# OSIsoft® UC2010

**Real Time Information** — Currency of the New Decade

Hilton San Francisco Union Square | San Francisco, CA

April 26-28, 2010

# Energy and Process Optimization

Francis Lauryssens
PI Systems Specialist
Sun Chemical Corporation

SunChemical®
a member of the DIC group

# Energy and Process Optimization

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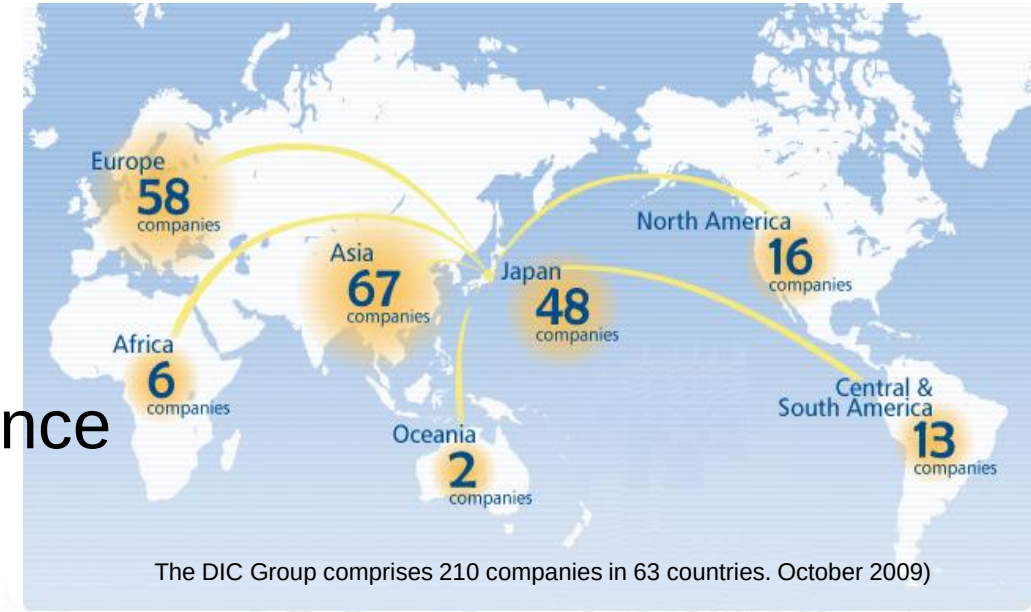
Product Development Lead
Exele Information Systems, Inc

# About “Sun Chemical”

- Chemical Industry
- Sun Chemical is world's largest producer of printing inks and pigments.
- Leading provider of materials to
  - packaging
  - publication
  - coatings
  - plastics
  - cosmetics
  - and other industrial markets

# About “Sun Chemical”

- Annual sales over $3.5 billion
- more than 10,000 employees
- > 210 locations in 63 countries



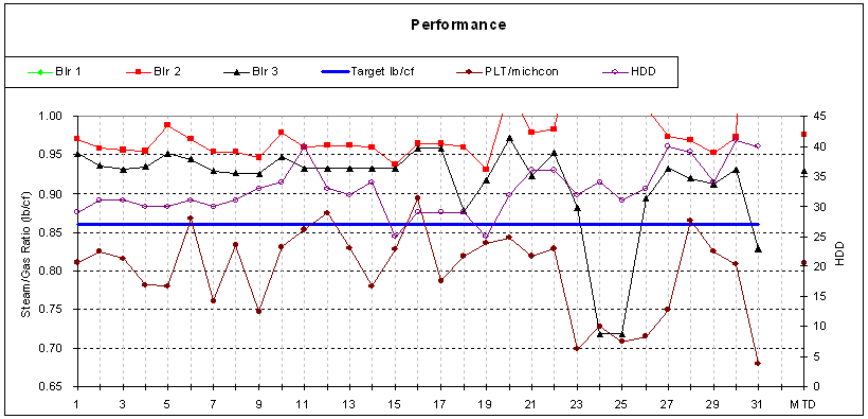
The DIC Group comprises 210 companies in 63 countries. October 2009)

Customer needs:

- improving performance
- improving reliability
- on time delivery
- consistent product quality

# Business Challenge / problem addressed

Create an energy model for the plant that can be used for budgets and set baselines.



# Tasks

- Use real time data for the model
  - Energy was measured weekly by manual meter readings.
  - Where and when is our energy used?
- Display and report energy usage
  - Create dashboards
  - Create reports
- Support Six Sigma energy projects
  - Analyze data for projects
  - Measure projects results (control plan)

# Challenge/problem details

Map utility resources and measure automatically and/or set up a better way to manual entry the data.

Analyze data and verify.

# Solution

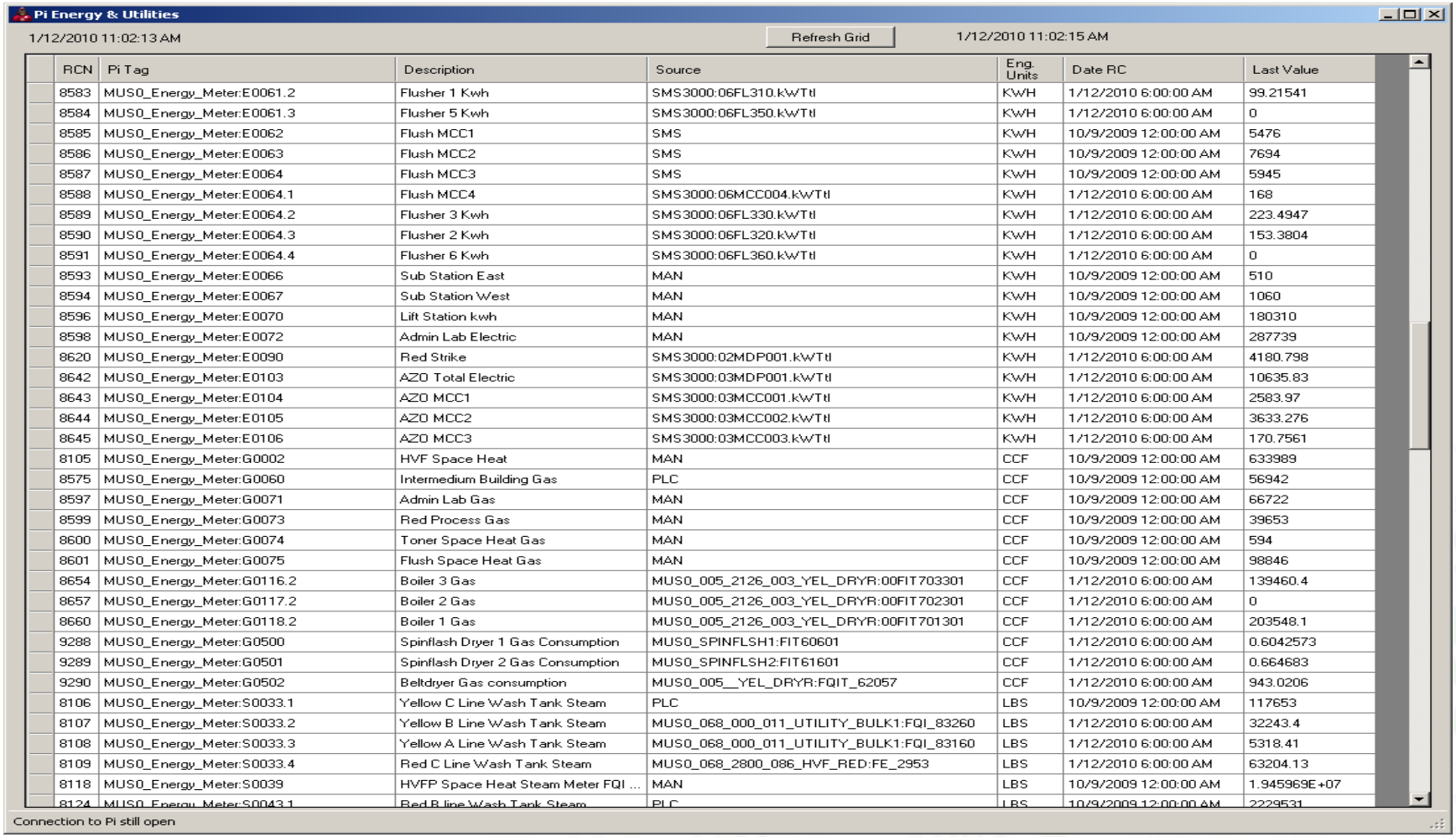
Utilities:

- Electricity: data from PowerLogic through SMS3000 OPC server to PI
- Gas: Flow meters in PI and manual readings
- Steam: boiler house steam production and flow meters in PI

