



Chevron's Power Performance Monitoring Solution

Presented by:
Ken Yoss
Roy Blanco

Empowering Business in Real Time
PI Infrastructure for the Enterprise

Agenda

- Power Support Center Overview
- PSC Performance Monitoring Solution
- PSC Workflow Process
- El Segundo Refinery CHP Overview
- Case Studies
- Q&A

Power Support Center Capabilities



Monitoring & Diagnostics Center

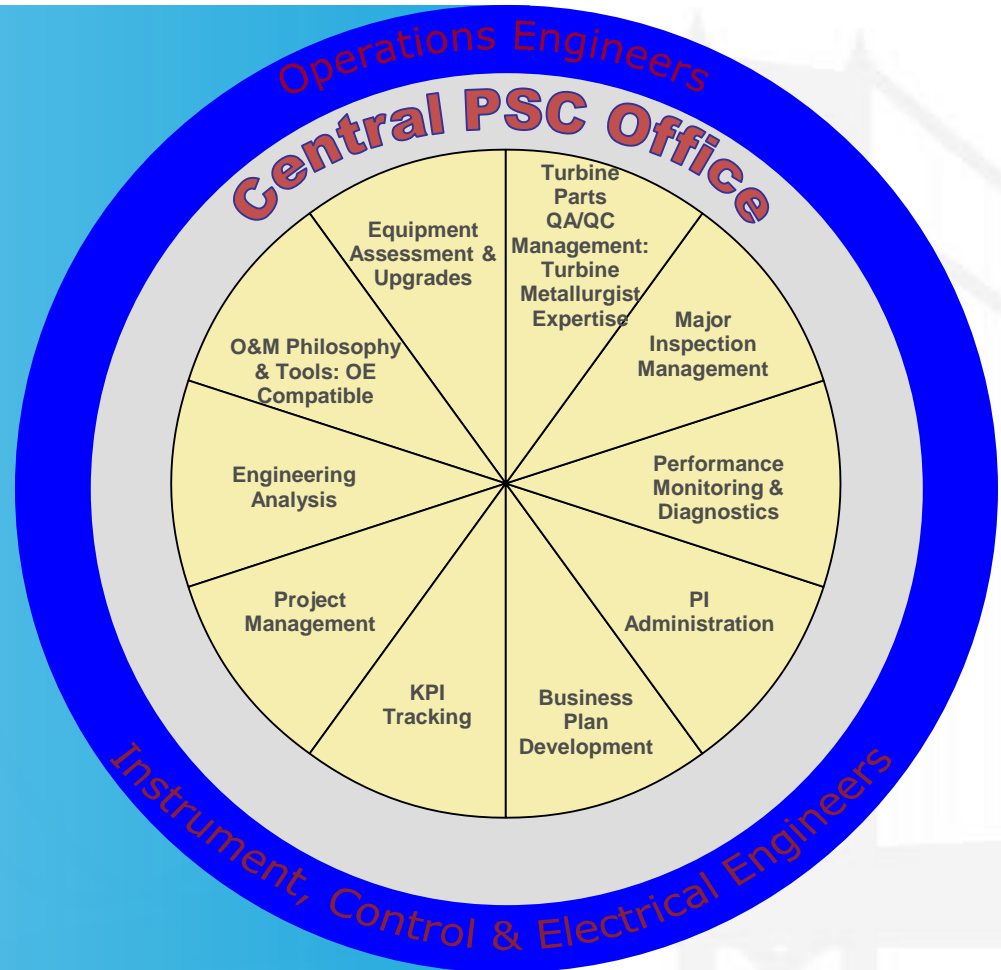
- Power Solutions Network
- Business planning support
- Operations philosophy and tools
- Maintenance philosophy and tools
- Engineering and technical solutions
- Performance monitoring/trip analysis
- Training/OC development
- Equipment modifications and upgrades

Power Support Center Organization



Refineries

Oil & Gas Operations



PSC Performance Monitoring Solution

OSIsoft EA for data infrastructure

- ProcessBook
- Datalink
- To come:
 - MD
 - RT Webparts via SharePoint
 - AF2.0 & Notifications
 - Etc.

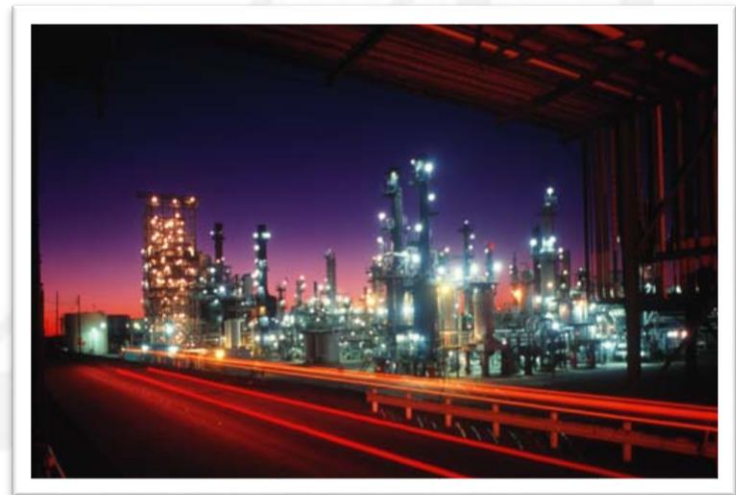
SmartSignal for predictive analytics

- SmartSignal EPI*Center
- SmartSignal participates in the performance monitoring portion of the weekly PSC/ES teleconference.
- To come:
 - Transition to Chevron hosted, monitored and maintained instance of EPI*Center.

El Segundo Refinery CHP Overview

Located on the Pacific coast in El Segundo, CA just south of LAX.

- 3 - Cogeneration Trains (GE Frame 6Bs, dual pressure HRSGs), + 170,000 hrs.
- 1 - Steam Turbine Generator
- 1 - Auxiliary Boiler
- 2 - Sets of BFWPs



Case Study: High Steam Drum Conductivity

B priority: ES B train E-3400 Conductivity HIGH

Sebastian Lama Gimbutas [slamagimbutas@smartsignal.com]

You forwarded this message on 11/12/2008 12:10 PM.

Sent: Wed 11/12/2008 10:11 AM

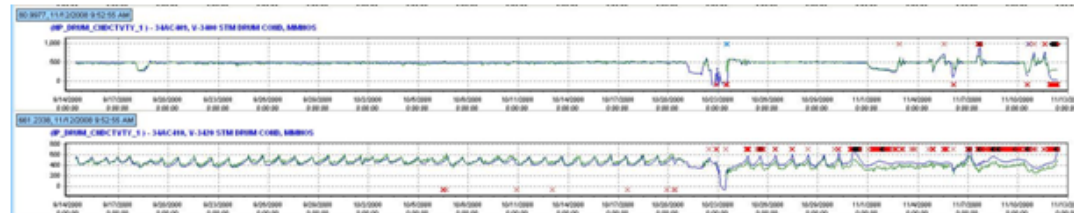
To: Blanco, Roy V

Cc: Konieczka, Matthew D; Yoss, Kenneth A; Chuck Cotton; Brian McCarthy

Roy,

Starting on 10/24 we've seen slight changes in the conductivity readings, but nothing significant until 11/7 when HP DRUM CONDUCTIVITY (4AC409, V-3400 STM DRUM COND) spiked up to ~855 MMHOS. It seems like some corrective action was taken because this sensor is now reading ~30 MMHOS. However IP DRUM CONDUCTIVITY (34AC410, V-3420 ST DRUM COND) continues to increase, and today reached 661 MMHOS and seems like it is still going up. See the screenshots below

Please let me know what you think, thank you for your time.



