PI Alchemy

Turning data into Gold

Presented by **Peter Smith,**

Metallurgy Superintendent

aurelia METALS Ltd.

Introduction

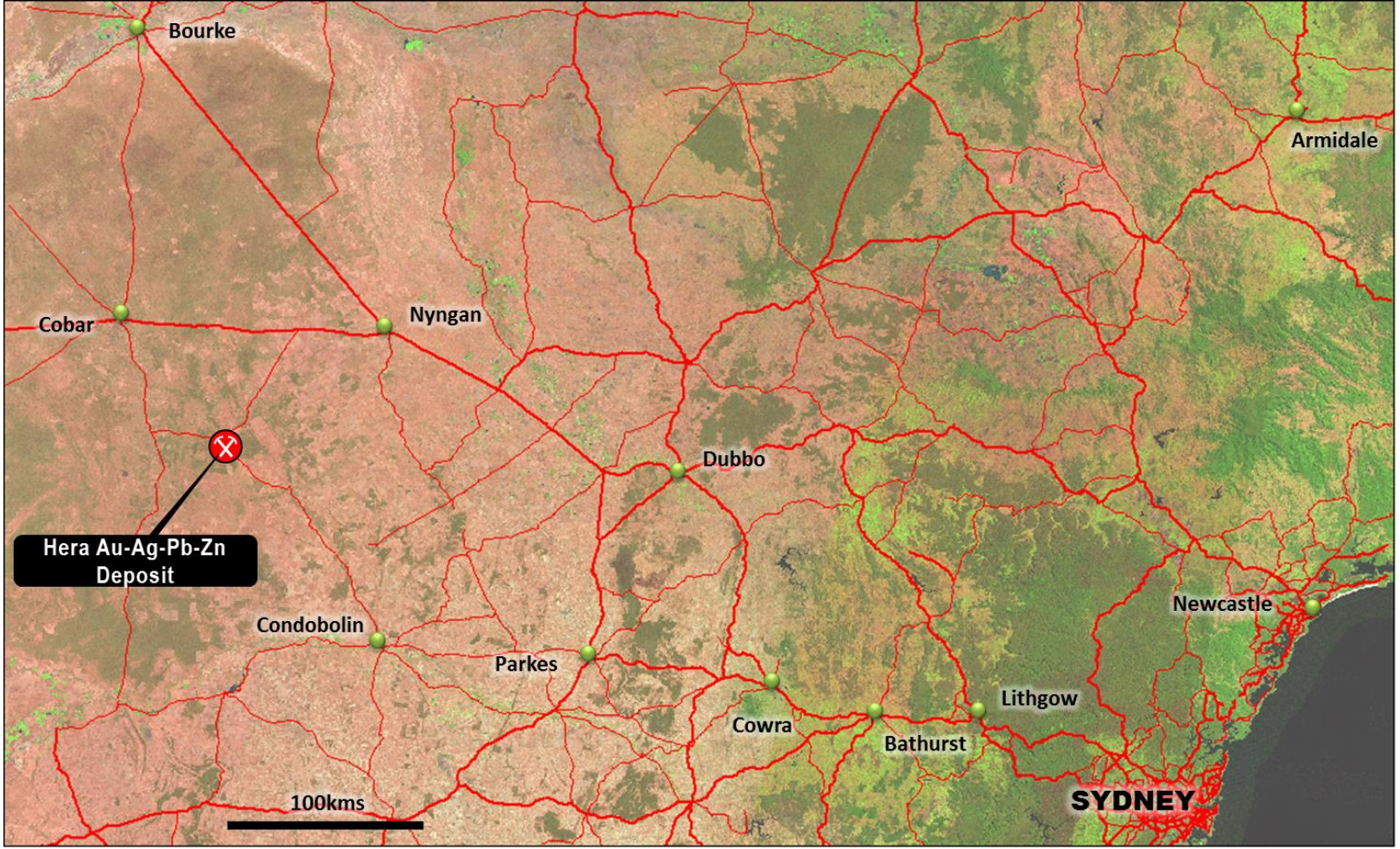
Alchemy

Any magical power or process of transmuting a common substance, usually of little value, into a substance of great value.

PI Alchemy

The process of transmuting raw data, usually of little value by itself, into Operational Intelligence, so that informed decisions can be made to effectively prioritise and generate value.

About Us



Gold-Silver Dore

Lead-Zinc Concentrate

Commercial Production : 2015

March 2016 : Quarterly Report:

