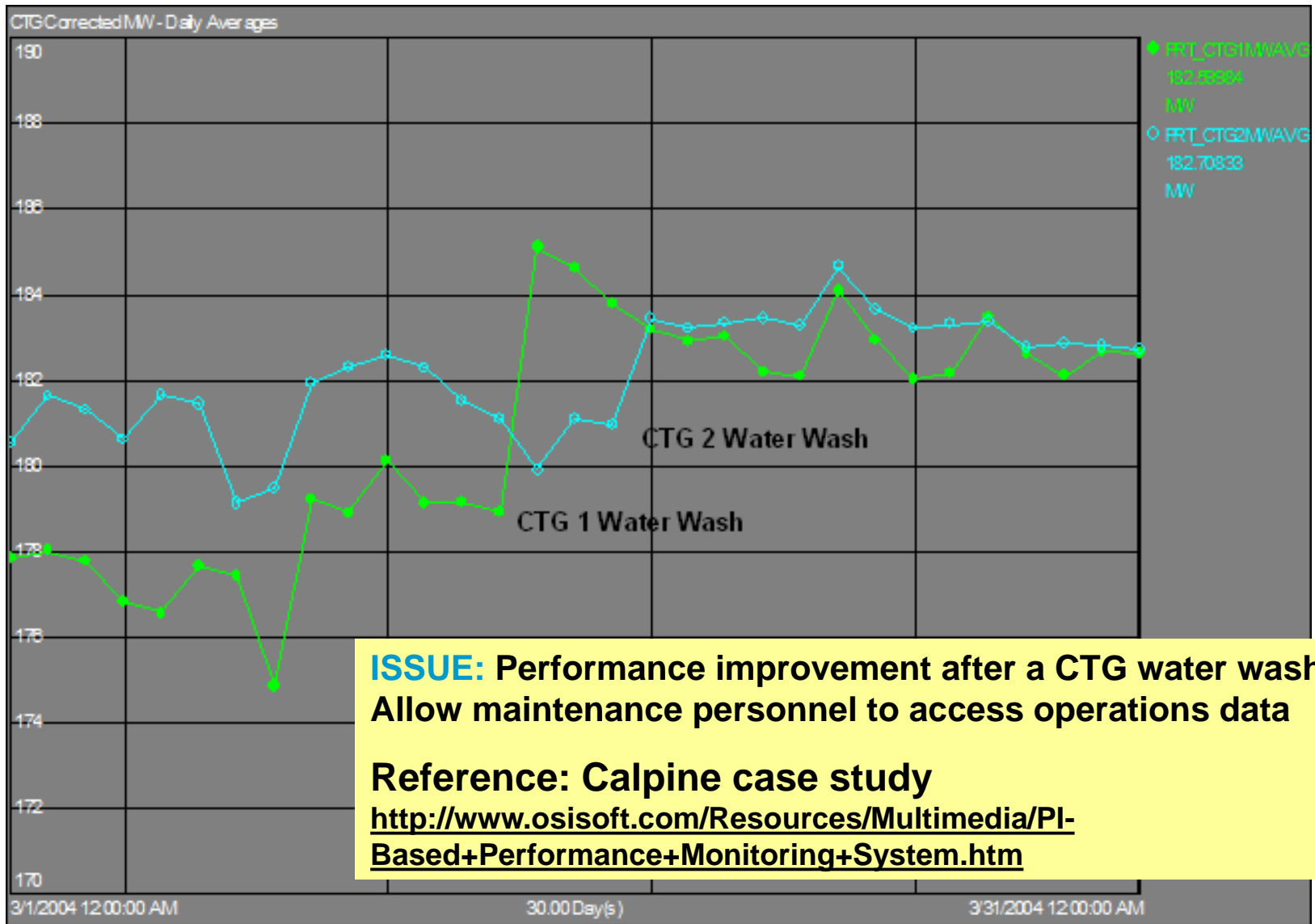
CA LTC New Action

CA LTC New Action Algorithm

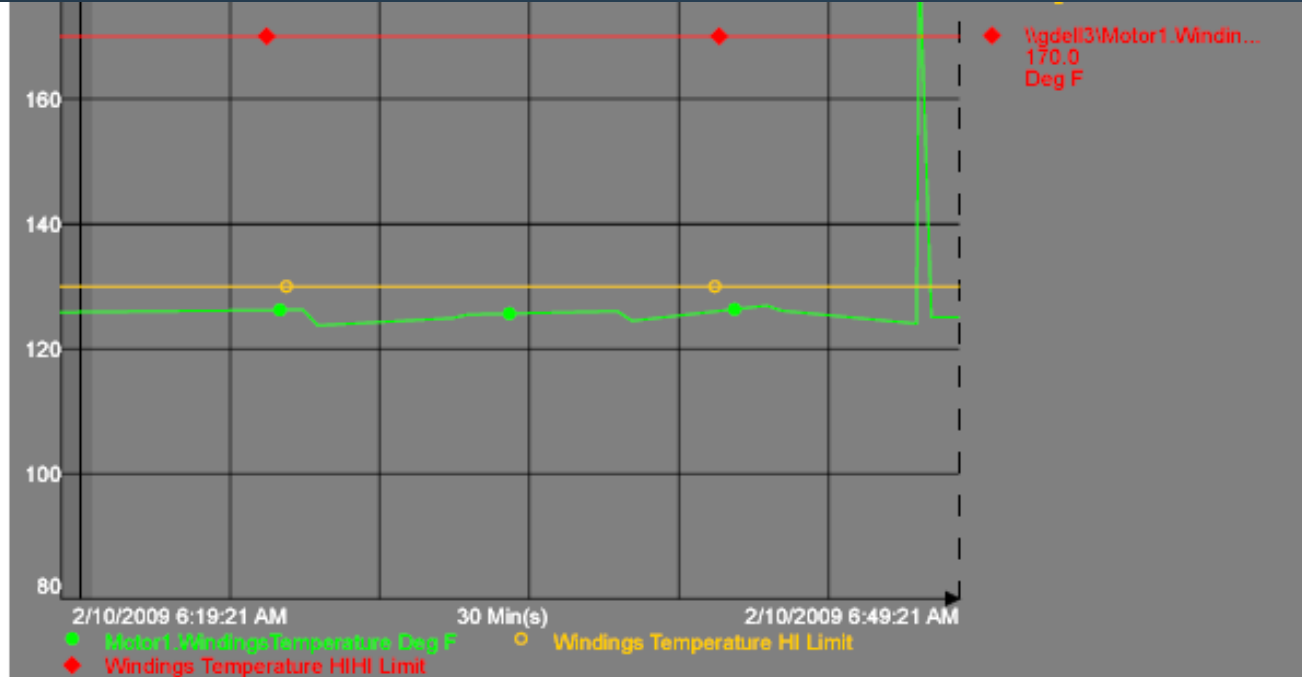
Details	Division	Floc	Floc Descr	Equipment	Equip Descr	Score	Person	Status
	CE	IPE-CE-SMN -1PM	132-1 Transformer	000000000010023218	Load Tap Changer 132-1	4.75	Mark	Being Monitored
	CE	IPE-CE-SOS -T2	# 2 Transformer	000000000010503189	Load Tap Changer (URT)	3.9	George	Pending Action
	CE	IPE-CE-SLI -132-5	132-5 Transformer	000000000010023211	Load Tap Changer 132-5 26Kv	3.1	Paul	Pending Action
	CE	IPE-CE-SBB -1TRX	500-1 Transformer	000000000010047625	Load Tap Changer A	3		
	ME	IPE-ME-SBV -1TRH	220-1 Transformer	000000000010026154	Load Tap Changer 1 B	3		
	ME	IPE-ME-SBV -1TRH	220-1 Transformer	000000000010509496	Load Tap Changer 1 A	3		
	PA	IPE-PA-SHU -2TRH	220-2	000000000010031723	Load Tap Changer	3		
	PA	IPE-PA-SWK -1TRW	345-1	000000000010500224	Load Tap Changer	3		
	CE	IPE-CE-GSE -31G	26-3 Transformer	000000000010023775	Load Tap Changer	2.8		
	ME	IPE-ME-SNW -3TRH	132-3 Transformer	000000000010510415	LTC/Selector and Transfer 13 Kv	2.7	George	OK