Sebastian Lama Gimbutas
Analyst, Availability & Performance Center
SmartSignal Corporation

901.Warrenville.Road - Suite.300
Lisle, Illinois 60532
Phone: +1_630_829_4000
Fax: +1_630_829_4001
Direct: +1_630_829_3209

Case Study: High Steam Drum Conductivity

From: Blanco, Roy V
Sent: Wednesday, November 12, 2008 10:17 AM
To: Wenschlag, Michael D (mwen)
Cc: Konieczka, Matthew D; Yoss, Kenneth A
Subject: FW: B priority: ES B train E-3400 Conductivity HIGH

Mike,

FYI... Please see SmartSignal's message below. The team is currently out of the office and has not had the chance to analyze this data. Just wanted to put it on your radar.

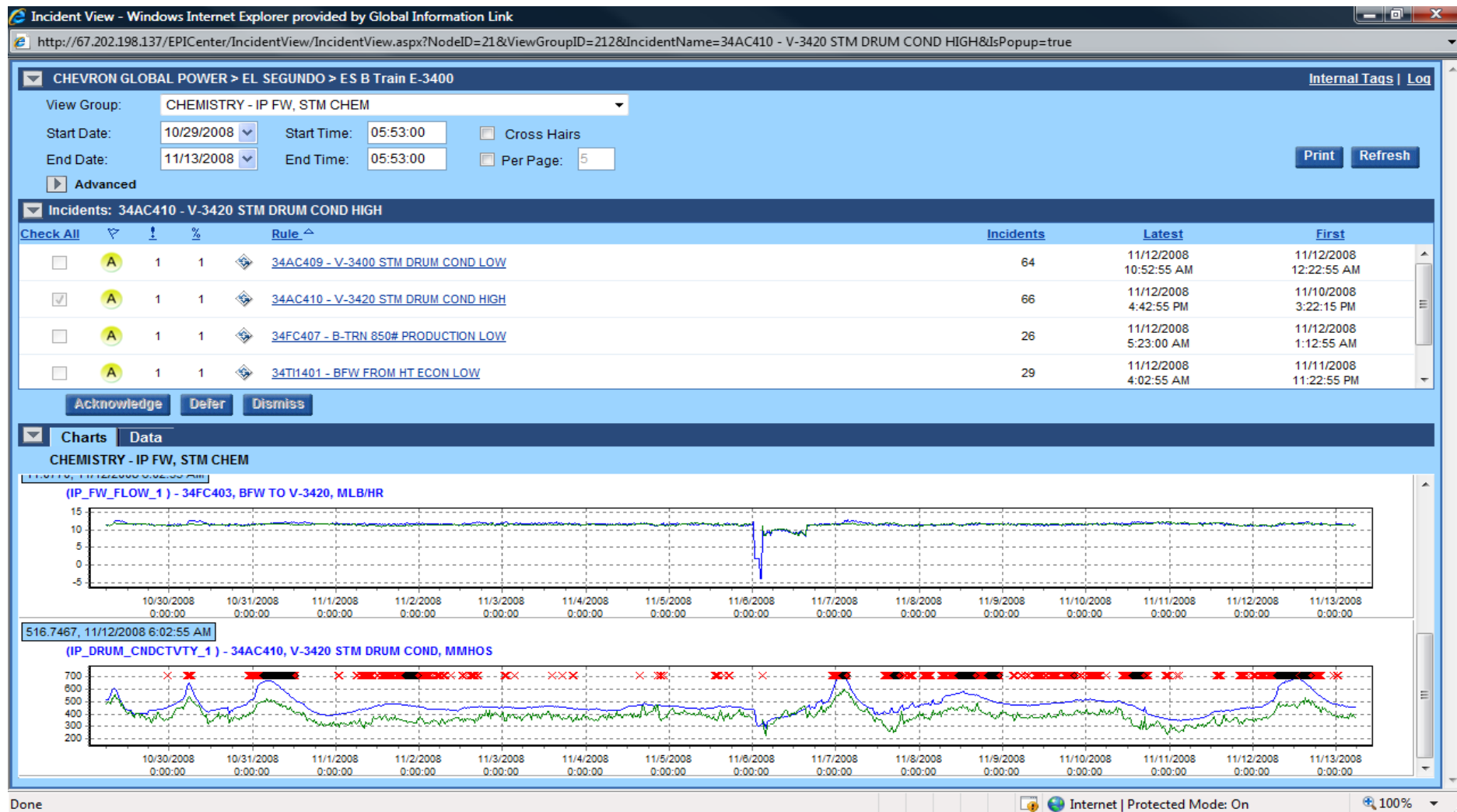
Please let me know if this is normal behavior (spikes in conductivity) or not. It looks like operations normally takes corrective action shy of 700 mmhos, you are currently at around 680 mmhos.

At what conductivity reading do you feel is "abnormally high" and action needs to be taken?