- 83,522 t ore processed
- 14,184 oz Gold
- 5,874 t Pb-Zn Concentrate

Automation Consultancy

Process Control Optimisation

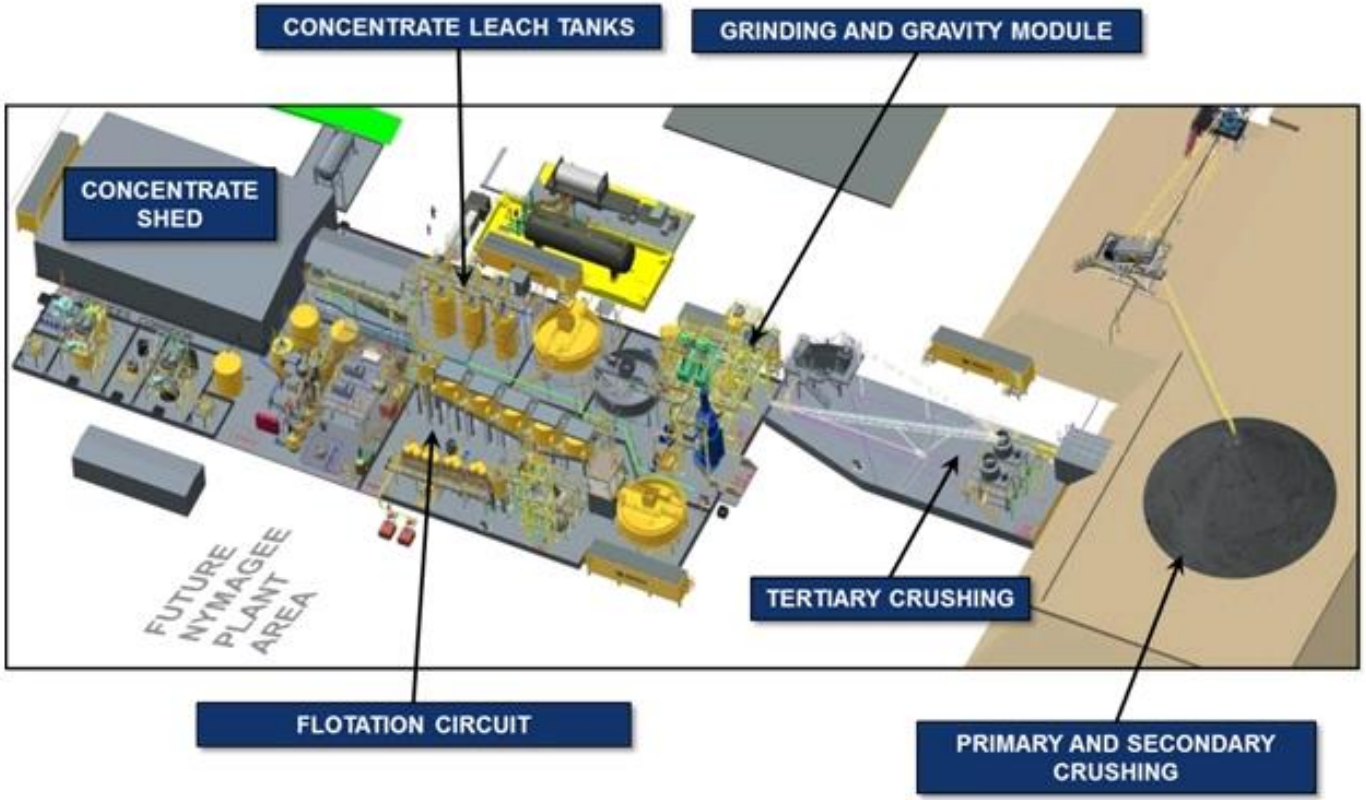
PI System Integration

PI System Management

Software Development

Hera Processing Plant

Hera Processing Plant



The Challenges

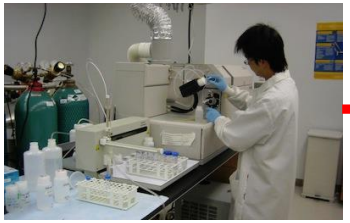
The Challenges

- Plant performance needed to be improved
- **Operational Insight** was difficult to achieve as data was not easy to get, distributed over a number of sources including discrete laboratory reports, process control system
- Time intensive to collate the information needed

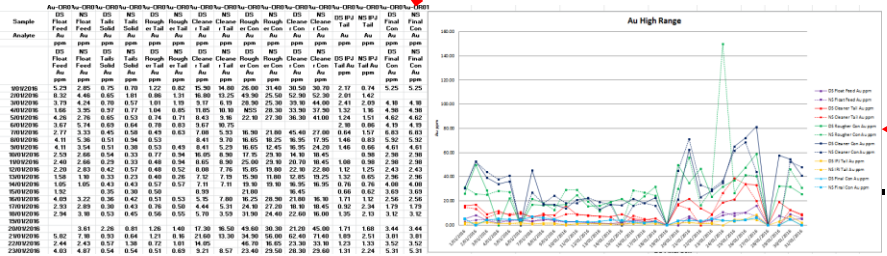
Typical Scenario

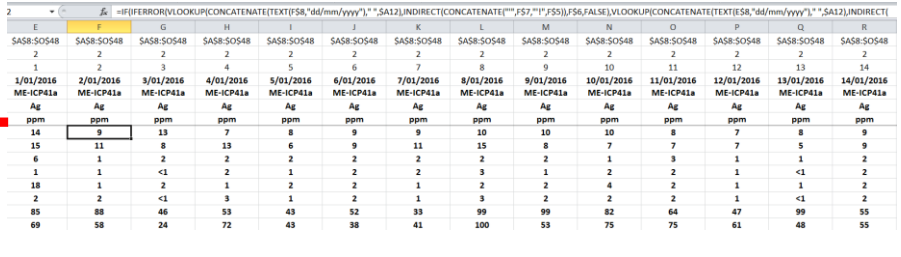
Manager

I need a graph of Au assays for 10 streams over 30 days

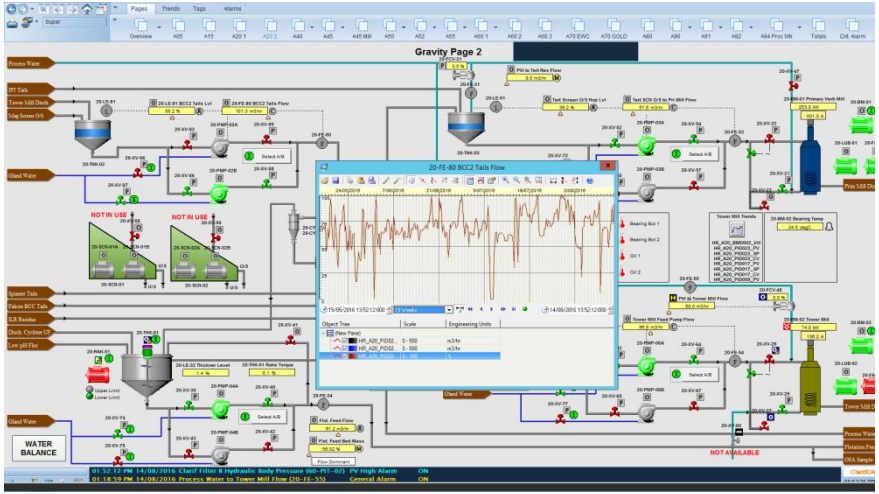


Metallurgist





How Plant Data Was Acquired



DAILY SAMPLE RESULTS

Lab Tech: Christine
Date: 1/01/2016

Au Samples

Date	Sample	Time	Conc	RSD%	Mean	Comments
1/01/16	CAL 0		0.00	40.50	0.001	
1/01/16	CAL 1		1.00	2.00	0.033	
1/01/16	CAL 2		5.00	1.20	0.157	
1/01/16	CAL 3		10.00	1.10	0.302	
1/01/16	CAL 4		20.00	1.40	0.579	
1/01/16	CAL 5		50.00	0.20	1.213	
1/01/16	Blank		-0.04	69.80	-0.001	
31/12/15	MC Barren	2000	0.44	1.60	0.015	
31/12/15	MC Barren (Line)	2000	1.62	2.10	0.052	
31/12/15	MC PLS	2000	22.29	0.50	0.634	
31/12/15	MC Barren	0000	3.45	0.7	0.109	
31/12/15	MC Barren (Line)	0000	7.54	1.1	0.233	
31/12/15	MC PLS	0000	21.63	0.8	0.617	
31/12/15	MC Barren	0400	5.01	0.7	0.157	
31/12/15	MC Barren (Line)	0400	0.06	3.8	0.003	
31/12/15	MC PLS	0400	18.47	1.0	0.537	
31/12/15	Tails Liquor	DS	3.67	1.4	0.116	
31/12/15	Tails Liquor	NS	0.50	1.6	0.017	
31/12/15	ILR Ewin Feed	Batch 277	70.03*	0.1	1.701	*OVER RANGE
31/12/15	ILR Ewin Feed x10 DIL	Batch 277	37.99	0.7	0.987	379.90
31/12/15	ILR Final Wash	Batch 277	42.93	0.9	1.085	
1/01/16	Process H2O	0600	0.46	1.5	0.015	
1/01/16	MC Barren	0600	5.85	0.7	0.183	
1/01/16	Detox	0600	3.71	1.8	0.118	
1/01/16	MC PLS	0600	20.33	1.0	0.585	
1/01/16	Ewin Spot	0600	53.40*	0.9	1.297	*OVER RANGE
1/01/16	Ewin Spot x5 DIL	0600	10.98	0.9	0.333	54.9
1/01/16	CAL 0		0.00	99.9	0.000	
1/01/16	CAL 1		1.00	1.6	0.032	
1/01/16	CAL 2		5.00	0.7	0.156	
1/01/16	CAL 3		10.00	0.3	0.300	
1/01/16	CAL 4		20.00	0.7	0.568	