  some manual meter readings
- Water: pump house and flow meters in PI

  more manual meter readings

# In-house development




| RCN | Pi Tag | Description | Source | Eng. Units | Date RC | Last Value |
|---|---|---|---|---|---|---|
| 8583 | MUSO_Energy_Meter:E0061.2 | Flusher 1 Kwh | SMS3000:06FL310.kWTtl | KWH | 1/12/2010 6:00:00 AM | 99.21541 |
| 8584 | MUSO_Energy_Meter:E0061.3 | Flusher 5 Kwh | SMS3000:06FL350.kWTtl | KWH | 1/12/2010 6:00:00 AM | 0 |
| 8585 | MUSO_Energy_Meter:E0062 | Flush MCC1 | SMS | KWH | 10/9/2009 12:00:00 AM | 5476 |
| 8586 | MUSO_Energy_Meter:E0063 | Flush MCC2 | SMS | KWH | 10/9/2009 12:00:00 AM | 7694 |
| 8587 | MUSO_Energy_Meter:E0064 | Flush MCC3 | SMS | KWH | 10/9/2009 12:00:00 AM | 5945 |
| 8588 | MUSO_Energy_Meter:E0064.1 | Flush MCC4 | SMS3000:06MCC004.kWTtl | KWH | 1/12/2010 6:00:00 AM | 168 |
| 8589 | MUSO_Energy_Meter:E0064.2 | Flusher 3 Kwh | SMS3000:06FL330.kWTtl | KWH | 1/12/2010 6:00:00 AM | 223.4947 |
| 8590 | MUSO_Energy_Meter:E0064.3 | Flusher 2 Kwh | SMS3000:06FL320.kWTtl | KWH | 1/12/2010 6:00:00 AM | 153.3804 |
| 8591 | MUSO_Energy_Meter:E0064.4 | Flusher 6 Kwh | SMS3000:06FL360.kWTtl | KWH | 1/12/2010 6:00:00 AM | 0 |
| 8593 | MUSO_Energy_Meter:E0066 | Sub Station East | MAN | KWH | 10/9/2009 12:00:00 AM | 510 |
| 8594 | MUSO_Energy_Meter:E0067 | Sub Station West | MAN | KWH | 10/9/2009 12:00:00 AM | 1060 |
| 8596 | MUSO_Energy_Meter:E0070 | Lift Station kwh | MAN | KWH | 10/9/2009 12:00:00 AM | 180310 |
| 8598 | MUSO_Energy_Meter:E0072 | Admin Lab Electric | MAN | KWH | 10/9/2009 12:00:00 AM | 287739 |
| 8620 | MUSO_Energy_Meter:E0090 | Red Strike | SMS3000:02MDP001.kWTtl | KWH | 1/12/2010 6:00:00 AM | 4180.798 |
| 8642 | MUSO_Energy_Meter:E0103 | AZO Total Electric | SMS3000:03MDP001.kWTtl | KWH | 1/12/2010 6:00:00 AM | 10635.83 |
| 8643 | MUSO_Energy_Meter:E0104 | AZO MCC1 | SMS3000:03MCC001.kWTtl | KWH | 1/12/2010 6:00:00 AM | 2583.97 |
| 8644 | MUSO_Energy_Meter:E0105 | AZO MCC2 | SMS3000:03MCC002.kWTtl | KWH | 1/12/2010 6:00:00 AM | 3633.276 |
| 8645 | MUSO_Energy_Meter:E0106 | AZO MCC3 | SMS3000:03MCC003.kWTtl | KWH | 1/12/2010 6:00:00 AM | 170.7561 |
| 8105 | MUSO_Energy_Meter:G0002 | HVF Space Heat | MAN | CCF | 10/9/2009 12:00:00 AM | 633989 |
| 8575 | MUSO_Energy_Meter:G0060 | Intermedium Building Gas | PLC | CCF | 10/9/2009 12:00:00 AM | 56942 |
| 8597 | MUSO_Energy_Meter:G0071 | Admin Lab Gas | MAN | CCF | 10/9/2009 12:00:00 AM | 66722 |
| 8599 | MUSO_Energy_Meter:G0073 | Red Process Gas | MAN | CCF | 10/9/2009 12:00:00 AM | 39653 |
| 8600 | MUSO_Energy_Meter:G0074 | Toner Space Heat Gas | MAN | CCF | 10/9/2009 12:00:00 AM | 594 |
| 8601 | MUSO_Energy_Meter:G0075 | Flush Space Heat Gas | MAN | CCF | 10/9/2009 12:00:00 AM | 98846 |
| 8654 | MUSO_Energy_Meter:G0116.2 | Boiler 3 Gas | MUSO_005_2126_003_YEL_DRYR:00FIT703301 | CCF | 1/12/2010 6:00:00 AM | 139460.4 |
| 8657 | MUSO_Energy_Meter:G0117.2 | Boiler 2 Gas | MUSO_005_2126_003_YEL_DRYR:00FIT702301 | CCF | 1/12/2010 6:00:00 AM | 0 |
| 8660 | MUSO_Energy_Meter:G0118.2 | Boiler 1 Gas | MUSO_005_2126_003_YEL_DRYR:00FIT701301 | CCF | 1/12/2010 6:00:00 AM | 203548.1 |
| 9288 | MUSO_Energy_Meter:G0500 | Spinflash Dryer 1 Gas Consumption | MUSO_SPINFLSH1:FIT60601 | CCF | 1/12/2010 6:00:00 AM | 0.6042573 |
| 9289 | MUSO_Energy_Meter:G0501 | Spinflash Dryer 2 Gas Consumption | MUSO_SPINFLSH2:FIT61601 | CCF | 1/12/2010 6:00:00 AM | 0.664683 |
| 9290 | MUSO_Energy_Meter:G0502 | Beltdryer Gas consumption | MUSO_005__YEL_DRYR:FQIT_62057 | CCF | 1/12/2010 6:00:00 AM | 943.0206 |
| 8106 | MUSO_Energy_Meter:S0033.1 | Yellow C Line Wash Tank Steam | PLC | LBS | 10/9/2009 12:00:00 AM | 117653 |
| 8107 | MUSO_Energy_Meter:S0033.2 | Yellow B Line Wash Tank Steam | MUSO_068_000_011_UTILITY_BULK1:FQI_83260 | LBS | 1/12/2010 6:00:00 AM | 32243.4 |
| 8108 | MUSO_Energy_Meter:S0033.3 | Yellow A Line Wash Tank Steam | MUSO_068_000_011_UTILITY_BULK1:FQI_83160 | LBS | 1/12/2010 6:00:00 AM | 5318.41 |
| 8109 | MUSO_Energy_Meter:S0033.4 | Red C Line Wash Tank Steam | MUSO_068_2800_086_HVF_RED:FE_2953 | LBS | 1/12/2010 6:00:00 AM | 63204.13 |
| 8118 | MUSO_Energy_Meter:S0039 | HVFP Space Heat Steam Meter FQI ... | MAN | LBS | 10/9/2009 12:00:00 AM | 1.945969E+07 |
| 8124 | MUSO_Energy_Meter:S0043.1 | Red B line Wash Tank Steam | PLC | LBS | 10/9/2009 12:00:00 AM | 2229531 |

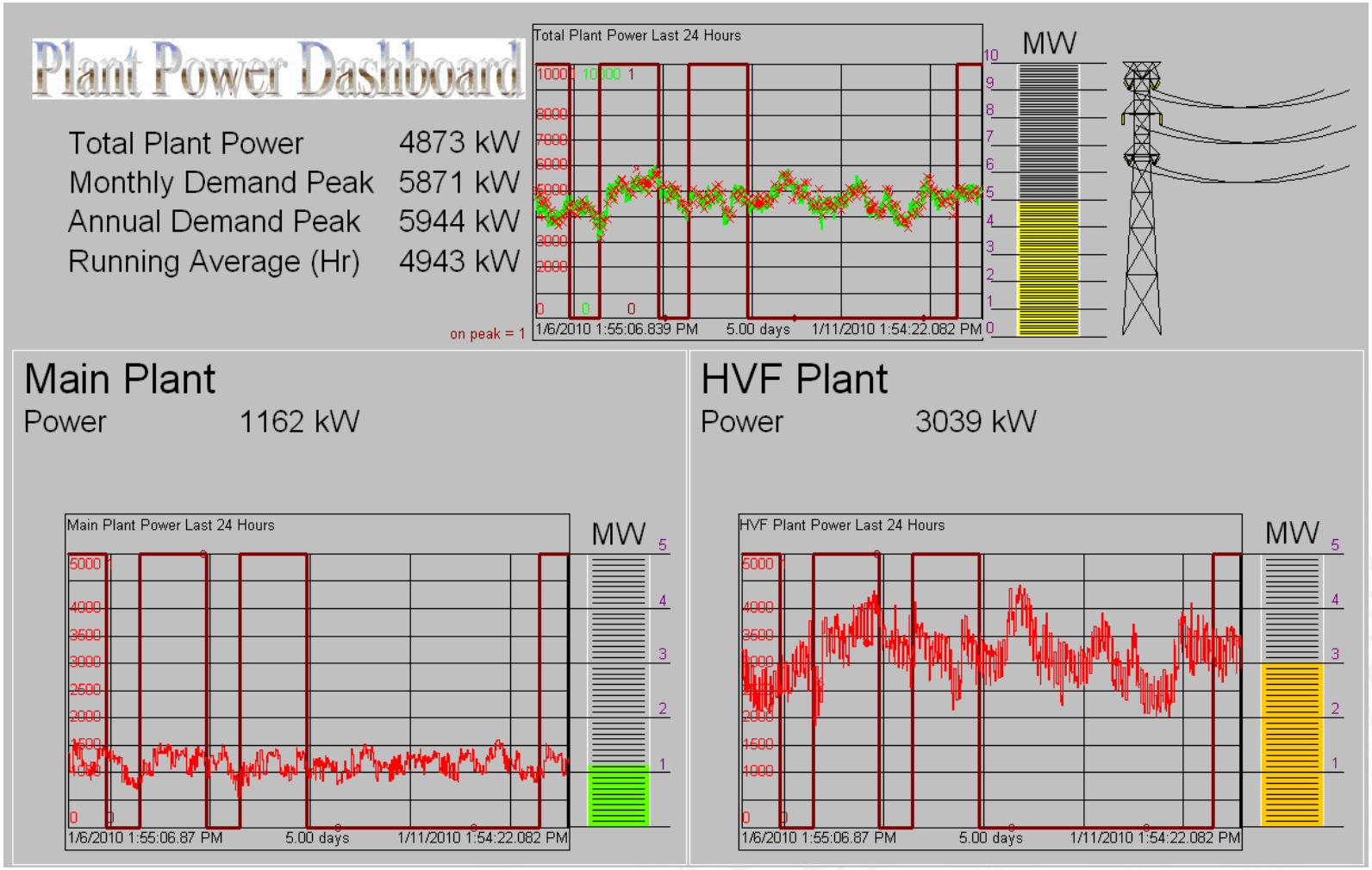
# Electricity

A dashboard that reflects how electricity is billed.

- A contracted usage for the site: 4 Mega Watts peak demand.
- Peak hours from 7 am to 11 pm on weekdays.
- A monthly and annual demand peak based upon 15 minutes and hourly averages and calculations.