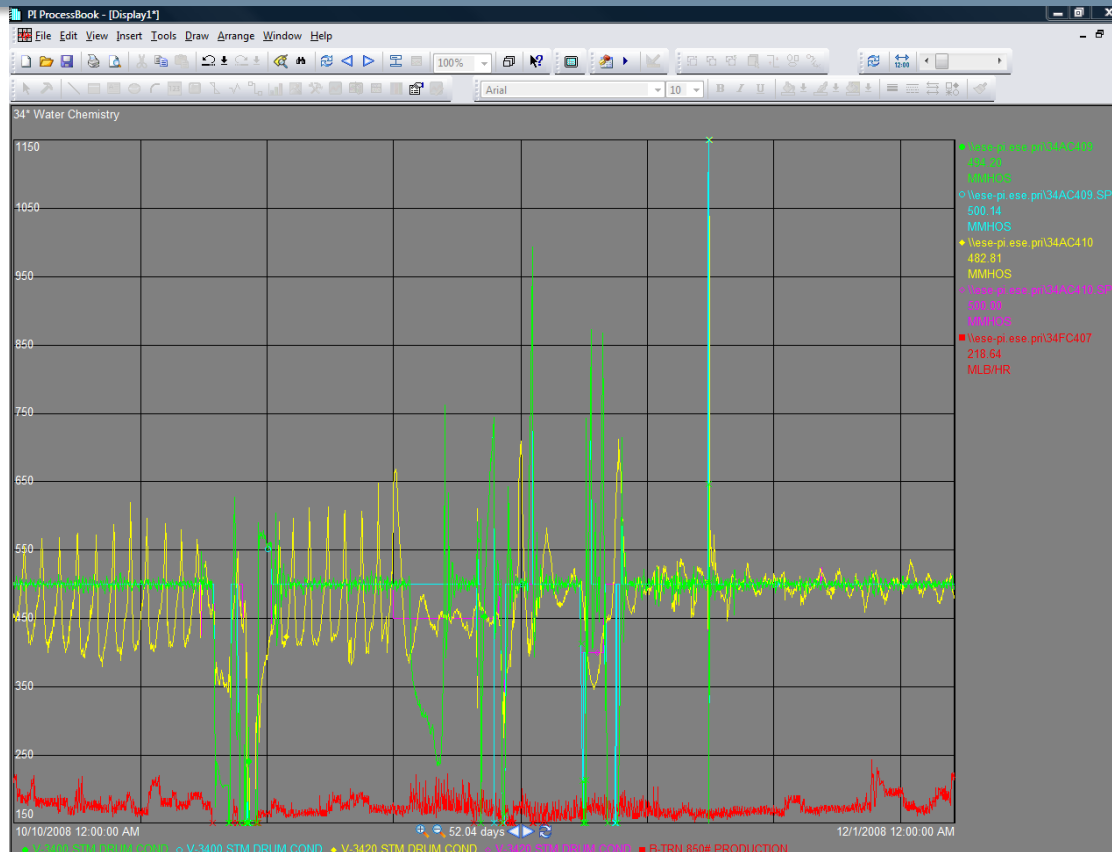
Thanks,

Roy

Case Study: High Steam Drum Conductivity



Case Study: High Steam Drum Conductivity



Equipment Integrity Review Log									
#	Exception Active/Closed	Report Date	Date Occurred	Train	Responsible Part	Trend	Tag	Tag Descriptor	Exception: Update: Emergent Item:
76	Closed	11/13/2008	10/24/2008	8 Trn	RB	SS	34AC410	V-3400 STM DRUM COND	<p>Monitor: Starting on 10/24 we've seen slight changes in the conductivity readings, but nothing significant until 11/7 when HP DRUM CONDUCTIVITY (4AC409, V-3400 STM DRUM COND) spiked up to ~855 MMHOS. It seems like some corrective action was taken because this sensor is now reading ~30 MMHOS. However HP DRUM CONDUCTIVITY (34AC410, V-3420 ST DRUM COND) continues to increase, and today reached 661 MMHOS and seems like it is still going up.</p>

Case Study: High Steam Drum Conductivity

El Segundo PSC Pilot Weekly Project Update: 08 November 13

1. Attendees:

Mike W., Matt K., Chuck Cotton(Smart Signal), Ken Yoss

2. Weekly Summary:

Equipment Integrity Review Log									
#	Report Date	Date Occurred	Train	Responsible Party	Trend	Tag	Tag Descriptor	Exception: Completed: COMPL Emergent Item:	Action Taken:
76	11/13/2008	10/24/2008	B Trn	RB	SS	34AC410	V-3400 STM DRUM COND	Monitor: Starting on 10/24 we've seen slight changes in the conductivity readings, but nothing significant until 11/7 when HP DRUM CONDUCTIVITY (44AC409, V-3420 STM DRUM COND) spiked up to ~855 MHHOS. It seems like some corrective action was taken because this sensor is now reading ~30 MHHOS. However P DRUM CONDUCTIVITY (34AC410, V-3420 ST DRUM COND) continues to increase, and today reached 661 MHHOS and seems like it is still going up. Update: Mike W. The system was taken out of service two time for downstream valve work on the blowdown system. Will discuss with console operator. Update: Operations has returned the system to normal behavior.	Mike W. notified of exception via email.

- o #76: The smart signal catch led successful action to site personnel as this point would not have alarmed and notified operations. This allowed operations to control this situation and bring the Conductivity back to normal levels. Good Catch for SmartSignal.
- o B Trn Trip 11-5-08: lost communication with seismic probes, which caused a controlled shutdown on B-Train. The shutdown functionality should have been disabled when we installed Mark VI, per MOC that was done at that time. Update:

Catch of the month: Mike W. saves B Train trip: B-Train had the same situation happen with the RST processors not seeing a signal from BB5 and getting a Transducer fault alarm on Friday night at 23:53:27 that happened on Wednesday night when the unit shutdown. The difference is the shutdown signal L39VD2_ALM has been forced to a good value. Previously GE eliminated the trip logic on high vibration for the seismic probes, but not loss of signal. During the next water wash Mike W. will change logic so the unit does not trip on loss of signal.

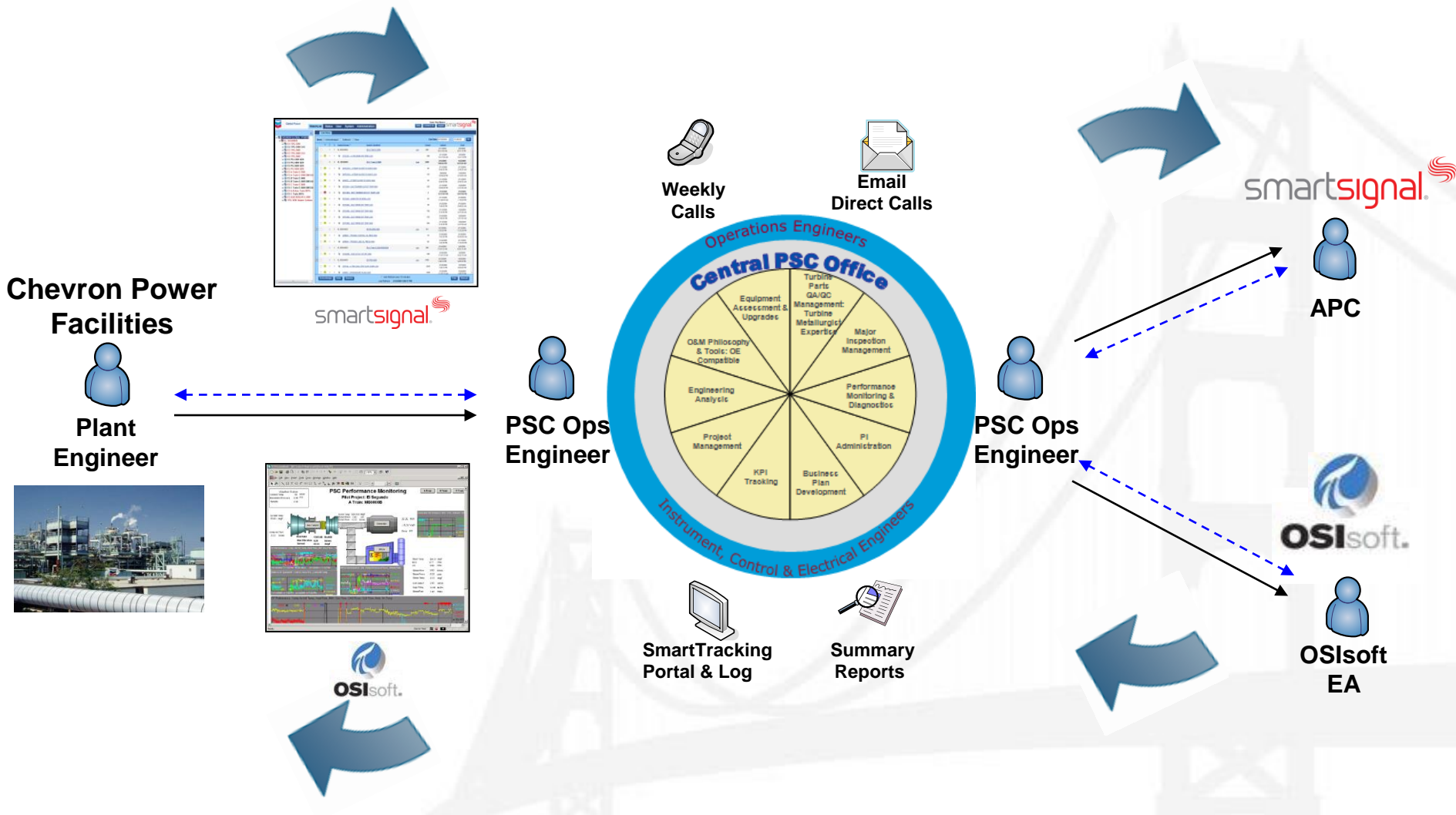
Case Study: High Steam Drum Conductivity