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1	2	3	4	5	6	7	8	9	10	11	12	13	14
1/01/2016	2/01/2016	3/01/2016	4/01/2016	5/01/2016	6/01/2016	7/01/2016	8/01/2016	9/01/2016	10/01/2016	11/01/2016	12/01/2016	13/01/2016	14/01/2016
ME-ICP41a	ME-ICP41a	ME-ICP41a	ME-ICP41a	ME-ICP41a	ME-ICP41a	ME-ICP41a	ME-ICP41a	ME-ICP41a	ME-ICP41a	ME-ICP41a	ME-ICP41a	ME-ICP41a	ME-ICP41a
Ag	Ag	Ag	Ag	Ag	Ag	Ag	Ag	Ag	Ag	Ag	Ag	Ag	Ag
ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
14	9	13	7	8	9	9	10	10	10	8	7	8	9
15	11	8	13	6	9	11	15	8	7	7	7	5	9
6	1	2	2	2	2	2	2	1	3	1	1	1	2
1	1	<1	2	1	2	2	3	1	2	2	1	<1	2
18	1	2	1	2	2	1	2	2	4	2	1	1	2
2	2	<1	3	1	2	1	3	2	2	2	1	<1	2
85	88	46	53	43	52	33	99	99	82	64	47	99	55
69	58	24	72	43	38	41	100	53	75	75	61	48	55

- Discrete lab reports
- High compression of plant data (900 data points)
- Manual assembly into Excel

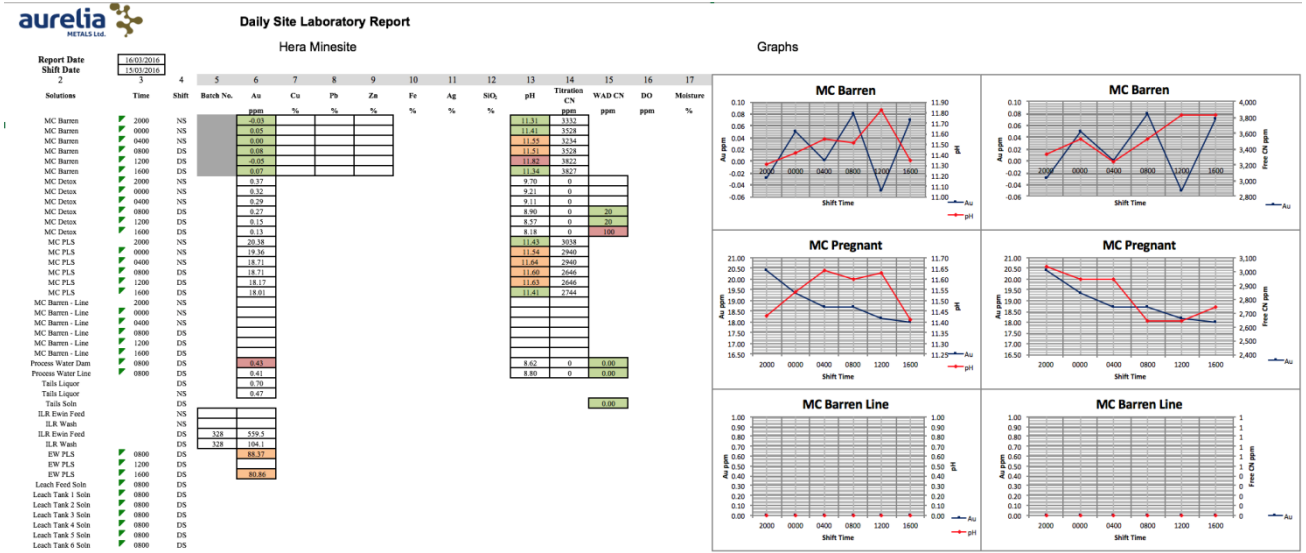
Phase 1 – Installation & Visualisation

Initial Business Case for a PI System

Streamline the reporting of Laboratory Assays and historise the assay data for subsequent analysis as required

Provide a repository of process data for key plant, equipment and instrumentation to enhance the operational perspective and allow long term statistical analysis of key data streams

Easy Lab Data Validation & Archiving Into PI System



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Daily Site Laboratory Report

Hera Minesite

Graphs

Report Date 16/03/2016
Shift Date 15/03/2016

Solutions	Time	Shift	Batch No.	Au ppm	Cu %	Pb %	Zn %	Fe %	Ag %	SiO2 %	pH	Titration CN ppm	WAD CN ppm	DO ppm	Moisture %
MC Barren	2000	NS		-0.03							11.31	3332			
MC Barren	0000	NS		0.05							11.41	3528			
MC Barren	0400	NS		0.00							11.55	3234			
MC Barren	0800	DS		0.08							11.51	3528			
MC Barren	1200	DS		-0.05							11.82	3822			
MC Barren	1600	DS		0.07							11.34	3827			
MC Detox	2000	NS		0.37							9.70	0			
MC Detox	0000	NS		0.32							9.21	0			
MC Detox	0400	NS		0.29							9.11	0			
MC Detox	0800	DS		0.27							8.90	0	20		
MC Detox	1200	DS		0.15							8.57	0	20		
MC Detox	1600	DS		0.13							8.18	0	100		
MC PLS	2000	NS		20.38							11.43	3038			
MC PLS	0000	NS		19.36							11.54	2940			
MC PLS	0400	NS		18.71							11.04	2940			
MC PLS	0800	DS		18.71							11.60	2646			
MC PLS	1200	DS		18.17							11.63	2646			
MC PLS	1600	DS		18.01							11.41	2744			
MC Barren - Line	2000	NS													
MC Barren - Line	0000	NS													
MC Barren - Line	0400	NS													
MC Barren - Line	0800	DS													
MC Barren - Line	1200	DS													
MC Barren - Line	1600	DS													
Process Water Dam	0800	DS		0.43							8.62	0	0.00		
Process Water Line	0800	DS		0.41							8.80	0	0.00		
Tails Liquor		DS		0.70											
Tails Liquor		NS		0.47											
Tails Soln		DS											0.00		
ILR Ewin Feed		NS													
ILR Wash		NS													
ILR Ewin Feed		DS	328	559.5											
ILR Wash		DS	328	104.1											
EW PLS	0800	DS		88.37											
EW PLS	1200	DS													
EW PLS	1600	DS		80.86											
Leach Feed Soln	0800	DS													
Leach Tank 1 Soln	0800	DS													
Leach Tank 2 Soln	0800	DS													
Leach Tank 3 Soln	0800	DS													
Leach Tank 4 Soln	0800	DS													
Leach Tank 5 Soln	0800	DS													
Leach Tank 6 Soln	0800	DS													