	CE	IPE-CE-GSE -132-7	132-7 Transformer	000000000010501565	Load Tap Changer	2.6		
	CE	IPE-CE-SOS -T1	# 1 Transformer	000000000010503188	Load Tap Changer (URT)	2.6	Mark	OK
	ME	IPE-ME-SNW -2TRH	132-2 Transformer	000000000010510411	LTC/Selector and Transfer 13 Kv	2.6	George	OK
	ME	IPE-ME-SNW -3TRH	132-3 Transformer	000000000010510418	LTC/Selector and Transfer 26 Kv	2.6	George	OK
	ME	IPE-ME-SNW -1TRH	132-1 Transformer	000000000010510410	LTC/Selector and Transfer 26 Kv	2.5	George	OK
	SO	IPE-SO-SNF -4TRX	500-4 Transformer	000000000010523970	Load Tap Changer 500-4A	2.5		
	CE	IPE-CE-ADA -T1	# 1 Transformer	000000000010503781	Load Tap Changer (URT)	2.1	Mark	OK
	CE	IPE-CE-GSE -21G	26-2 Transformers	000000000010501561	Load Tap Changer	2.1		
	CE	IPE-CE-SMN -2PM	132-2 Transformer	000000000010023219	Load Tap Changer 132-2	2.1	Mark	OK
	ME	IPE-ME-HAW -T2	# 2 Transformer	000000000010507132	Load Tap Changer	2.1	Paul	OK
	ME	IPE-ME-SBV -2TRHB	220-2B	000000000010509499	Load Tap Changer	2.1		
	ME	IPE-ME-SNW -2TRH	132-2 Transformer	000000000010510413	LTC/Selector and Transfer 26 Kv	2.1	George	OK
	CE	IPE-CE-ELI -26PF	S-357 Par	000000000010045176	LTC Voltage	2		