9.0	11/26/2008 8:55:27	Michelle Walton
Site/Unit		
Asset	ES B Train E-3400	
Category	Other - see comments	
Category Description/Detail	IP DRUM CONDUCTIVITY HIGH	
Assigned To	rblanco	
Priority	MEDIUM	
Action	Other - see comments	
Comment	Starting on 10/24 we've seen slight changes in the conductivity readings, but nothing significant until 11/7 when HP DRUM CONDUCTIVITY (4AC409, V-3400 STM DRUM COND) spiked up to ~855 MMHOS. It seems like some corrective action was taken because this sensor is now reading ~30 MMHOS. However IP DRUM CONDUCTIVITY (34AC410, V-3420 ST DRUM COND) continues to increase, and today reached 661 MMHOS and seems like it is still going up. See the screenshot attached	
10.0	12/3/2008 1:31:35	rblanco
Site/Unit		
Asset	ES B Train E-3400	
Category	Other - see comments	
Category Description/Detail	IP DRUM CONDUCTIVITY HIGH	
Assigned To	Chuck Cotton	
Priority	MEDIUM	
Action	Other - see comments	
Comment	The blowdown on this system has issues. It is usually placed into manual. This was a legitimate catch for SmartSignal. Thanks!	

Value delivered:

- Long term reliability
- Confirmation of equipment issues

PSC Performance Monitoring Workflow



Case Study: NH3 Over Injection

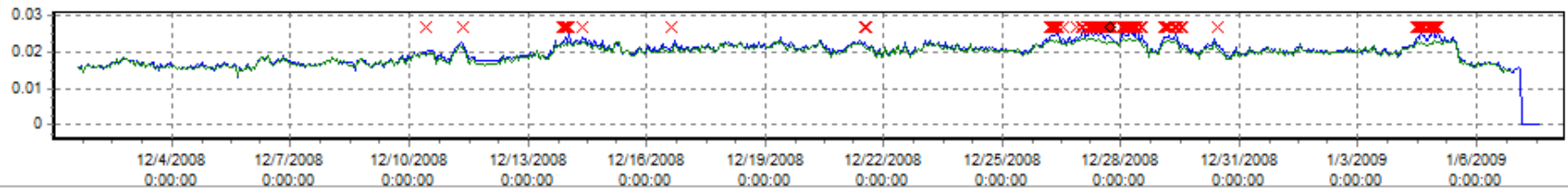
11/7/2008: PSC received phone call from SmartSignal APC informing of a NH3/air ratio High Rule posting on the WatchList.