convergio

PI DataLink

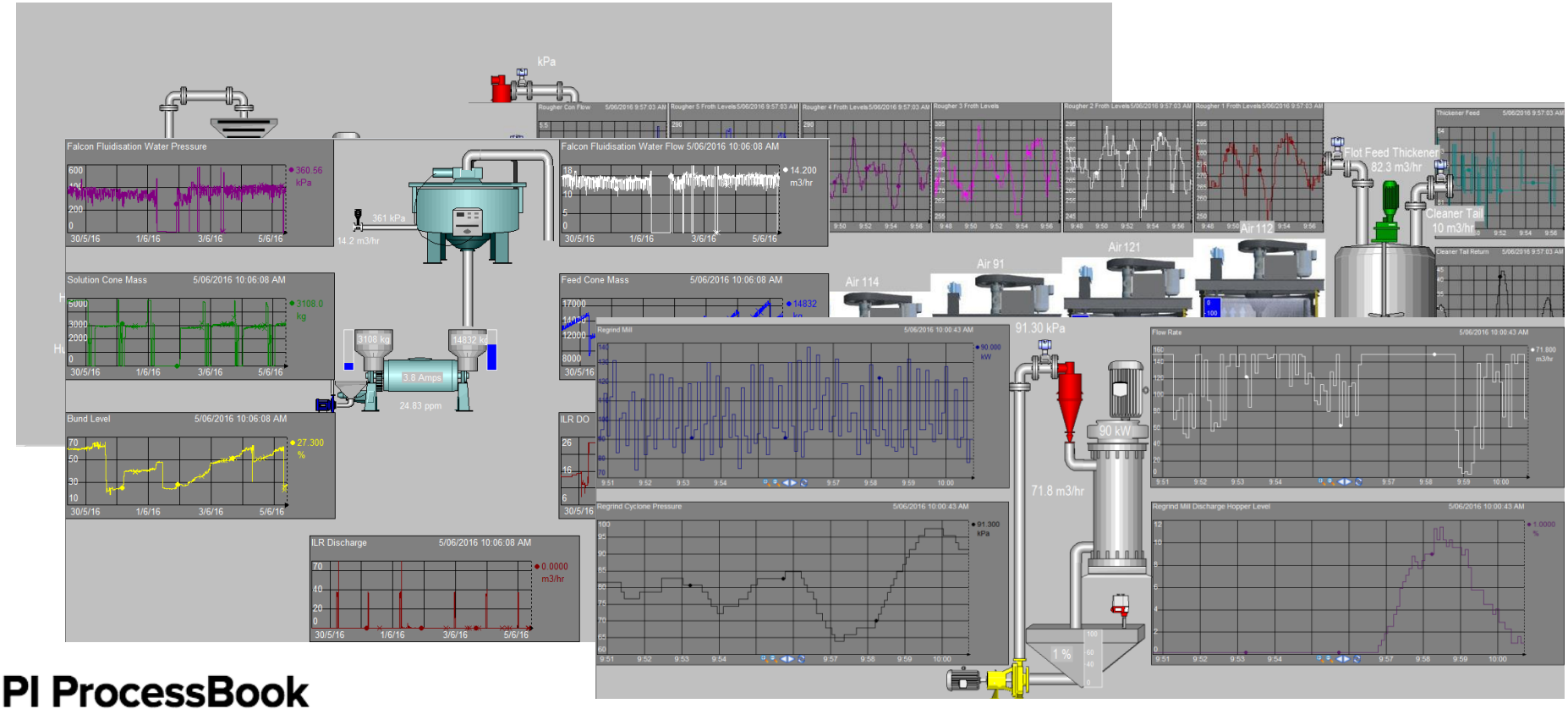
Before

- 1 day to update & report 1 month of data for 1 assay
- 1 day history per spreadsheet

After

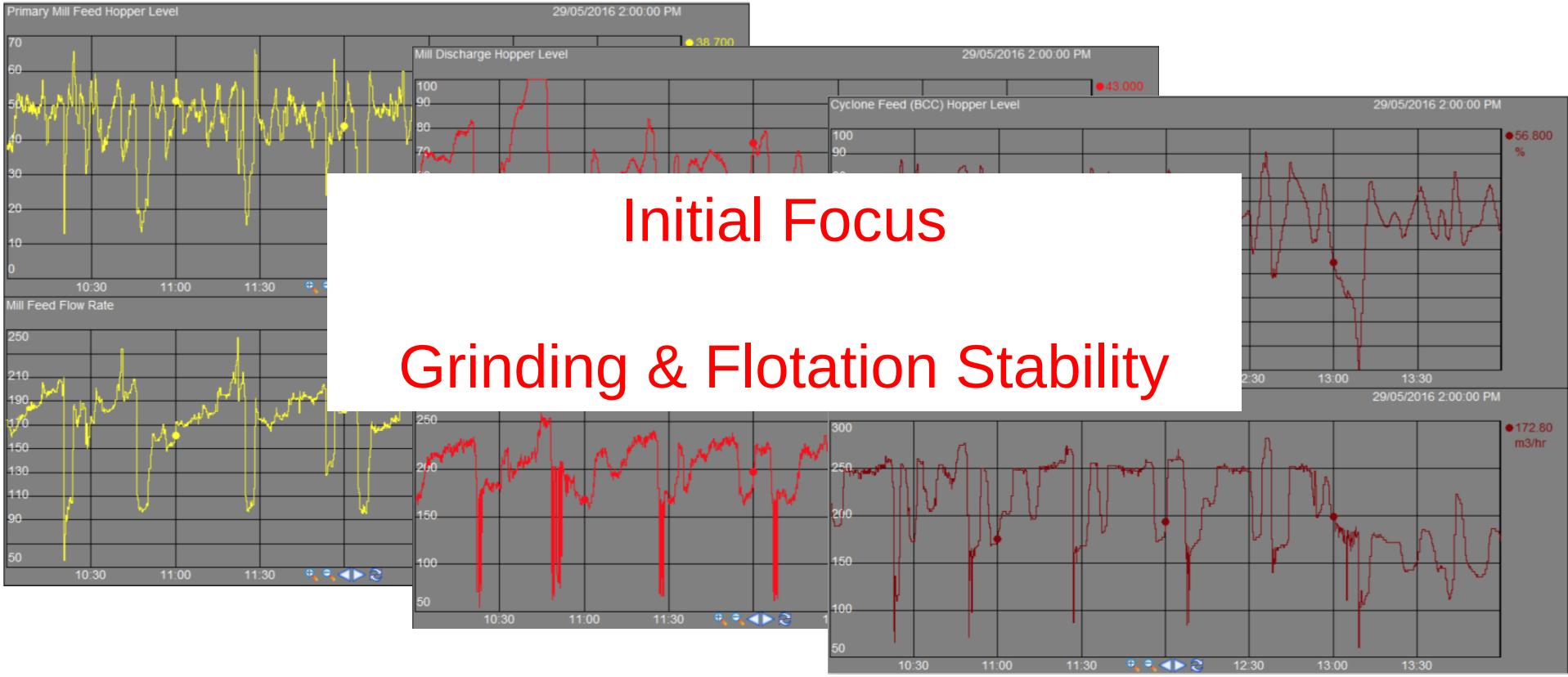
- 30 mins to update & report 1 month of data for hundreds of assays
- All assays historised