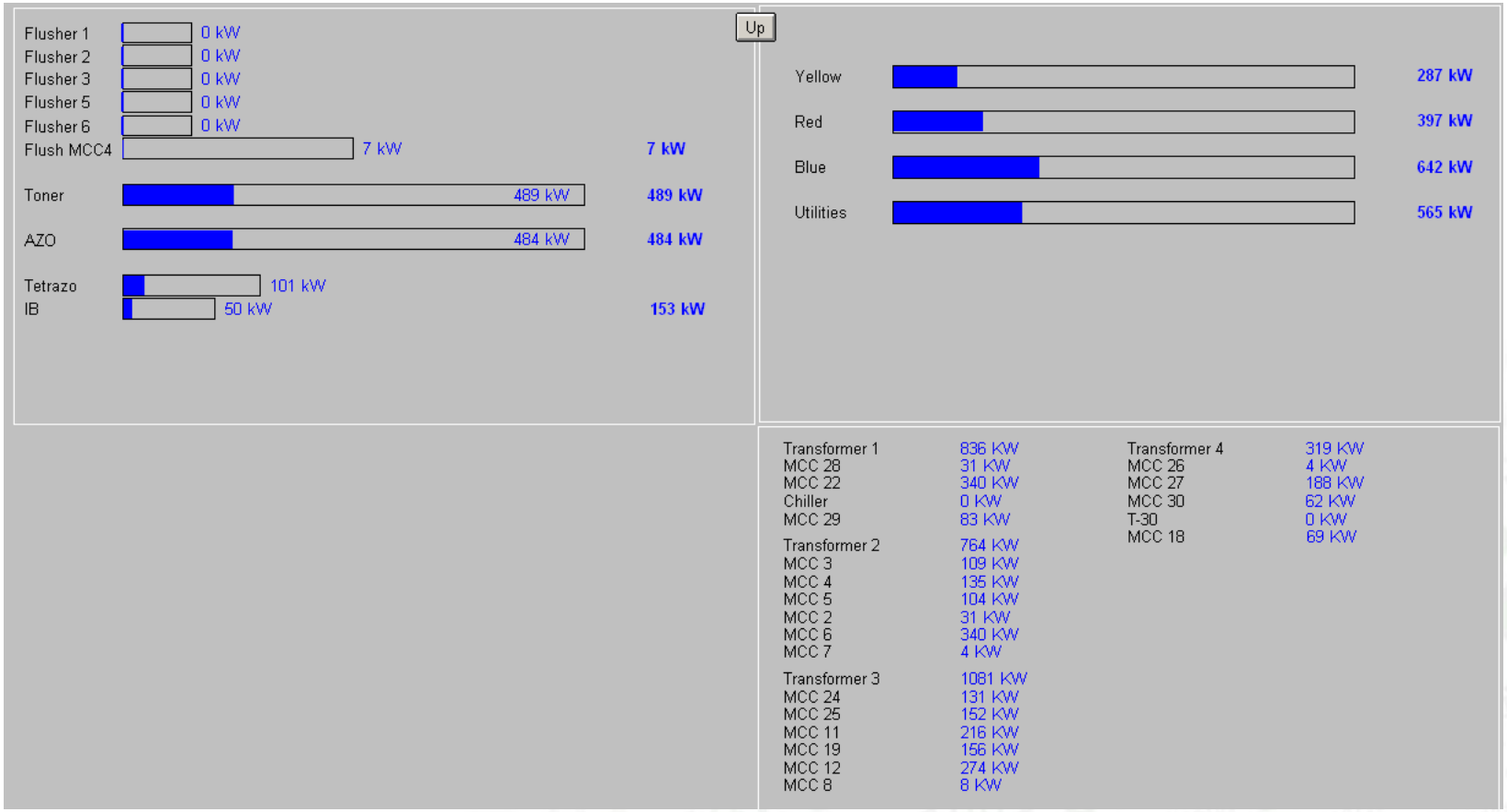
# Power dashboard

Real time data on the power dashboard in PI Processbook



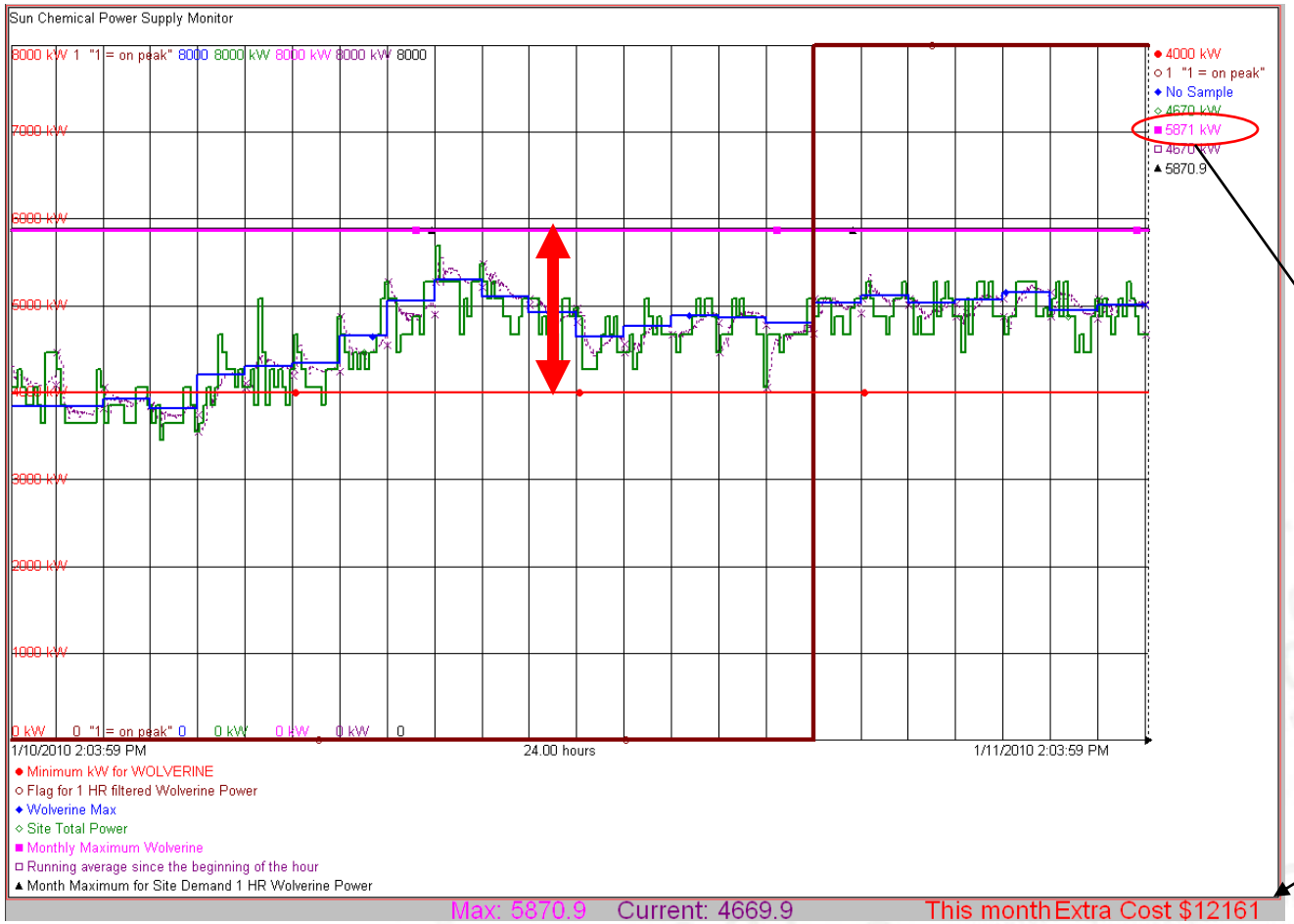
# Plant usages

Break down of the plant usages by department or entity.



# Real time monitoring

Real time energy monitor calculates extra cost




5871 kW

-4000 kW

**1871 kW**

$6.50

$12,161

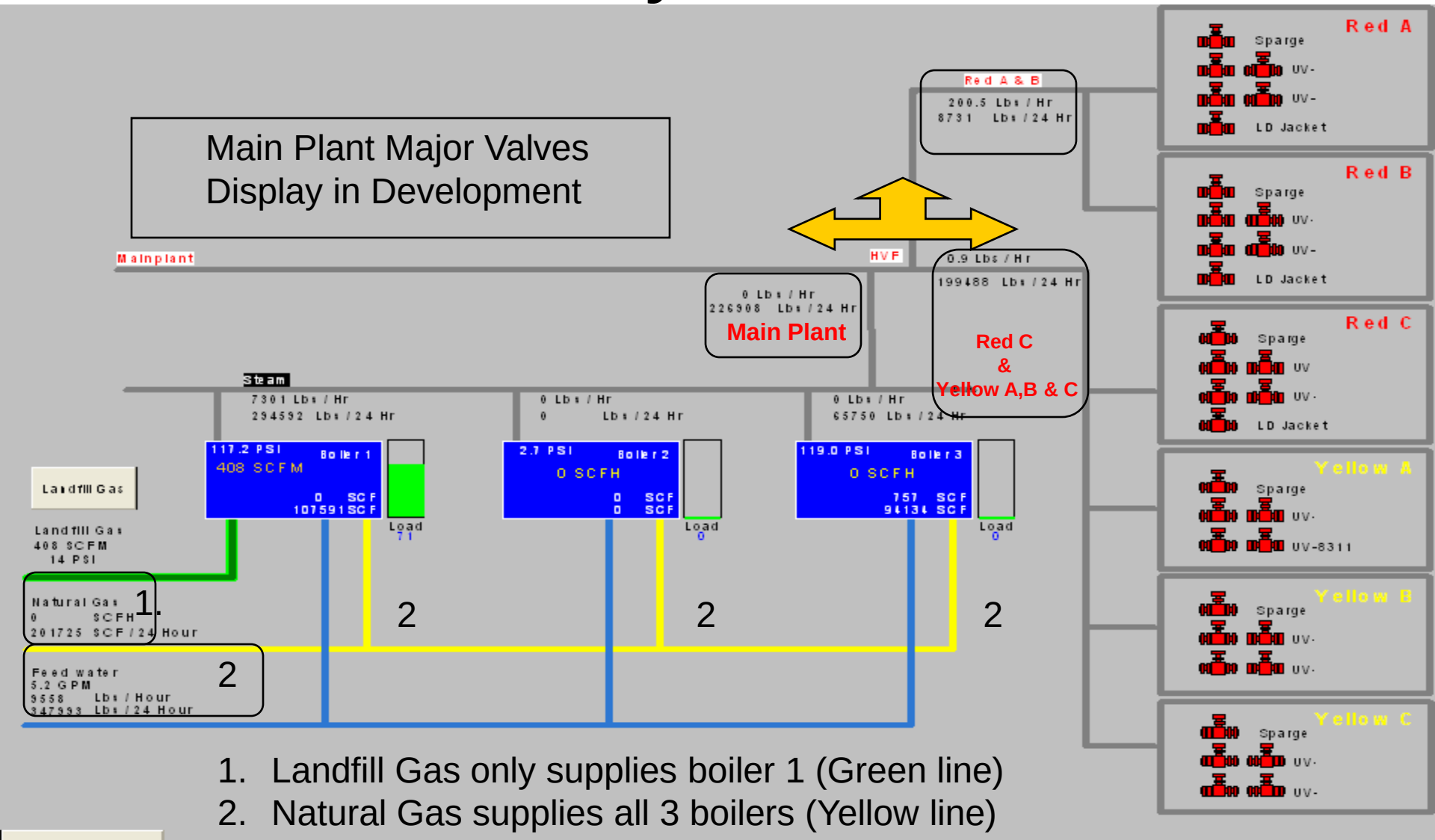
# Gas

New project : landfill gas in the area available.

PI data was used to calculate how much gas we used and how much we could replace with landfill gas to save money.

- Landfill gas not used by our neighbor would be available to Sun Chemical.
- Savings in cheaper gas and no transportation costs.
- 1 Boiler was converted to consume landfill gas.