Case Study: NH3 Over Injection

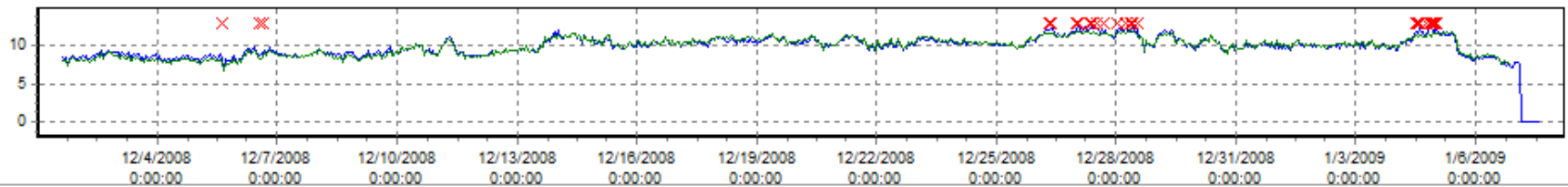
0.0167, 12/5/2008 10:46:25 AM

(NH3/AIR_RATIO) - 36FFI610, V3610 NH3/AIR MOLE RATIO, RATIO



8.7177, 12/5/2008 10:46:25 AM

(NH3_FLOW_RATE) - 36FC610, AQ NH3 TO V3610, GPH



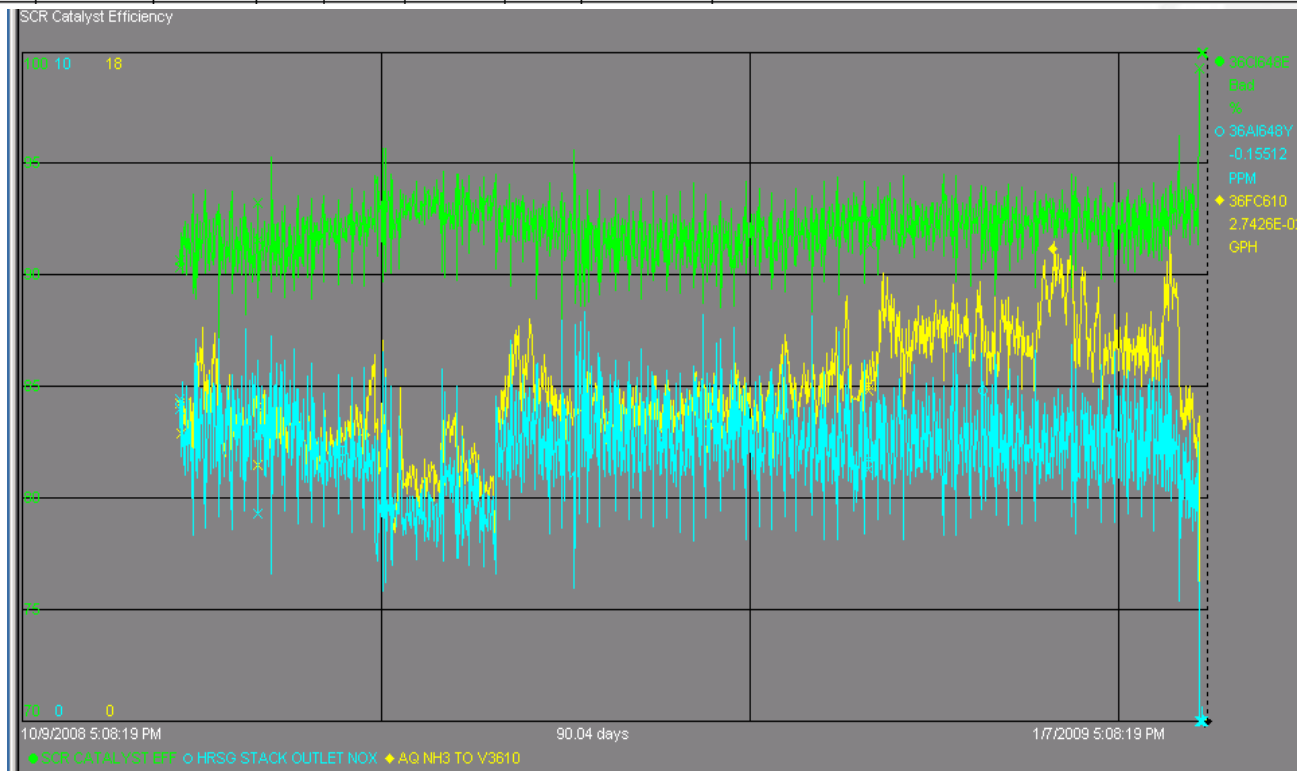
3.9749, 12/5/2008 1:46:25 PM

(STACK_NOX) - 36AI648Y, HRSG STACK OUTLET NOX, PPM



Case Study: NH3 Over Injection

Equipment Integrity Review Log										
#	Exception Active/Closed	Report Date	Date Occurred	Train	Responsible Party	Trend	Tag	Tag Descriptor	Exception: Update: Emergent Item:	Action Taken:
88	Closed	1/7/2008	1/7/2008	C	RB	SS	36FC610	AQ NH3 to V3610	Monitor: NH3 Injection appears to be increasing without a correlation in catalyst efficiency.	Will notify site during weekly meeting.



Case Study: NH3 Over Injection

El Segundo PSC Pilot Weekly Project Update: 09 January 22nd (minutes)

1. Attendees:

- Mike Wenschlag (Site Cogen Specialist)
- Chuck Cotton (SmartSignal)
- Brian McCarthy (SmartSignal)
- Roy Blanco (PSC)
- Ken Yoss (PSC)

#	Report Date	Date Occurred	Train	Response Part	Trend	Tag	Tag Description	Exception: Update: Closed / Open Emergent Item:	Action Taken:
84		12/6/2008	46	RB	SS	46VB10	TP-3200 THRST A P2	Monitor: 11-17-08 46V1010 - TP-3200 THRST A P2 This sensor began exhibiting what appears to be erratic behavior on 11-13-08, jumping up and down between ~1 and ~8 mls, while 46V1009 - TP3200 THRST B P2 tag has been fairly steady between 7 and 8 mls. Can this sensor be checked? Update: 1/21/09 - Mike Popp to investigate. Open	PSC Ops Engineer reviewed with Machinery Analyst on site.
88	1/7/2009	1/7/2009	C	RB	SS	36FC610	AQ NH3 to V3610	Monitor: NH3 injection appears to be increasing without a correlation in catalyst efficiency. Update:	Will notify site during weekly meeting.
89	1/22/2009	1/20/2009	BOP	RB	SS	46T11220 46T11221	MP-3320 MOTOR JRNL IOUTBRD MP-3320 MOTOR JRNL INBRD	Monitor: Motor JRNl bearing temperatures about 10 degrees higher than expected. The fin fan cooling circuit has been having difficulty meeting capacity. All other A/B/Aux bearing temperatures were alerting high but have returned to normal behavior except MP3320 Temps.	Email notification sent to the Machinery Analyst (Mike Popp). Continue to Monitor.
90	1/22/2009	1/21/2009	C	RB	SS	36HR016 6	TURB WHL SPC TEMP 2ND STG	Monitor: Wheel-space temperature running about 23 degF higher than expected. Continue to monitor.	
91	1/22/2009	1/16/2009	BOP	RB	SS	P_3240 P1	THRUST VIB	Monitor: Thrust vibrations (P1 & P2) moving from ~6 MILS to ~1 MILS with corresponding drop in thrust bearing temperature. Continue to monitor.	
92	1/22/2009	1/19/2009	A & B	RB	FSR Position and Flow	33PQ414	ATN INTERVLV PRESS,NG	Monitor: Social line pressure fluctuations causing cogen fuel pressure to fluctuate including a 7 psi fluctuation in inter-valve pressure. Inter-valve pressure went as low as 257 psi. What is low inter-valve pressure alarm point?	Will notify site during weekly meeting.
93	1/22/2009	1/19/2009	A/B/Aux BFWPs	RB	SS		Bearing Temps	Monitor: A/B/Aux BFWP bearing temperatures range from 200 to 275 deg F compared to C Tm BFWPs bearing temperatures ranging between 50 and 200 deg F. Are these accurate measurements? What are upper alarm limits for BFWP bearing temperatures?	Will notify site during weekly meeting.

*Screenshots can be found in the appendix section.