Making It Easy To See What Was Happening



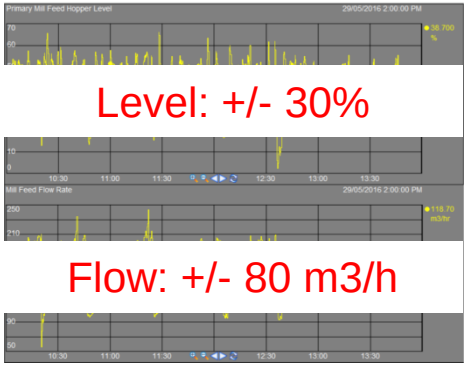
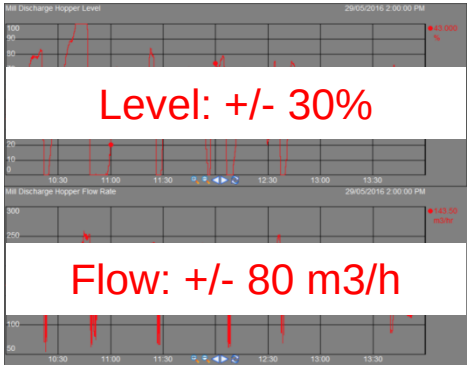
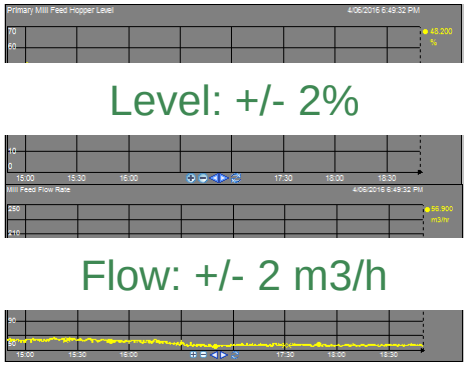
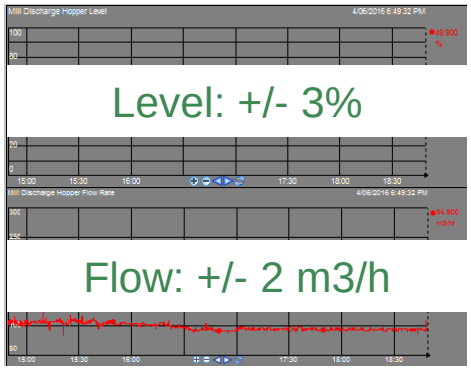
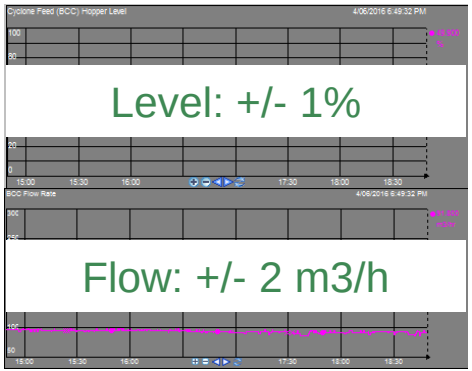
PI ProcessBook

Identifying & Justifying Process Improvement Campaign



Phase 2 – Initial Grinding, Flotation and Cyanide Optimisation

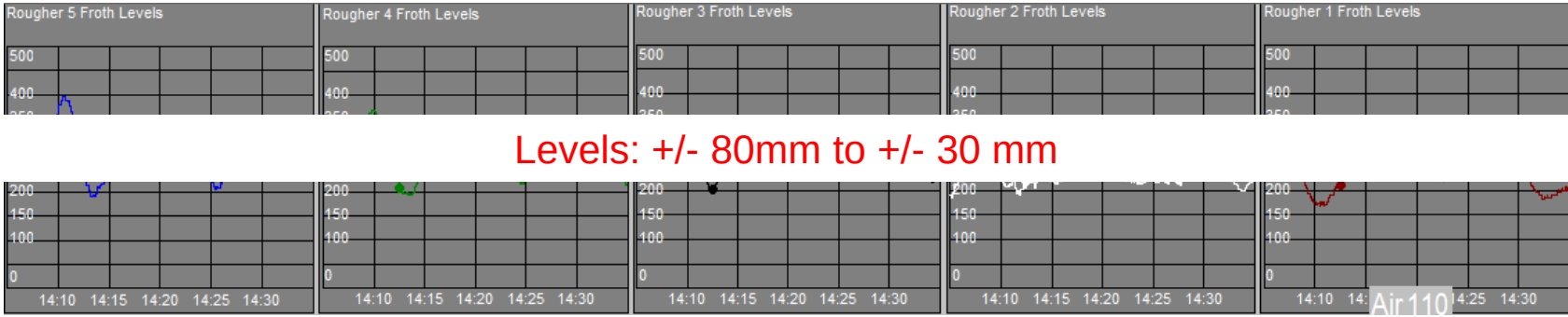
Using the PI System to Measure & Validate Process Improvement

	Mill Feed	Mill Discharge	Cyclone Feed
Before	 Level: +/- 30% Flow: +/- 80 m3/h	 Level: +/- 30% Flow: +/- 80 m3/h	 Level: +/- 17% Flow: +/- 95 m3/h
After	 Level: +/- 2% Flow: +/- 2 m3/h	 Level: +/- 3% Flow: +/- 2 m3/h	 Level: +/- 1% Flow: +/- 2 m3/h