# Overview of Steam System

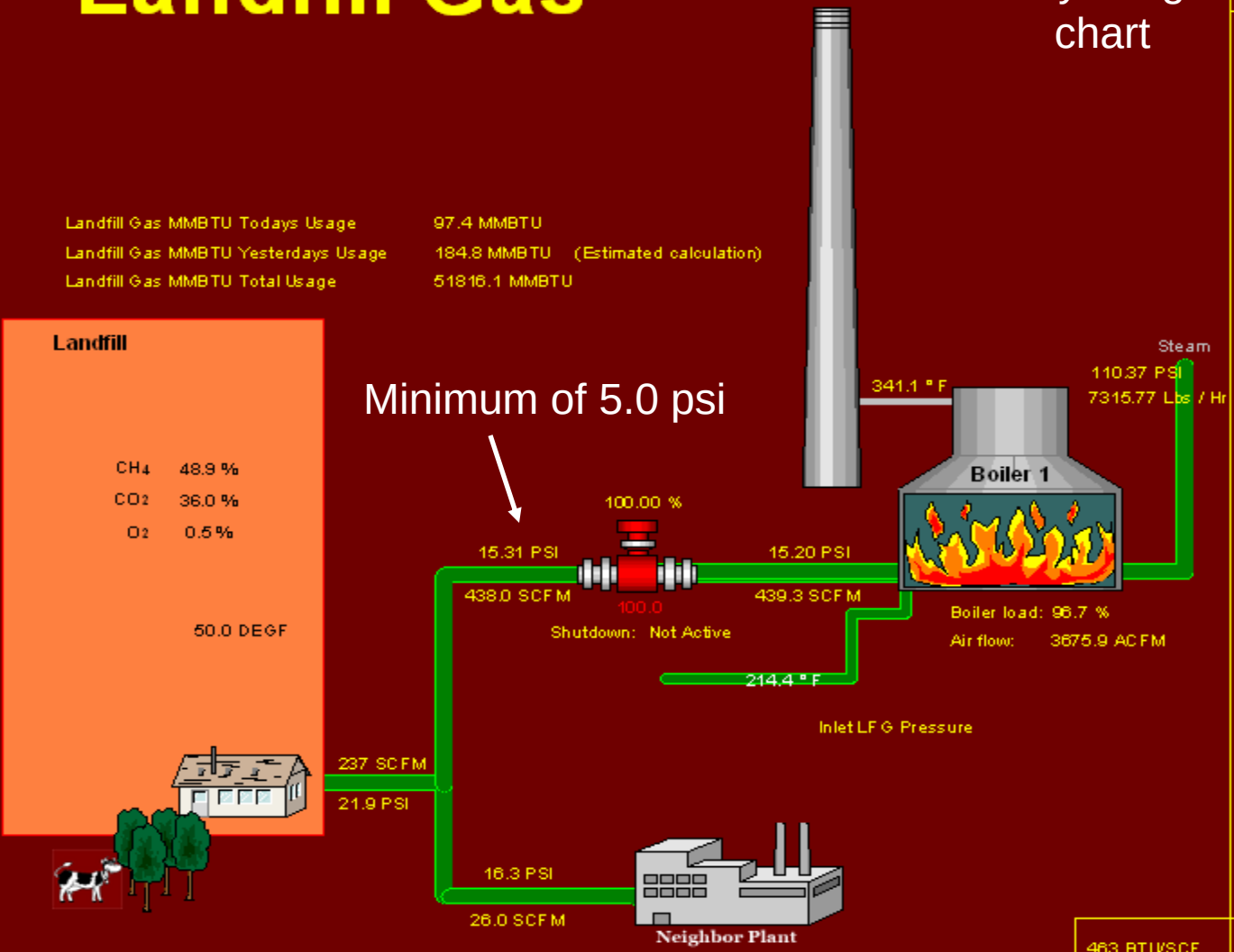



1. Landfill Gas only supplies boiler 1 (Green line)
2. Natural Gas supplies all 3 boilers (Yellow line)

# Landfill Gas

Daily usage chart

Landfill Gas MMBTU Todays Usage 97.4 MMBTU
Landfill Gas MMBTU Yesterdays Usage 184.8 MMBTU (Estimated calculation)
Landfill Gas MMBTU Total Usage 51816.1 MMBTU




| October | 2009 | | |
|---|---|---|---|
| | Landfill gas | Landfill gas counter | Natural gas |
| 1 | 371198 SCF | 50817 MMBTU | 104000 SCF |
| 2 | 366868 SCF | 50994 MMBTU | 118159 SCF |
| 3 | 515699 SCF | 51159 MMBTU | 0 SCF |
| 4 | 273774 SCF | 51462 MMBTU | 0 SCF |
| 5 | 396239 SCF | 51543 MMBTU | 47830 SCF |
| 6 | 419033 SCF | 51707 MMBTU | 122511 SCF |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |
| 16 | | | |
| 17 | | | |
| 18 | | | |
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| 21 | | | |
| 22 | | | |
| 23 | | | |
| 24 | | | |
| 25 | | | |
| 26 | | | |
| 27 | | | |
| 28 | | | |
| 29 | | | |
| 30 | | | |
| 31 | | | |
| 463 BTU/SCF | Total 2,114,850 SCF | 990 MMBTU | 330,273 SCF |

# Improvements realized

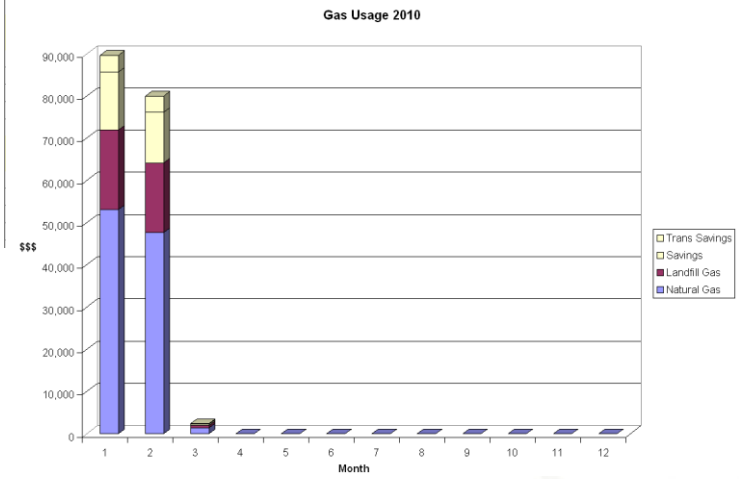
Optimizing boiler house operations:

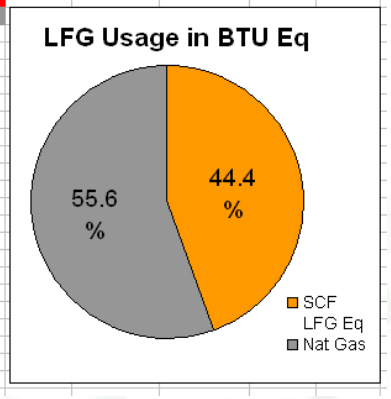
- Major steam leaks were identified and repaired.
- Boiler 2 was shutdown.
- Reduced pressure on boiler 3 to minimize natural gas usage.
- Increased the allowable steam header pressure on boiler 1 to maximize landfill gas.
- Requested a 2 psi pressure increase from the county.
- Increased allowable load on the landfill gas boiler from 60% to 80% to maximize usage of landfill gas.
- Adjusted controls on boiler 1 to keep boiler running during low landfill gas conditions.

# Gas: savings report

| Landfill gas | | | | Year 2010 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | January | February | March | April | May | June | July | August | September | October | November | December | Totals | | |
| | Nymex | 5.814 | 5.274 | 4.816 | | | | | | | | | | | | |
| Boiler 1 | SCF LFG | 11818068 | 13106100 | 425785 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25349952 | 25349952 | 61.5% |
| Boiler 1 | MMBTU | 5597 | 5409 | 191 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11196 | | |
| Boiler 1 | Nat Gas | 4364818 | 4572997 | 148414 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9086230 | 15883580 | 38.5% |
| Boiler 2 | Nat Gas | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | | |
| Boiler 3 | Nat Gas | 3546331 | 3159639 | 91330 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6797300 | | |
| Boiler 1 Eq | % LFG | 57.5% | 58.9% | 58.9% | | | | | | | | | | SCF LFG Eq | 12674975.98 | 44.4% |
| All BTU Eq | % LFG | 42.8% | 45.9% | 47.0% | | | | | | | | | | Nat Gas | 15883580 | 55.6% |
| | Nymex 2009 | 6.136 | 4.476 | 4.056 | 3.631 | 3.321 | 3.538 | 3.949 | 3.379 | 2.843 | 3.73 | 4.289 | 4.486 | | | |
| | Nat Gas $$$ | 53,087 | 47,601 | 1,363 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 102,051 | |
| | Landfill $$$ | 18,872 | 16,545 | 533 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 35,950 | |
| | Total Gas $$$ | 71,960 | 64,146 | 1,896 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 138,001 | 138,001 |
| | Saving $$$ | 13,666 | 11,981 | 386 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 26,033 | |
| | T Savings $$$ | 4030 | 3894 | 137 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | 8,061 | 34,094 |
| | Monthly Savings | 17696 | 15875 | 523 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| | YTD Savings | 17696 | 33571 | 34094 | 34094 | 34094 | 34094 | 34094 | 34094 | 34094 | 34094 | 34094 | 34094 | | | |

| | Boiler 1 SCF LFG | Boiler 1 Ctr MMBTU | Boiler 1 Nat Gas | Boiler 2 Nat Gas | Boiler 3 Nat Gas | Projected Saving | LFG MMBTU | Totals for the month SCF LFG | Totals for the month Ctr MMBTU | Boiler 1 Nat Gas | Boiler 2 Nat Gas | Boiler 3 Nat Gas |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/1/2010 | 107485 | 2024 | 87776 | 0 | 7599 | -139.46 | 53 | | | | | |
| 1/2/2010 | 109956 | 2076 | 86797 | 0 | 5126 | -233.91 | 54 | | | | | |
| 1/3/2010 | 115260 | 2130 | 86905 | 0 | 5588 | -230.08 | 58 | | | | | |
| 1/4/2010 | 171952 | 2188 | 65673 | 0 | 8180 | -109.74 | 82 | | | | | |
| 1/5/2010 | 345241 | 2270 | 66739 | 0 | 64469 | -25.95 | 166 | | | | | |
| 1/6/2010 | 415921 | 2436 | 160942 | 0 | 94619 | 4.39 | 196 | | | | | |
| 1/7/2010 | 434911 | 2633 | 114658 | 0 | 108619 | 15.61 | 208 | | | | | |



# Steam

Steam is measured when produced in the boiler house and some reports (for one department) exist that calculate the usage of steam per batch.

Using less steam can be accomplished by:

- Fixing steam leaks
- Knowledge of the process and reduce usage.

# Steam

- Process Optimization is key to save more.
- Better scheduling by improving FPY and cycle times.
- Higher FPY by removing variation and waste.
- High quality and happy customers

# PI ProcessTemplates Project

Providing our customers quality, service and innovation  is our Quality Statement.

Exele PI Process Templates Project

- Chartered in 2009
- Improve the First Pass Yield in strike department.

# Before PI ProcessTemplates

- Using PI software for about 10 years.
- Abundance of data and history.
- Difficult to analyze and time consuming .
- Reactive approach to investigating process upsets.
- A rear view mirror of what happened.

# After PI ProcessTemplates

- Building on our event history (PI Batch)
- Builds a “visual roadmap” of a process by displaying upper and lower control limits from historical data.
- Shows where the process is versus where the process is supposed to be.
- Critical to Quality parameters such as pH, temperature, transfer rates, etc…