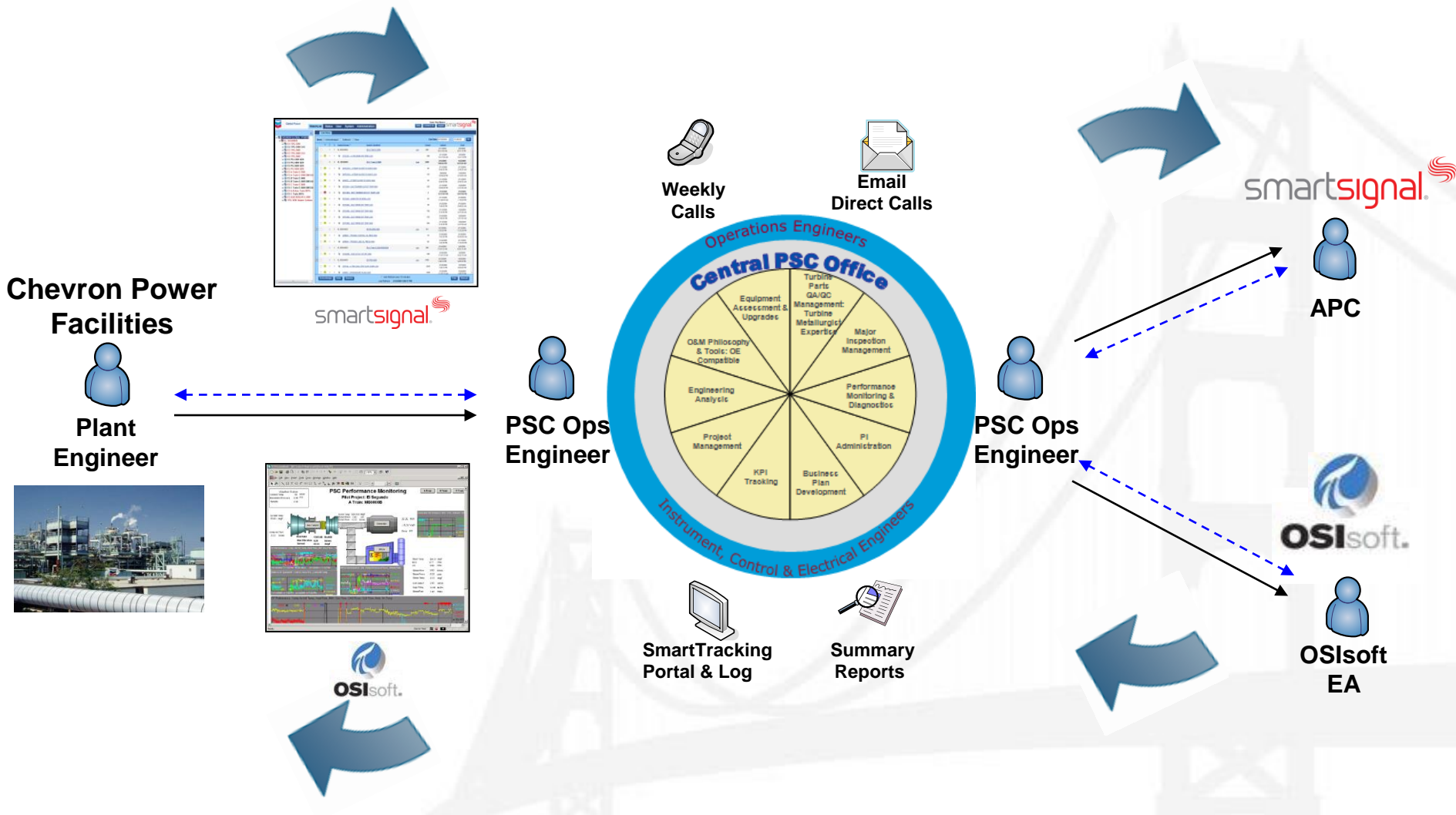
Updates:

- o #84 – Mike Popp will investigate during upcoming scheduled maintenance to turbine drive leak off heat exchanger.
- o #89 – SmartSignal Catch! Communication with console operations is going into calibration and coming out as a bad point causing the system to go into manual mode, at a low NOx ppm setpoint causing excess NH3 injection, without notification or alarm to the console operator. Operator procedures have been modified to verify operational mode and raise setpoint to 4 ppm.
- o #91 – Roy to create PI trend and forward to Mike Popp.
- o #92 – Site believes exception is not a significant reliability risk. The SRV valve has to open up 100% to go into alarm. Lately, the NG

Value delivered:

- Decrease in NH3 release to atmosphere
- \$ decrease in NH3 purchases
- Operational procedures/training modified

PSC Performance Monitoring Workflow



Case Study: NH3 Control Valve

High Priority Notification regarding E-3300 Catalyst Efficiency

Chuck Cotton [ccotton@smartsignal.com]

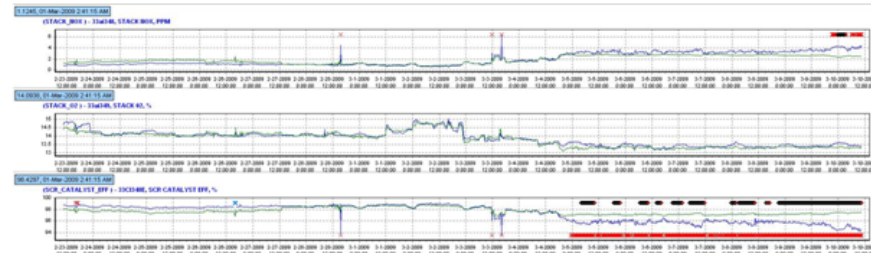
You forwarded this message on 3/10/2009 11:06 AM.

Sent: Tue 3/10/2009 10:48 AM

To: Blanco, Roy V

Cc: Yoss, Kenneth A; Konieczka, Matthew D; Sebastian Lama Gimbutas; Brian McCarthy

Roy, we noticed this morning that the efficiency of the catalyst on the E-3300 is declining rather precipitously. Here is a screen shot. It is only down about 4% but it does not appear to be turning. I have included the NOX as well since it is trending up and away from the estimate. I have made SmartTracking entries on these as well.



Chuck Cotton
Sr. Customer Monitoring Manager

smartsignal
ELIMINATE FAILURE

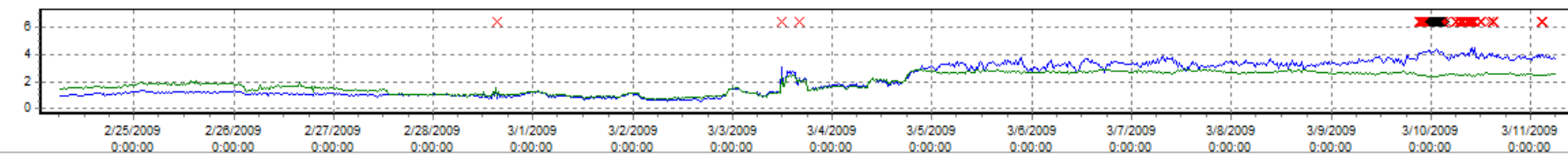
901. Warrenville Road - Suite 300
Lisle, Illinois 60532

Phone: +1-630-829-4000
Fax: +1-630-829-4001
Mobile: +1-630-849-9213
Direct: +1-630-829-4572
Home Office/Fax: +1-817-645-2948

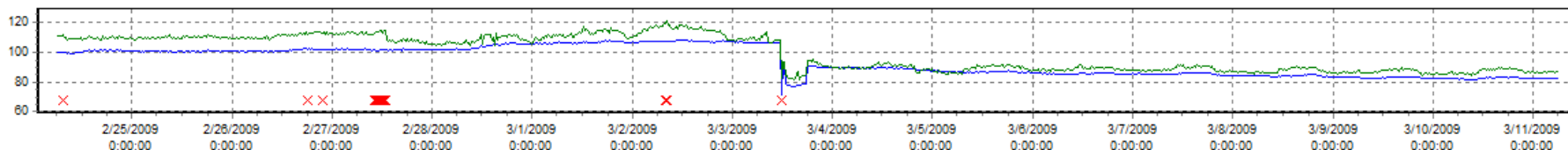
Case Study: NH3 Control Valve

1.0364, 2/24/2009 5:24:15 PM

(STACK_NOX) - 33ai348, STACK NOX, PPM

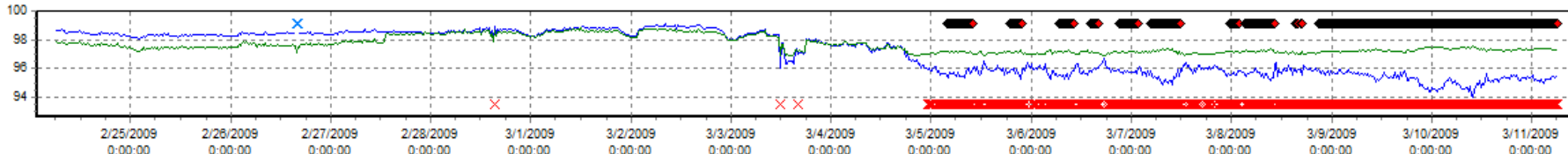


(NH3_FLOW_RATE) - 33FC355, NH3 FLOW RATE, LB/HR



98.2687, 2/25/2009 3:34:15 AM

(SCR_CATALYST_EFF) - 33CI348E, SCR CATALYST EFF, %



Case Study: NH3 Control Valve

RE: High Priority Notification regarding E-3300 Catalyst Efficiency

Wenschlag, Michael D (mwen)

Sent: Tue 3/10/2009 11:27 AM

To: Blanco, Roy V

Roy,

I will look into this. It does seem to move with the steam production.