Using the PI System to Measure & Validate Process Improvement

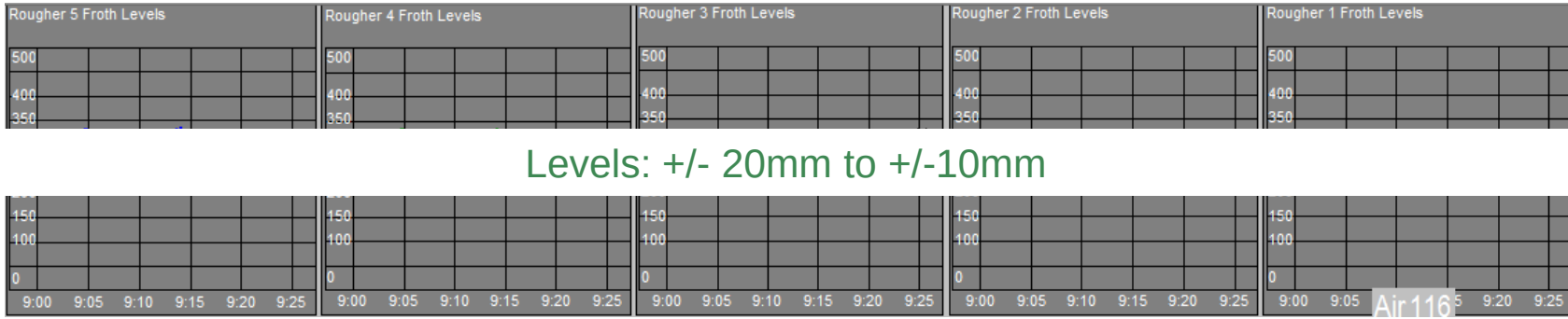
Rougher Flotation Cell Levels

Before



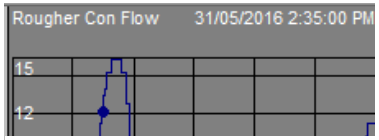
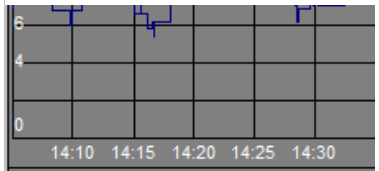
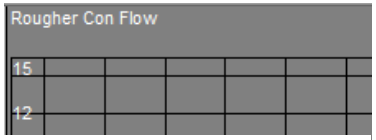
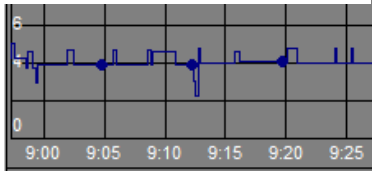
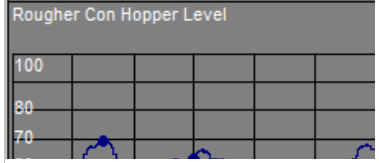
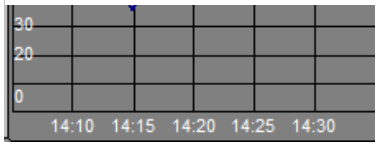
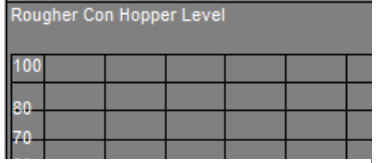
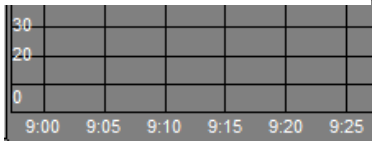
Levels: +/- 80mm to +/- 30 mm

After



Levels: +/- 20mm to +/-10mm

Using the PI System to Measure & Validate Process Improvement

	Before	After
Rougher Con Flow	 Flow: +/- 5 m3/h 	 Flow: +/- 2 m3/h 
Rougher Con Level	 Level: +/- 35% 	 Level: +/- 3% 

Phase 3 – Benefit Realisation

What Does Improved Stability Give Us?

- Improved Grinding Efficiency
- Improved Classification Efficiency
- Reduced wear rates
- Reduced energy consumption
- Reduces reagent consumption
- Reduced spills / cleanups
- Reduced water consumption
- Improved throughput
- Improved plant recovery
- Reduced Operator stress/fatigue

How Much is Stability Worth?

+1% Plant Gold Recovery = approx. USD$750,000 per annum

Considering:

- PI System Costs
- Installation Costs
- Optimisation Costs
- Small Plant (~ 45 t/h)

+1% Recovery Improvement

=

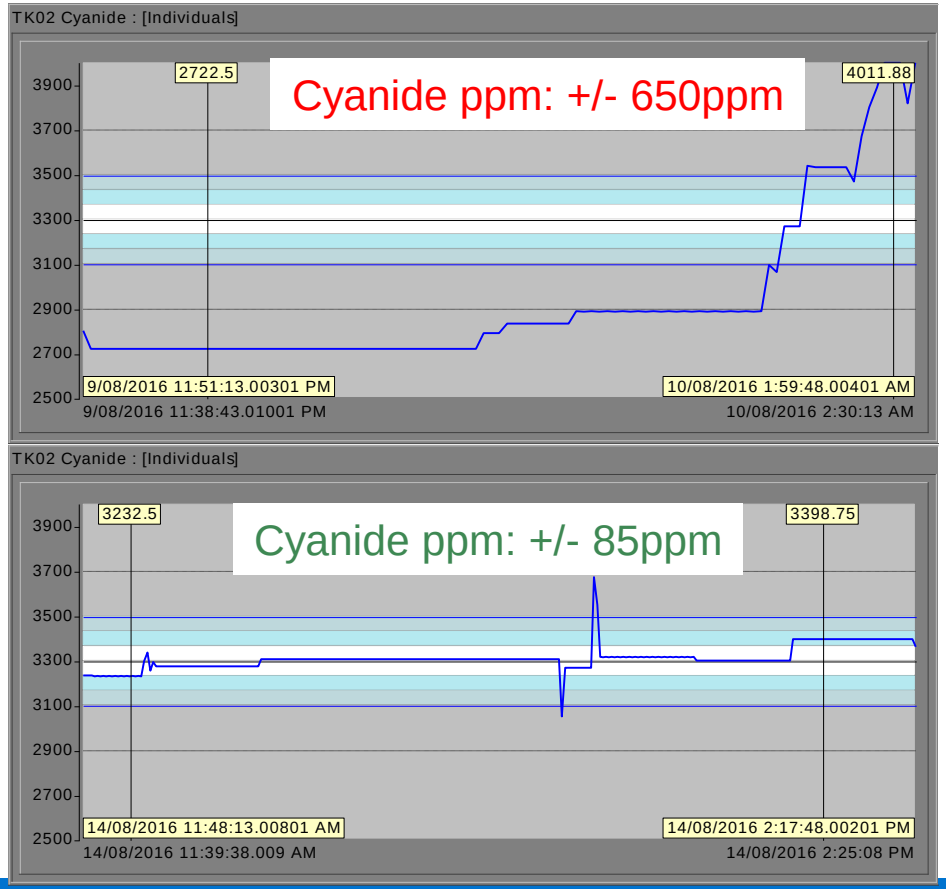
12 Day Payback Period

Cascade Loop Development in Key Areas (August)