# Benefits of PI ProcessTemplates

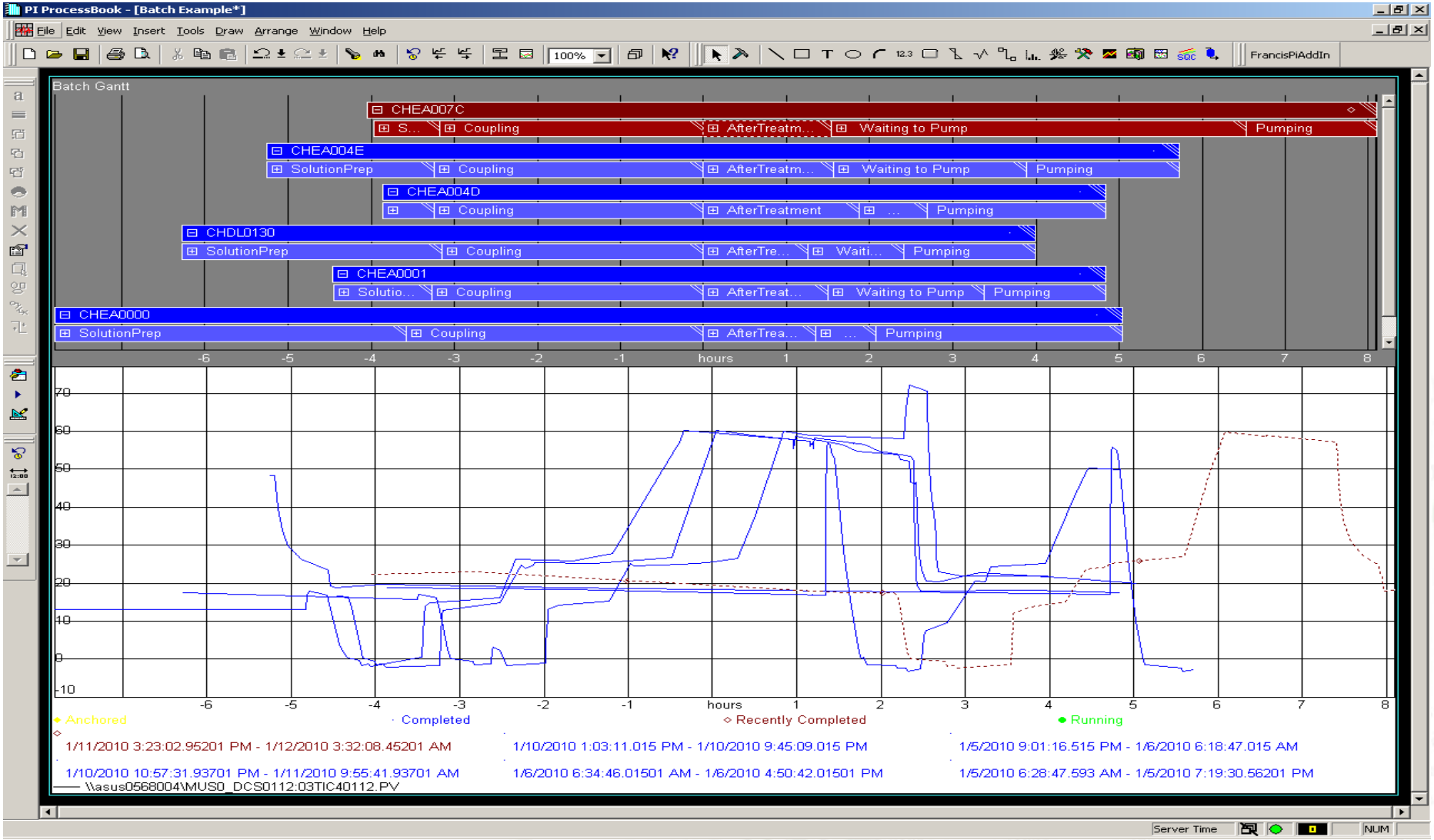
- 6 to 9 Critical-To-Quality parameters for each of over 70 codes made in the department were “templated”.
- A visual roadmap of the expected process makes analysis timely and easy.
- Batches are reviewed with operators upon completion. This interaction is critical to learning every day what does and what doesn’t make our processes work.
- Potential process upsets are alarmed in real time; therefore decisions can be made in real time. A proactive approach to avoiding process upsets.

# Defining events for ProcessTemplates

Template limits applied during “events”

- **PI-Batch support**
  - SubBatch and tag expression filters
- **ExpressionEvents**
  - Event definition using PI tag expressions
  - Dynamic: event start/end times determined real-time
  - Flexible: event start and end times can be changed after the event completes
  - Non-batch customer support
  - Batch customers have new event tool

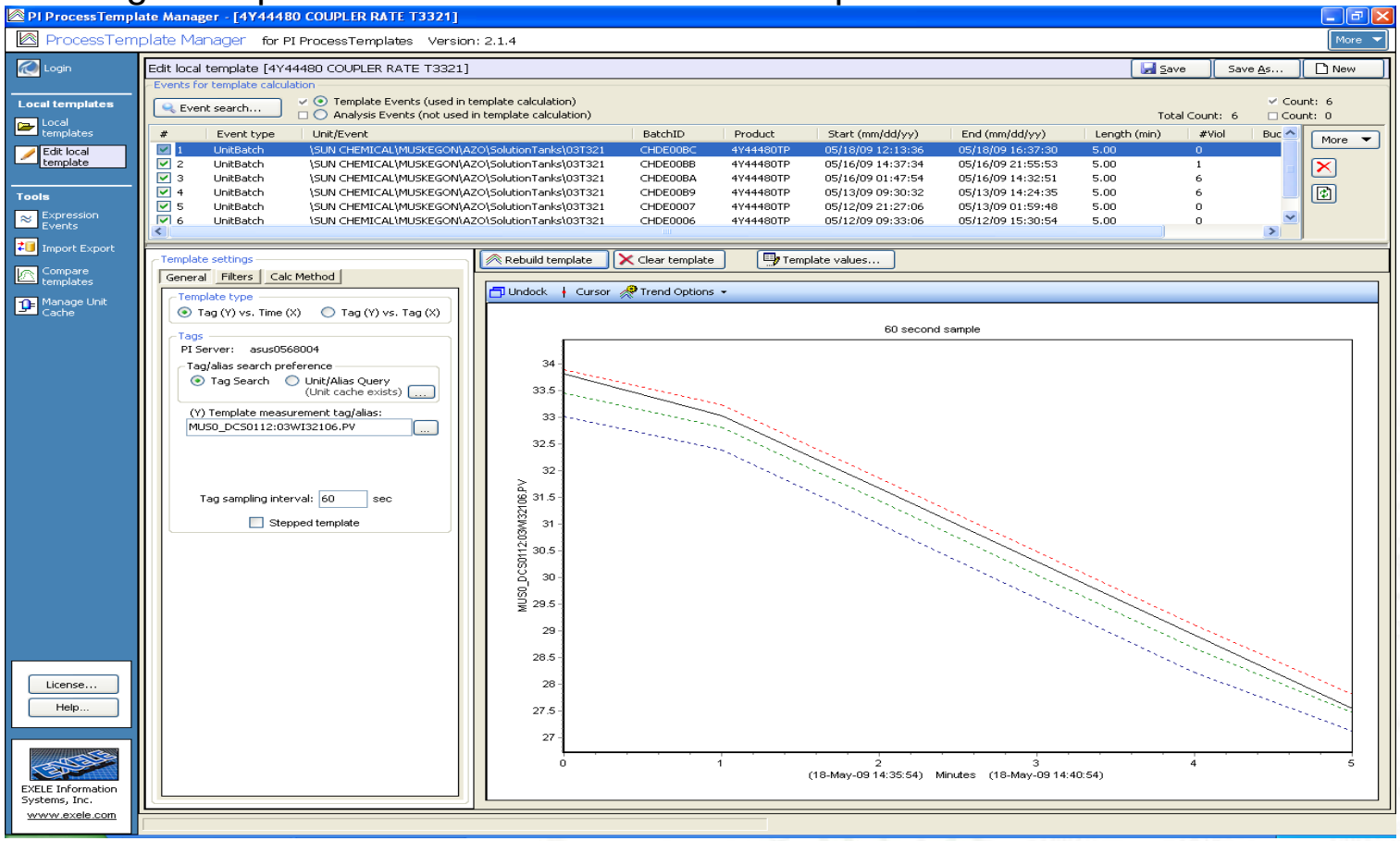
# Batch View and Trends



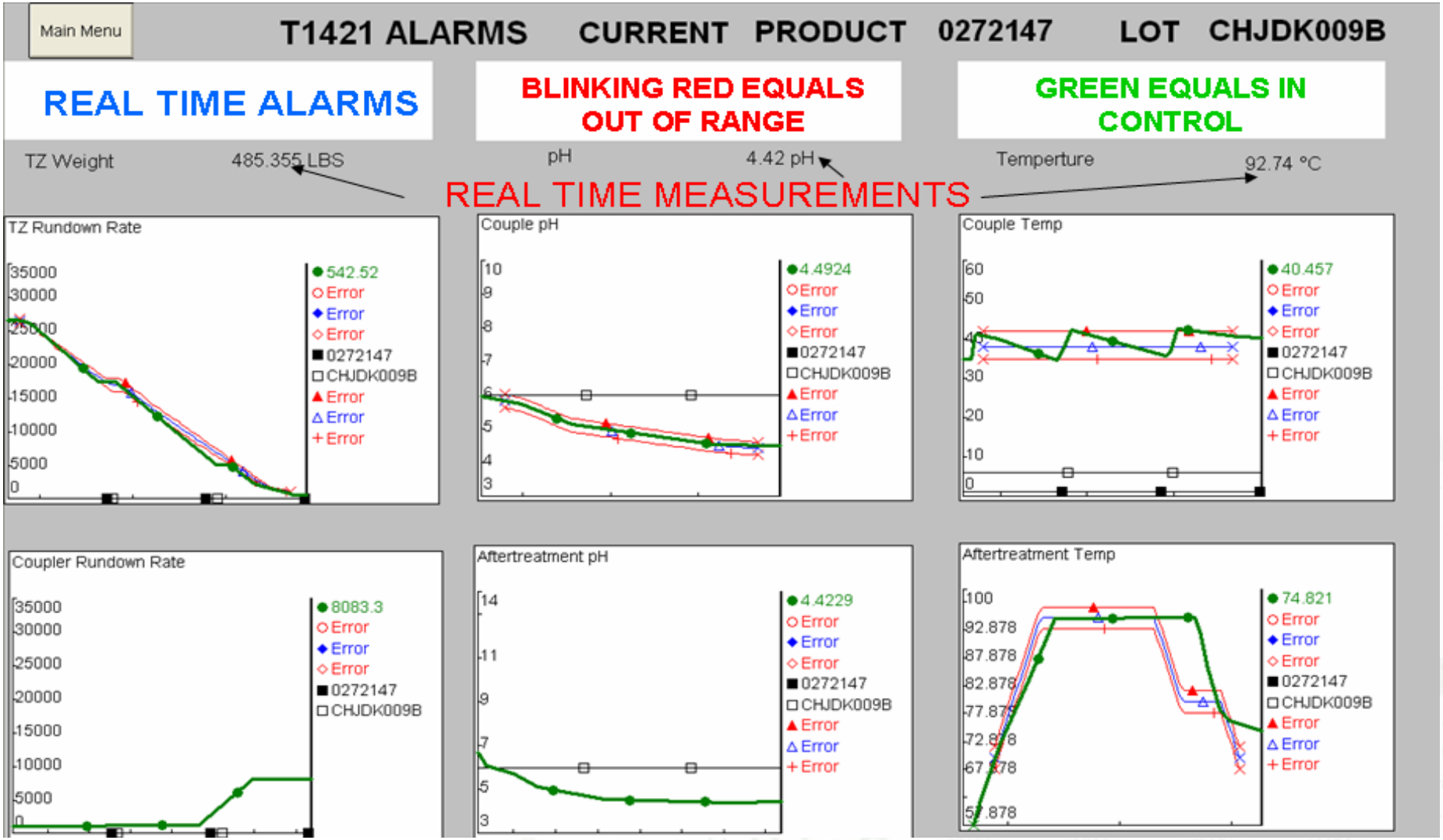
# Template creation

## More than 1100 templates running

Building a template from batch/event data or expression events.