Mike

From: Blanco, Roy V

Sent: Tuesday, March 10, 2009 9:07 AM

To: Wenschlag, Michael D (mwen)

Cc: Yoss, Kenneth A

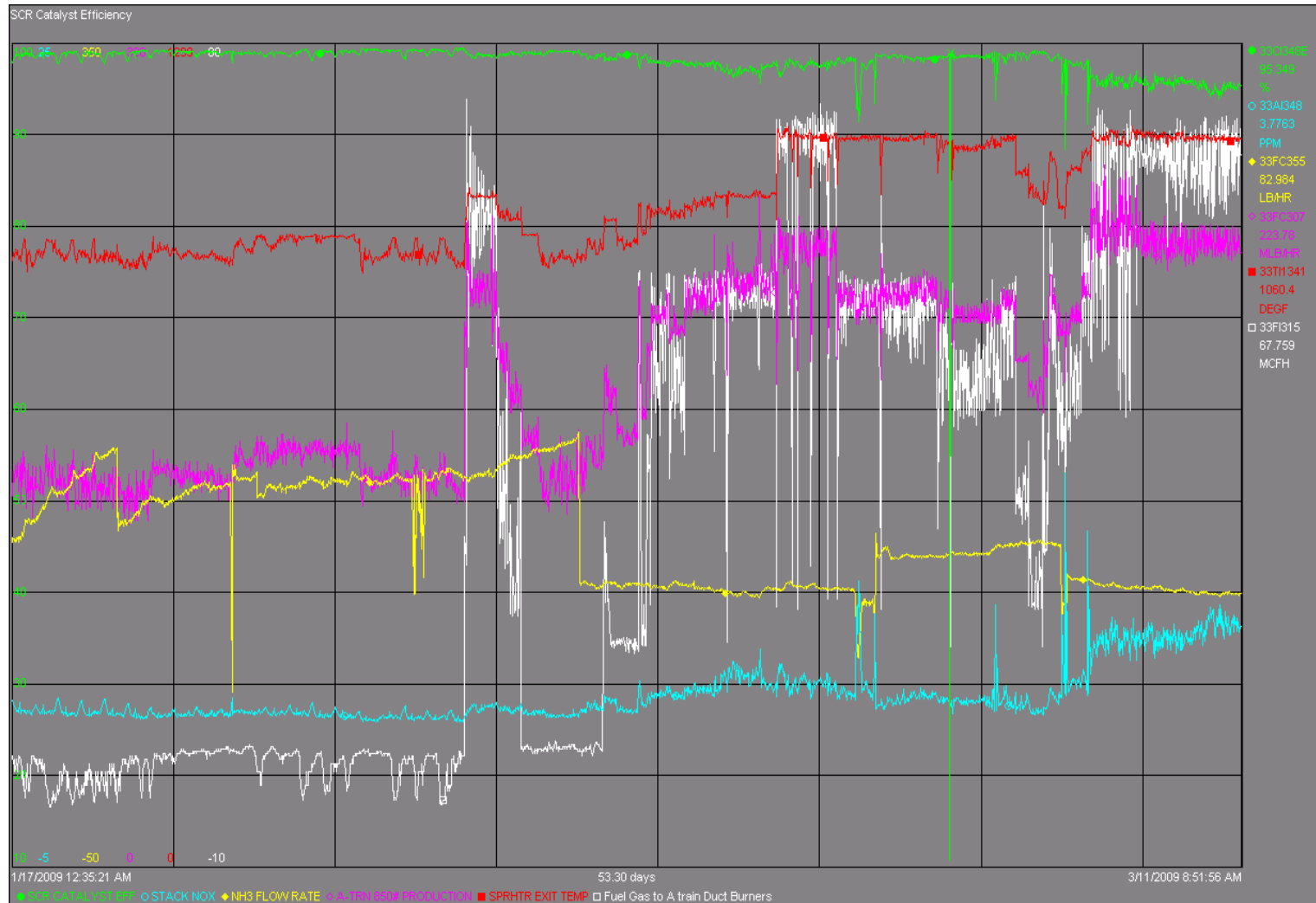
Subject: FW: High Priority Notification regarding E-3300 Catalyst Efficiency

Mike,

It looks like A Trn NOx is creeping up. There is no step change so it doesn't look like an operator set-point change.



Case Study: NH3 Control Valve



Case Study: NH3 Control Valve

El Segundo PSC Pilot Weekly Project Update: March 12th 2009 (minutes)

1. Attendees:

- Mike Wenschlag
- Roy Blanco
- George Freeman
- Chuck Cotton (SmartSignal)
- Bill Nieman (SmartSignal)
- Sebastian Lama Gimbutas (SmartSignal)
- Greg Metzger (SmartSignal)