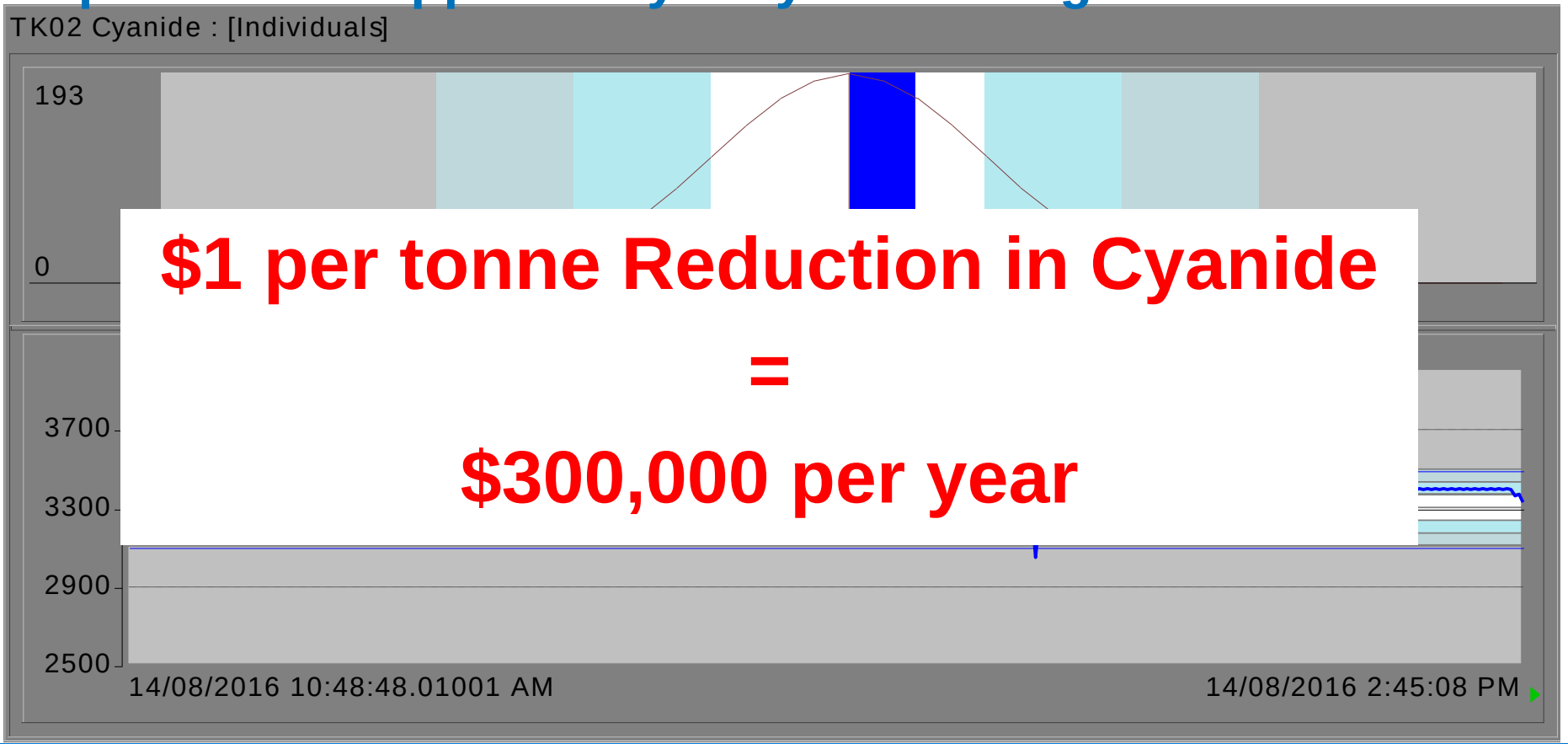
Before

Tank 5 Cyanide
First pass
cascade loop

After



Improvement Opportunity – Cyanide Reagent Control



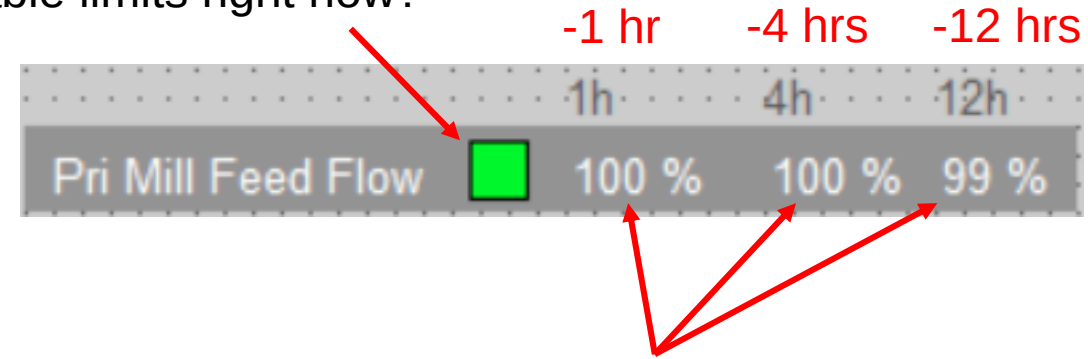
$1 per tonne Reduction in Cyanide

=

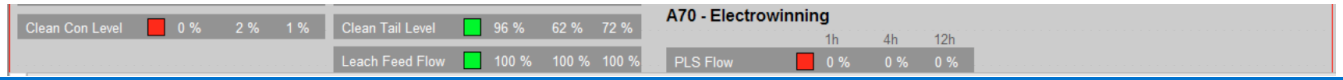
$300,000 per year

INFINITUM™ – Loop Analytics

Is the measurement within acceptable limits right now?



What % of time has the measurement been within acceptable limits?