# Real-time Templates in ProcessBook

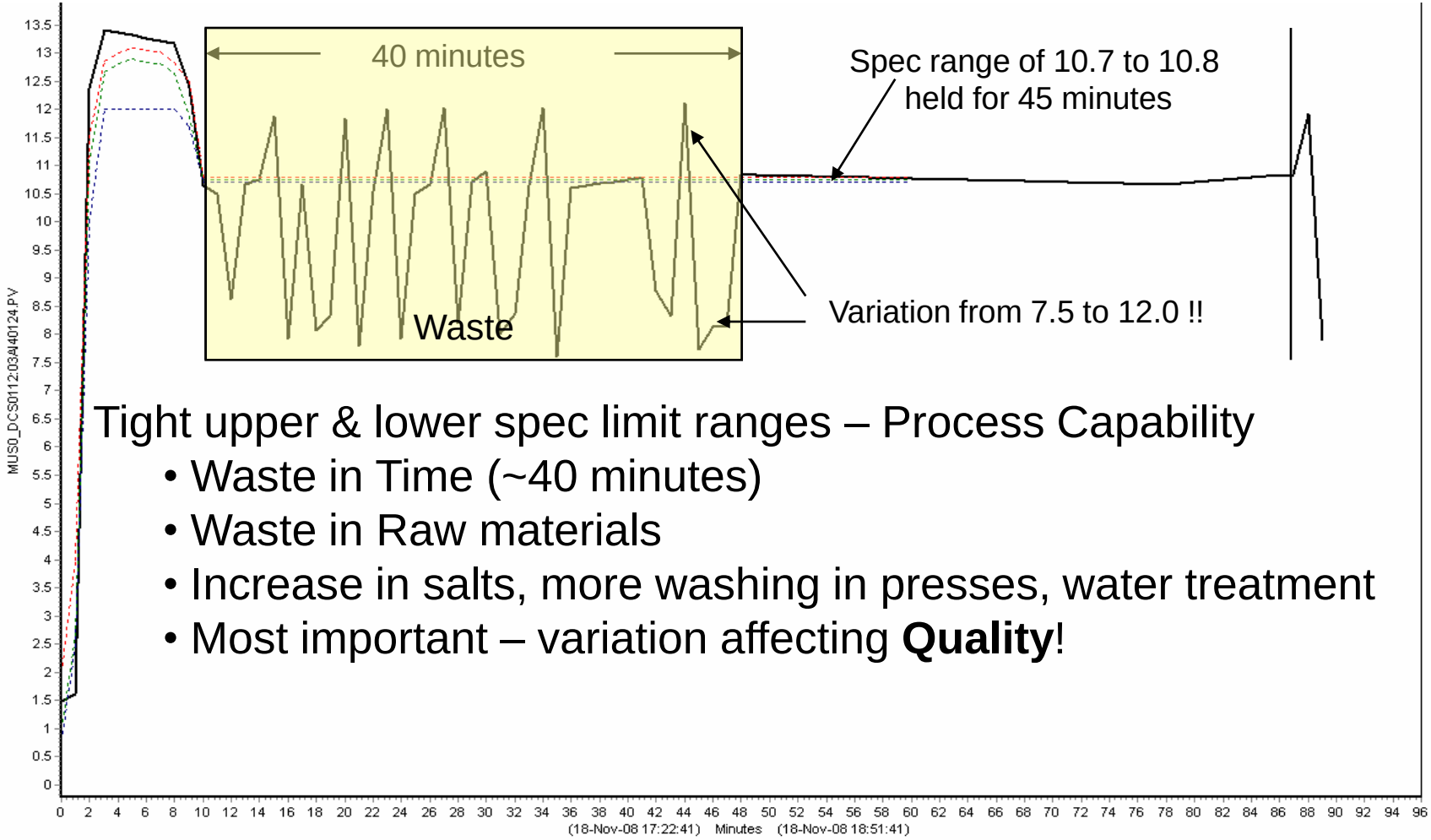


# Continuous Improvement Examples

- pH specification range : 10.7 to 10.8.
  - The control system struggled to maintain the pH.
  - ProcessTemplates highlighted an opportunity
    - decrease wasted raw materials
    - decrease wasted time associated with repeated over corrections.
- Historically, this code suffered from poor quality.

(see next slide)

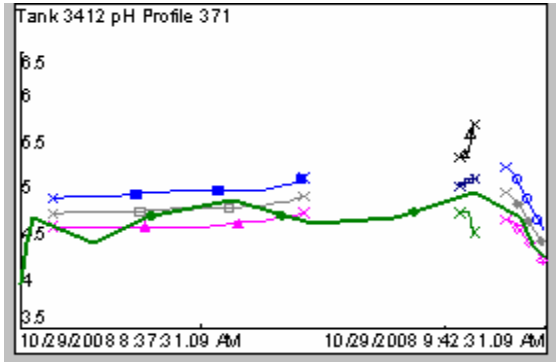
# Automated process controlling pH

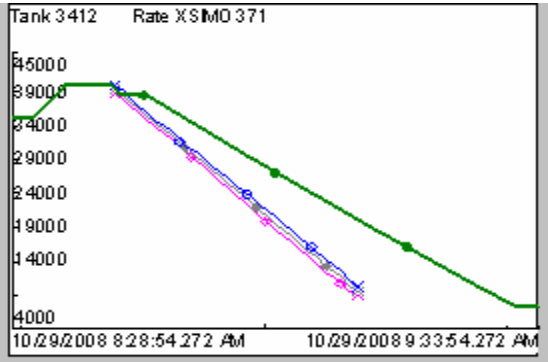


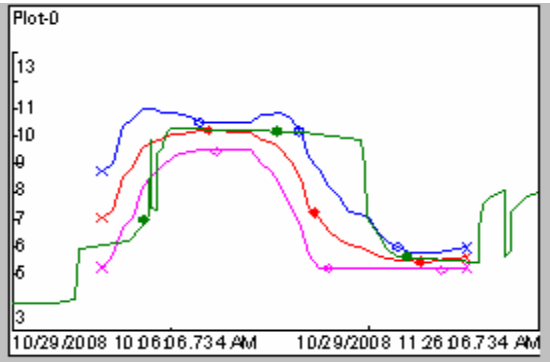

Tight upper & lower spec limit ranges – Process Capability

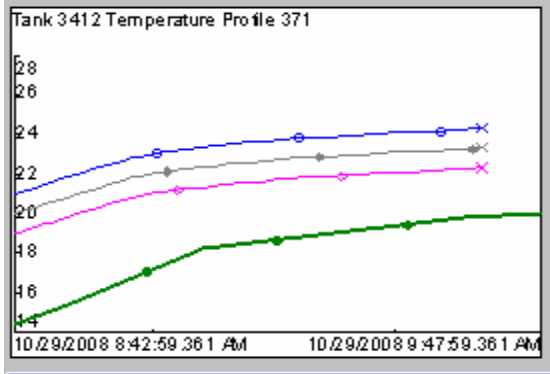
- Waste in Time (~40 minutes)
- Waste in Raw materials
- Increase in salts, more washing in presses, water treatment
- Most important – variation affecting **Quality**!

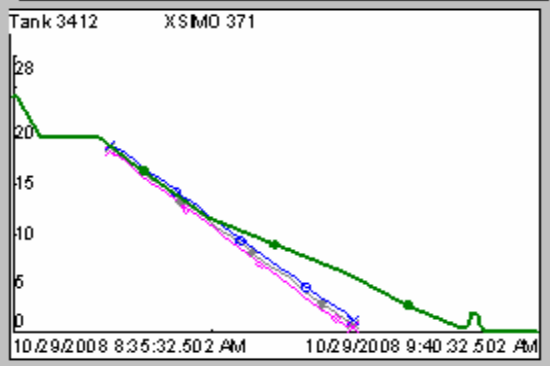
# Continuous Improvement Examples

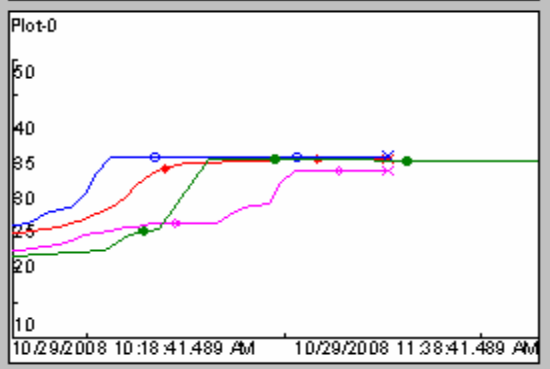


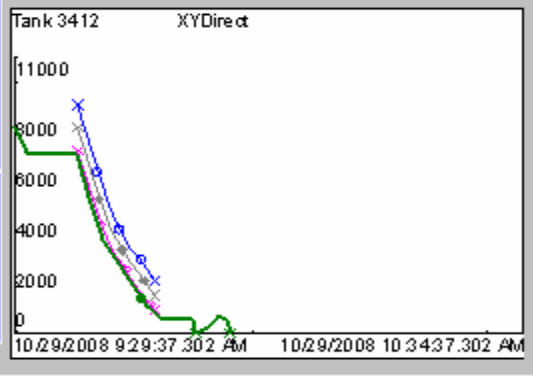



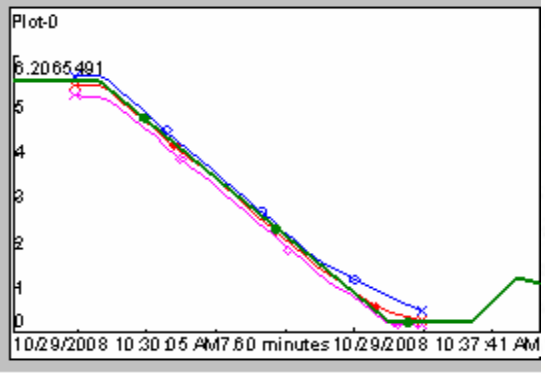




| | | |
|---|---|---|
| pH ALARM | Inactive | 8.24 |
| TEMP ALARM | Inactive | 35.3 |
| RUNDOWN RATE ALARM | Inactive | 25532 |
| A RUNDOWN RATE ALARM | Inactive | 15.738 |

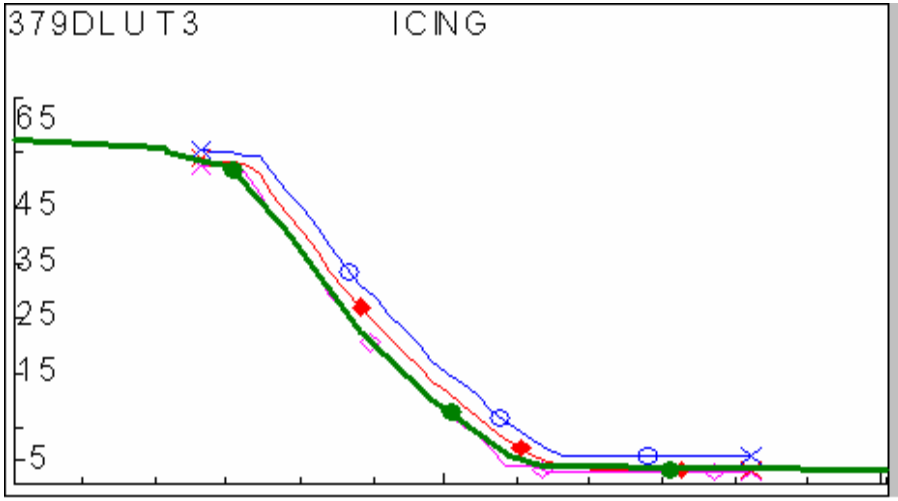
371 Coupling Template for 3412

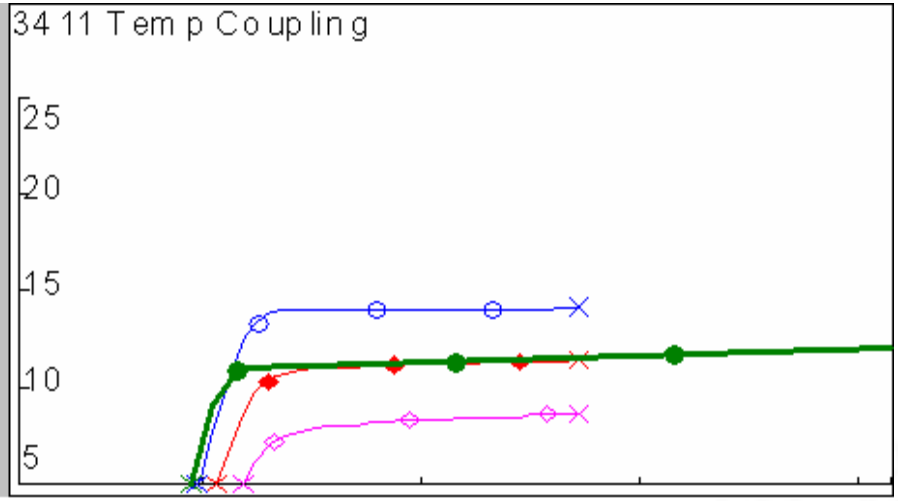
Waiting to Pump02 Y3371TL CHCJ0250 RUNNING