Equipment Integrity Review Log										
#	Exception Active/Closed	Report Date	Date Occurred	Train	Responsible Party	Trend	Tag	Tag Description	Exception: Update: Emergent Item:	Action Taken
91	Closed	1/22/2009	1/16/2009	BOP	RB	SS	46V2648	P-3240 P1 THRUST VB	Monitor: Thrust vibrations (P1 & P2) moving from ~6 MLS to ~1 MLS with corresponding drop in thrust bearing temperature. Continue to monitor.	Will notify site during weekly meeting.
93	Active	1/22/2009	1/19/2009	A/B/Aux BFWPs	RB	SS		Bearing Temps	Monitor: A/B/Aux BFWP bearing temperatures range from 200 to 275 deg F compared to C Tr BFWPs bearing temperatures ranging between 50 and 200 deg F. Are these accurate measurements? What are upper alarm limits for BFWP bearing temperatures? Update: 1-22-09 - Mike P. to investigate with i&E and to verify magnitudes coming into Sensi/Honeywell rack. Rack feeds DCS. Probable situation where DCS ranges are off.	Will notify site during weekly meeting.
95	Active	1/1/2009	1/26/2009	B	RB	B TRAIN SESMIC VIBRATIONS	34V2427	ATR 888 VIBRATION	Monitor: Bearing vibration signal is showing an erratic spiking behavior with peaks as high as 0.85 RMS. The sensor has been removed from trip logic.	High priority email sent to Cogen Specialist and Machinery Analyst.
96	Active	2/5/2009	1/30/2009	P3320	RB	P3320 B JRL 4x VBE	46V634	P-3320 B JRL 4x VBE	Monitor: Vibration has a history of having more movement than other pickups on this pump. Unit is currently offline and erratic vibration behavior still exists. Suspect cabling issue in room.	Email sent to Machinery Analyst.
98	Active	2/5/2009	1/22/2009	35	RB	SS	35L5014	Steam Drum Level A	Monitor: When Auxiliary Boiler is shutdown the "a" transmitter reports a bad value. The b transmitter is reporting almost 100%. Also, the two drum levels tend to deviate from one another a bit at times. At times they even appear to have an inverse relationship.	Will notify site during weekly meeting.
102	Active	2/26/2009	2/16/2009	A & B	RB	SS/FSR Comparison	33X2406	A TRN RAT/LV POSITION	Monitor: SRV on A & B Trains rapidly fluctuates ~3%. C Train fluctuates ~5%. Update: 3/12/09 - Mike W. is working to optimize the SRV/FSR balance, line pressure is limited, fluctuations in valve position due to pressure fluctuations in the line. Low reliability risk.	Will notify site during weekly meeting.
103	Active	3/12/2009	3/10/2009	A	RB	SS/SCR	33a048	Stack NOx	Monitor: NOx emissions have increased from ~1.3 ppm to ~4.3 ppm over the past week. There is a strong correlation to a decrease in NH3 injection. Auxiliary firing and B50W production is also elevated but the correlation to decrease in NH3 injection is stronger. Mike W. is investigating.	Discussed with Cogen Specialist over phone.

Performance Monitoring:

*Screenshots can be found in the appendix section.

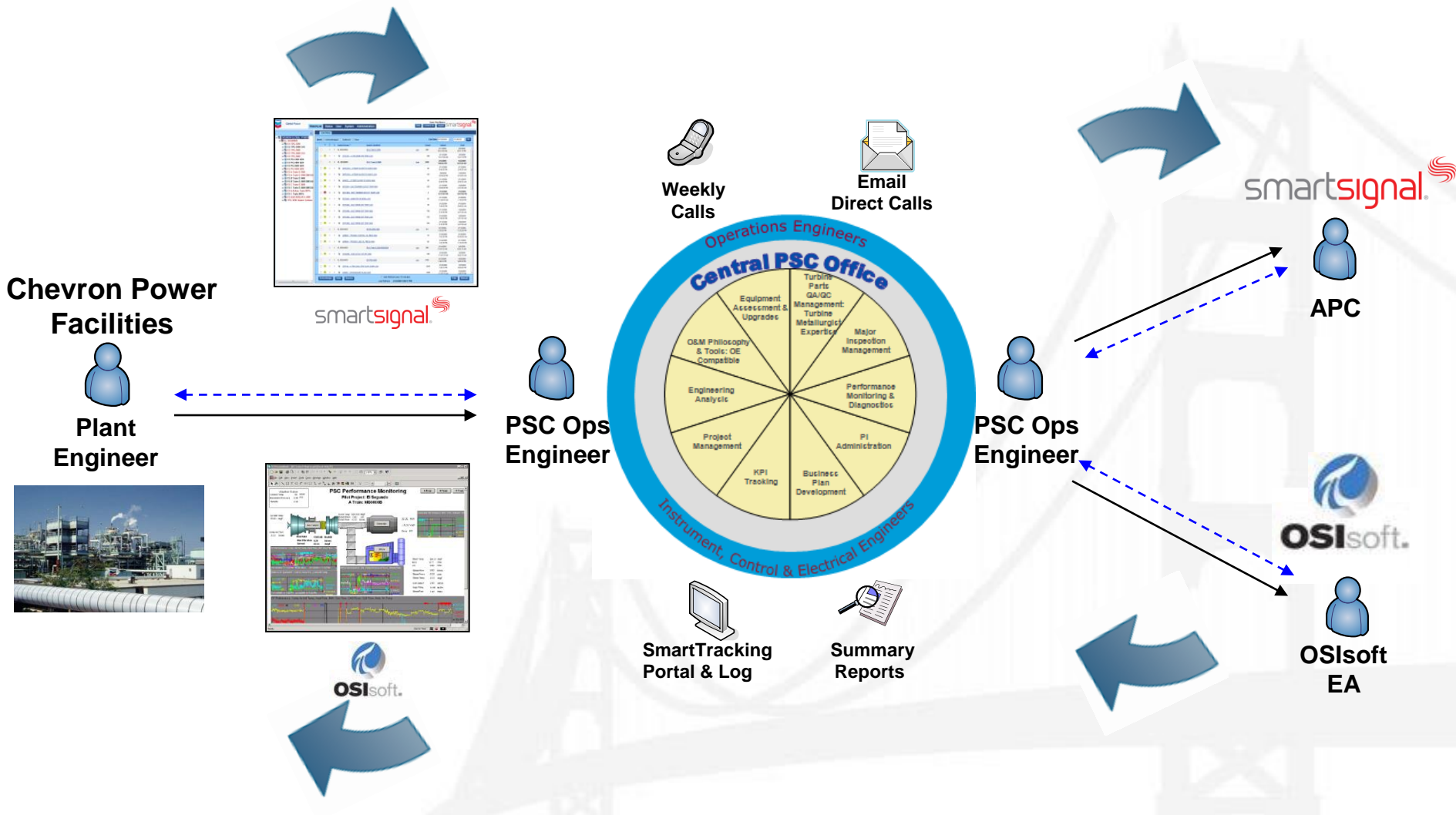
Updates:

- #102 – Mike W. to investigate.
- #103 – Operators are attempting to control stack NOx to a 4 ppm setpoint. In the past the setpoint was lowered to 2 ppm for better control of NH3 injection. The NH3 injection control valve has issues controlling at the low flows needed for 4 ppm stack NOx. The system must either over inject NH3 at a lower NOx setpoint (high slip) or have issues (stack NOx can jump up suddenly) controlling at lower flows with less slip. PSC will investigate NH3 slip and recommend optimum setpoint.

Path forward:

- Find optimal NOx ppm setpoint for SCR efficiency and operability
- Upgrade the SCR system

PSC Performance Monitoring Workflow



Performance Monitoring Value

- **PI** (1 year)
 - **Confirmed** – 3 trip avoidances
 - **Potential** – 6 trip avoidances
 - **Equipment Abnormalities** – Over 70 abnormalities monitored - - - > *long term reliability*
- **SmartSignal** (3 months)
 - **Equipment Abnormalities** - 14 identified that either returned to normal or communications to plant lead to corrective actions. - - - > *long term reliability*
 - **Instrumentation Issues** – Over 35 identified resulting in a potential increase of plant reliability. - - - > *long term reliability*
 - **Efficiency** - 2 efficiency catches resulting in the scheduling of a water wash and NH3 injection reduction.
- **Culture Change**
 - PSC has noticed plant personnel are more cognizant of equipment abnormalities that are not yet urgent.
 - Operational procedures have been modified to prevent less than optimal operational conditions.

Q

&

A