[http://videostar.osisoft.com/Regional\\_Seminars/2009/Boston/Video/RS2009\\_Boston\\_CBM\\_PSEG\\_Gopal\\_Rothweiler.wmv](http://videostar.osisoft.com/Regional_Seminars/2009/Boston/Video/RS2009_Boston_CBM_PSEG_Gopal_Rothweiler.wmv)

# Validate performance improvement after maintenance (Calpine)



# Visual integration - PI System and Maximo



## Maximo Work Orders

Equipment	WoNum	PM	Description	Status	StatusDate	Location	ReportedBy	ReportDate
11430	1668		HiTempAlert	COMP	12/8/2008 10:22:18 AM	BR430	WILSON	12/8/2008 10:22:18 AM
11430	1666		HiTempAlert	COMP	11/21/2008 10:21:53 AM	BR430	WILSON	11/21/2008 10:21:53 AM
11430	T1573		Check pump operation.	WSCH	5/2/2008 1:33:34 PM	BR430	MAXADMIN	5/2/2008 1:33:22 PM
11430	T1574		Check pump float switch.	WSCH	5/2/2008 1:33:34 PM	BR430	MAXADMIN	5/2/2008 1:33:23 PM
11430	T1575		Check seal and housing for leaks.	WSCH	5/2/2008 1:33:33 PM	BR430	MAXADMIN	5/2/2008 1:33:23 PM

# Other resources



[Using PI System to Back - Test Usage and Condition Based Maintenance Strategies to predict Quantifiable Benefits Prior to Deployment in Asset Management](#) (Sebastien Cournoyer, DTE Energy, Laurence Hruby, Basin Electric Power Cooperative, Gopal GopalKrishnan, OSIsoft) - [PPT](#)

Using Basic PI System Tools to Implement a Critical Variables Program that is Inexpensive and Easy to Maintain, Cytec Industries Inc.

<http://www.osisoft.com/templates/item-abstract.aspx?id=2521&terms=cytec>

[http://videostar.osisoft.com/Regional\\_Seminars/2009/NOLA/Video/RS2009\\_NOLA\\_Cytec\\_Fregosi.wmv](http://videostar.osisoft.com/Regional_Seminars/2009/NOLA/Video/RS2009_NOLA_Cytec_Fregosi.wmv)

Substation Inspection and Condition Based Maintenance using PI System

[http://videostar.osisoft.com/Regional\\_Seminars/2009/Boston/Video/RS2009\\_Boston\\_CBM\\_PSEG\\_Gopal\\_Rothweiler.wmv](http://videostar.osisoft.com/Regional_Seminars/2009/Boston/Video/RS2009_Boston_CBM_PSEG_Gopal_Rothweiler.wmv)

[SDG&E PI-based Substation Real-Time Condition Based Maintenance System](#) (Neal Bartek, Subburaman Sankaran, SDG&E) - [PPT](#)

Darryl Hammond, Alyeska Pipeline - Achieving Reliability Centered Maintenance and Diagnostics with the PI System

[http://videostar.osisoft.com/Regional\\_Seminars/2009/HOU/Video/RS2009\\_HOU\\_Alyeska\\_Hammond.wmv](http://videostar.osisoft.com/Regional_Seminars/2009/HOU/Video/RS2009_HOU_Alyeska_Hammond.wmv)

Harvard Medical School talk - Brian Barmmer (Maximo)

<http://videostar.osisoft.com/marketing/video/HMS.html>

Using PI System as a Maintenance Tool - King County Wastewater Treatment

<http://www.osisoft.com/Templates/item-abstract.aspx?id=4653&type=events&cid=1673&year=2009&industry=All&event=611>



# Thank you

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