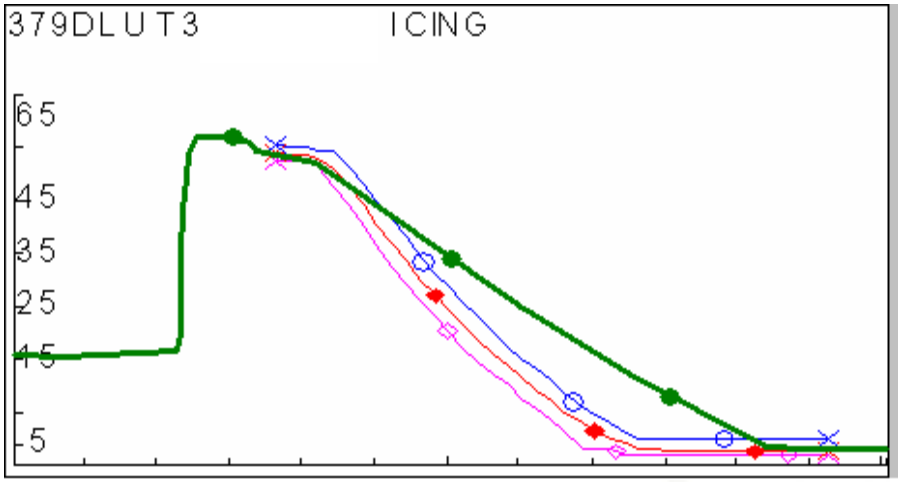


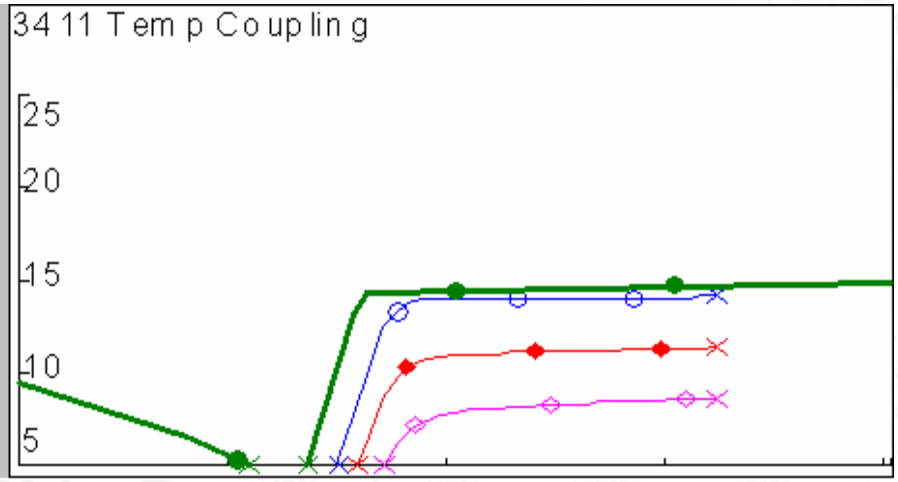



# Continuous Improvement Examples



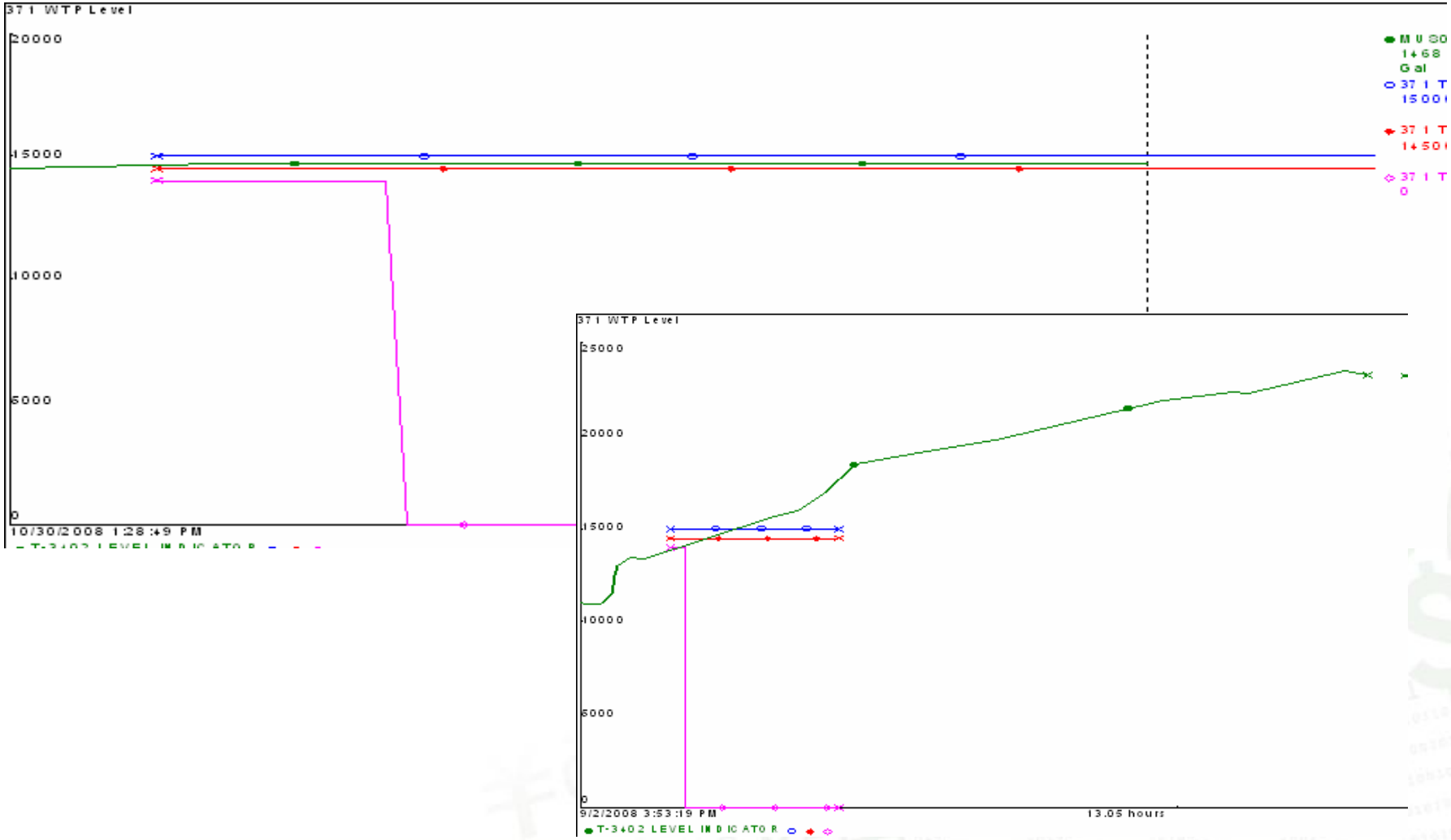



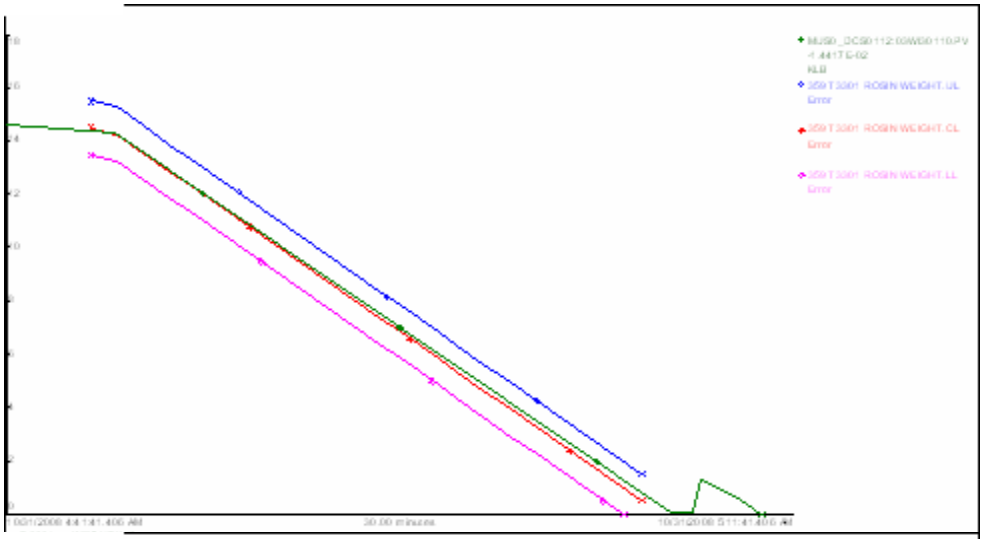



# Continuous Improvement Examples

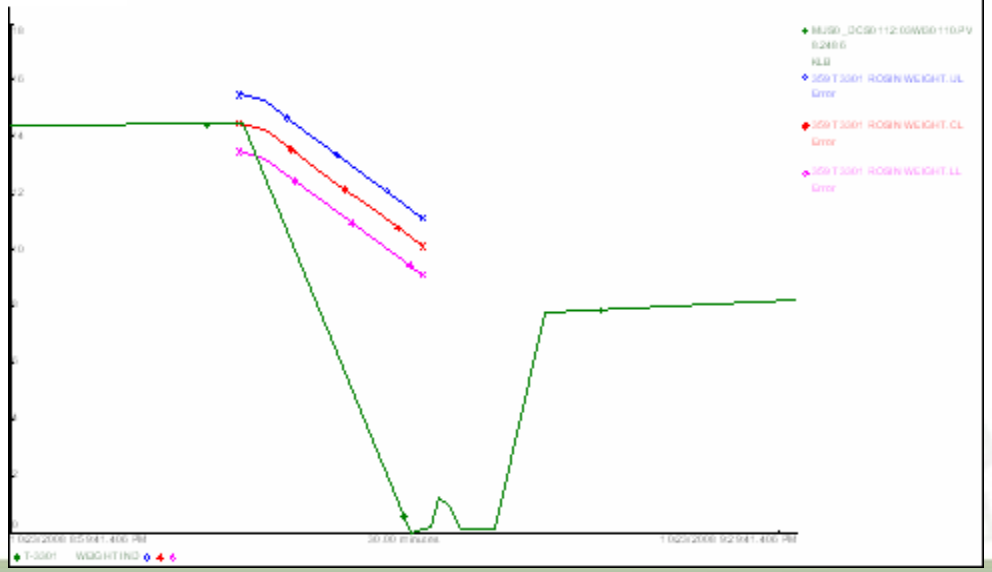
Volume control at the end of a batch



# Continuous Improvement Examples



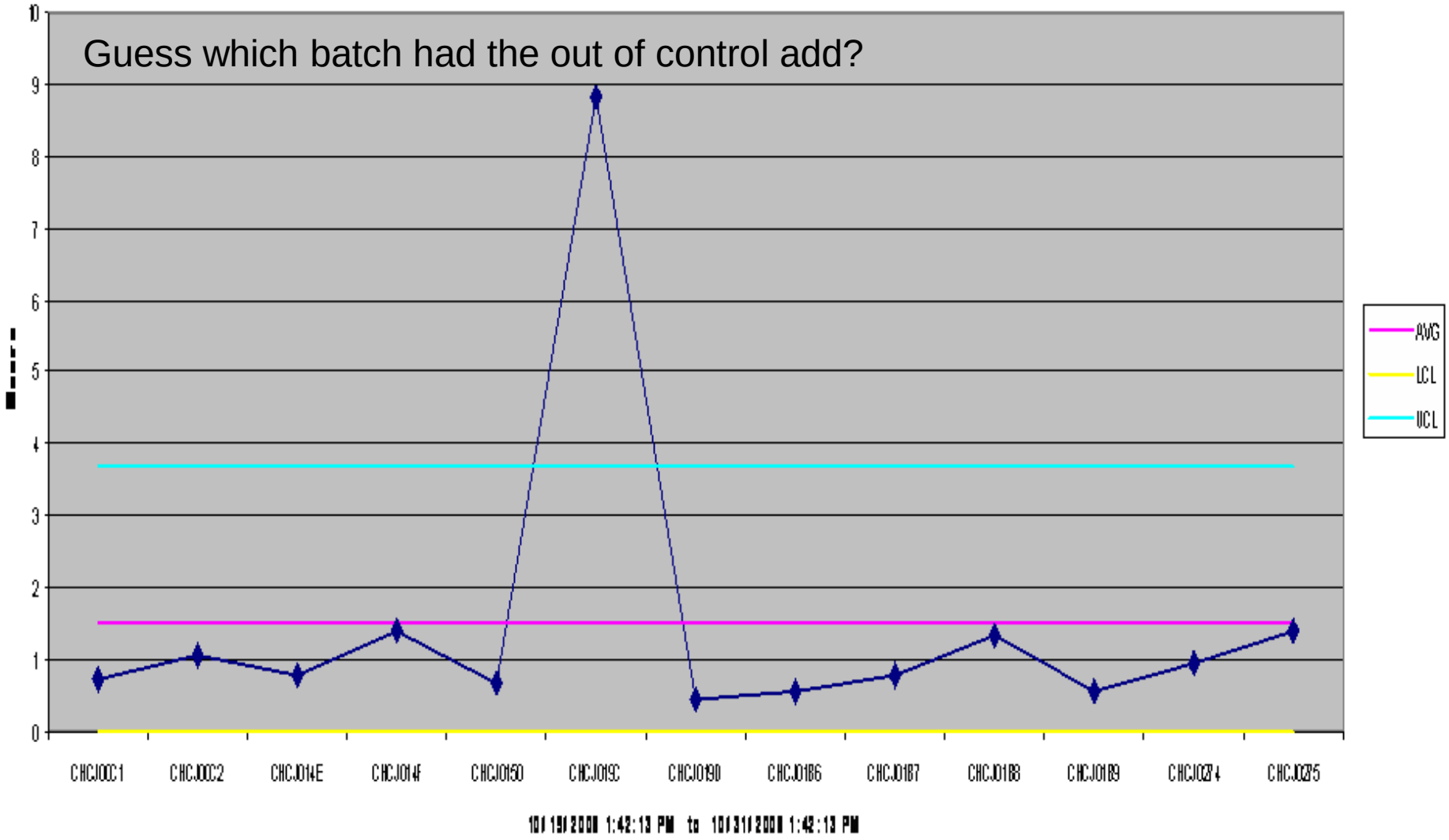
needs to be added over 20 minutes



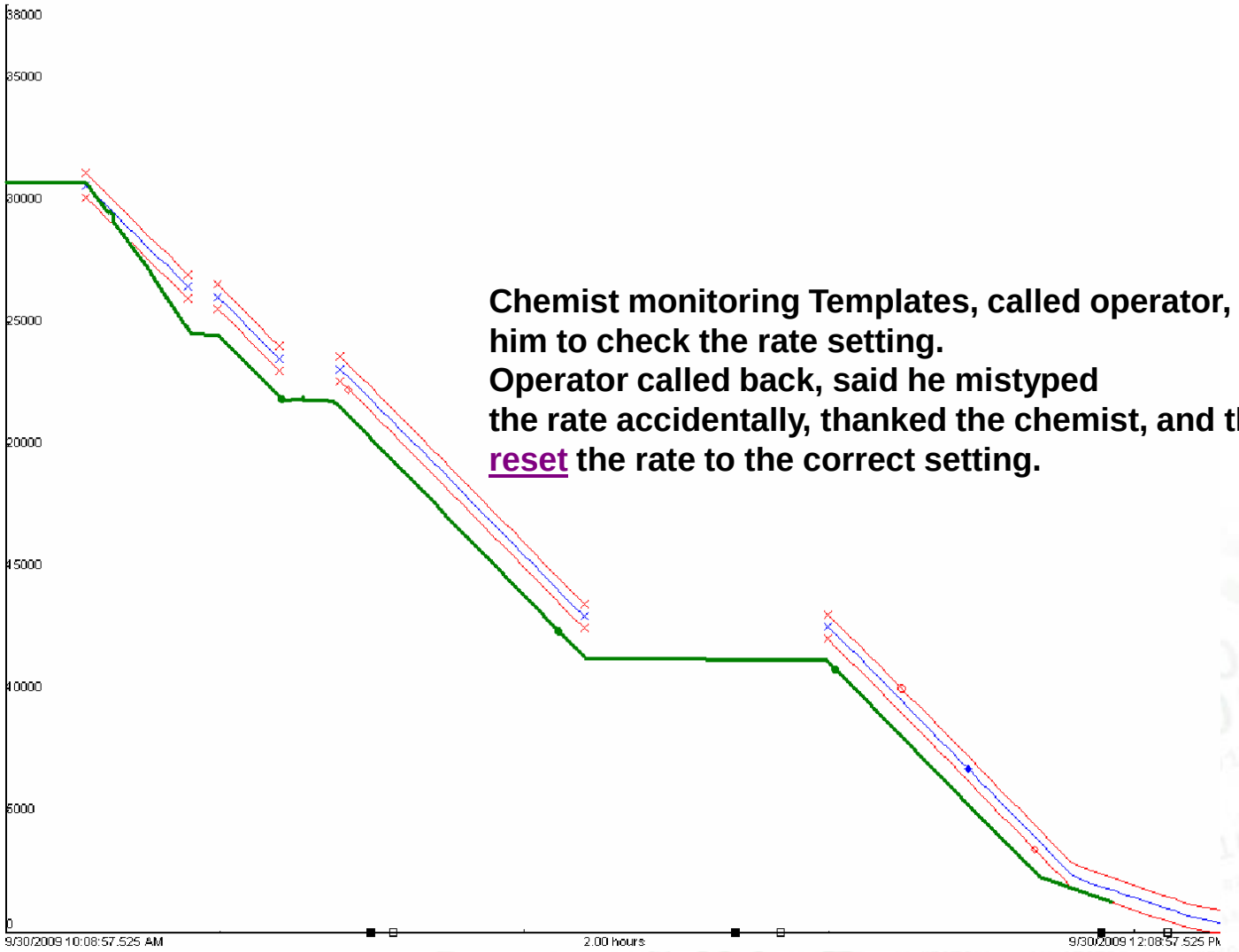
was added over 5 minutes

Does this affect anything?

# Continuous Improvement Examples



# Continuous Improvement Examples




**Chemist monitoring Templates, called operator, asked him to check the rate setting.**
**Operator called back, said he mistyped the rate accidentally, thanked the chemist, and then reset the rate to the correct setting.**

# Template Storage and Retrieval

Templates are primarily static data

<u>Challenge: configuration retrieval times</u>

- Over 1200 Monitors
- Over 1400 Templates (Changes Daily)
- Real-time monitoring:
  - Startup time (reading templates) monitor
  - Check for configuration changes
- Clients (ProcessBook):
  - Startup: load of configuration information into DataSets
  - ProcessBook display open: retrieval of template limits into displays

# Template Storage and Retrieval

Results

- Real-time monitoring:
  - Reduced startup time
  - Check for configuration changes (sub-second)

- Clients (ProcessBook):
  - Startup: load of configuration information into DataSets (3X improvement)
  - ProcessBook display open: retrieval of template limits into displays (15X improvement)

# What's next?

- Continued improvements in strike department
  - Detailed custom templates for specific codes
  - Process Capability improvements
- Next process?
  - More departments are waiting.
  - Our High Volume Plant
- Other uses
  - Mechanical Integrity / Calibration Analysis
  - Energy consumption
  - HSE alarming

# OSIsoft Software and Services

- PI System with 15000 tags
- Using PI Processbook, Batch Generator and BatchView, DataLink, PI Manual Logger, SQC, PISDK, PIOLEDB, PIODBC

# Partner Software and Services

Exele PI-Process Templates

EXELE Information Systems, Inc.

Cost effective solutions for the process industries

585 • 385 • 9740 (USA)

# PI System Architecture

- Two separate control networks:
  - Mainplant controls:
    - DCS communicating = OPC to PI
    - Fix32 SCADA nodes
  - High Volume controls:
    - Fix32 SCADA nodes
    - SMS3000 OPC = Power Logic

# Tangible Benefits

- FPY improvement
  - Goal for 2009 was to improve 20% on FPY
    - 2008 FPY was 96.27%
    - Goal for 2009 was 97.02%
    - Result was 97.25% or improvement of 26.14% !

# Tangible/Intangible Benefits

What does this mean?

- 0.98% higher FPY
- Example: If 20 million pounds are made this is 196,000 pounds more FPY
- Example: If the cost would be for example $1 per pound this would be $196K ( considering non FPY is waste) or $0.3 rework cost per pound would be $58.8K

# Future plans at Sun Chemical

- Muskegon site
  - Expand PI templates usage from the strike department to all processes.
  - Generate process optimization projects by identifying process capability opportunities
  - Lay the ground work of Standard Work by displaying desired batch profiles.
- Conclusion:
  - PI Process Templates implements SPC on a batch process.
  - We make consistent quality each and every time.
  - Impact on product quality
  - Impact on the growth of our people and process knowledge for years to come.

OSIsoft® UC 2010

Real Time Information — Currency of the New Decade

# Thank you