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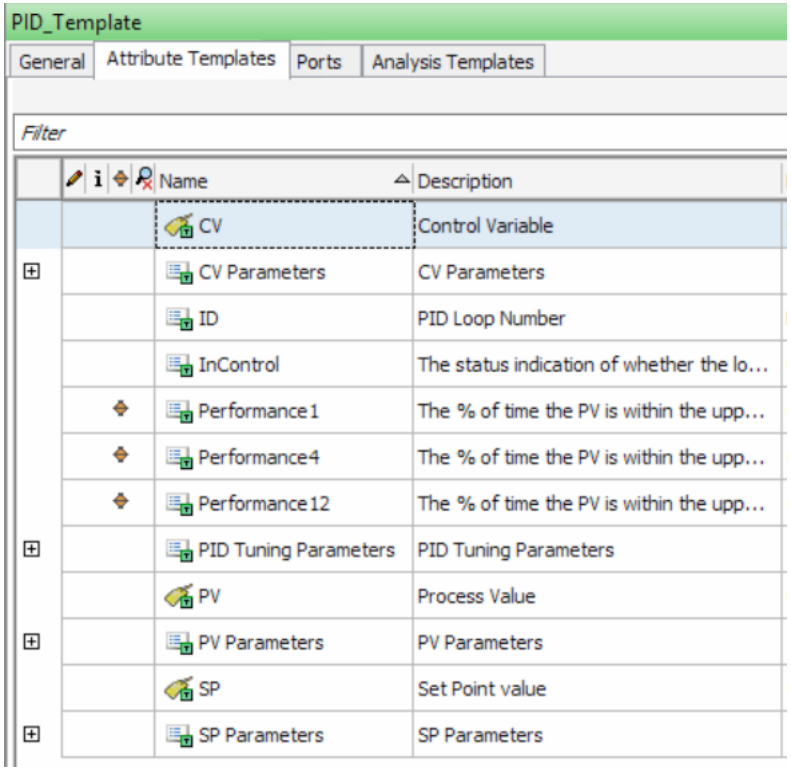
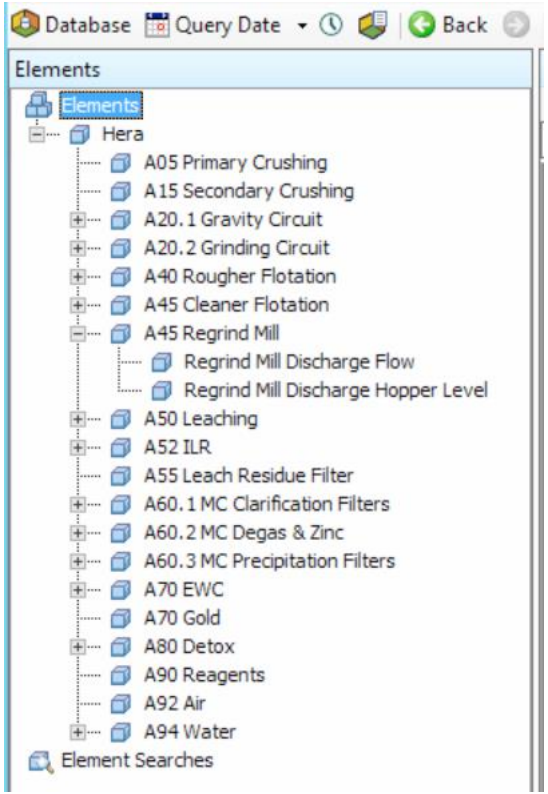
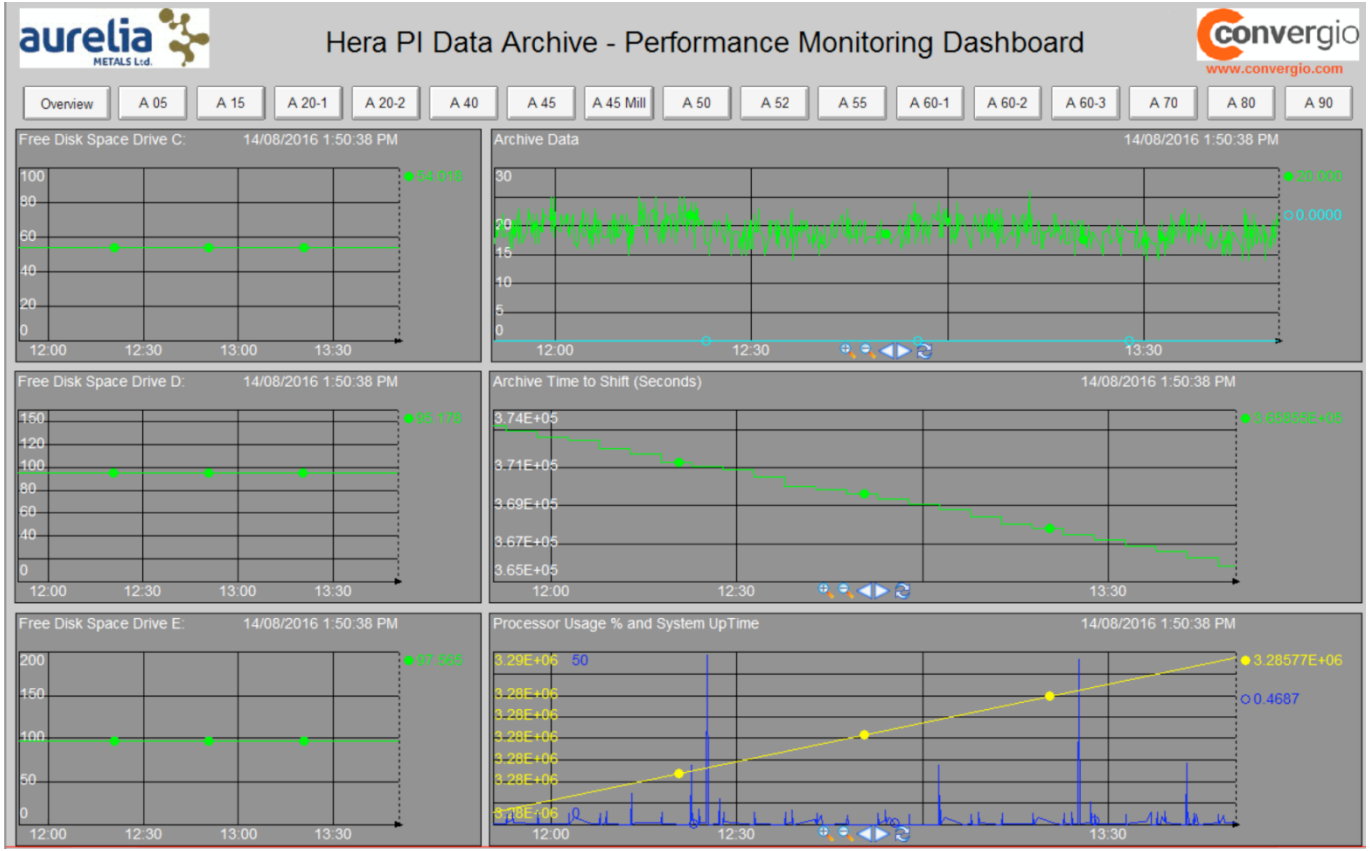




Asset Framework (AF)

PI System Monitoring – Using PI to Monitor PI



Phase 4 – Squeezing More Value Out Of The PI System

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More Process Improvement Opportunities

- Plant Water Pressure Optimisation
- Flotation Cell Reagent Optimisation
- On Stream Analyser Integration
- Grinding Circuit Reconfiguration
- Flotation Level Advanced Control
- Merryl-Crowe Reagent Optimisation
- Gravity Circuit Optimisation

More Maintenance Improvement Opportunities

- Automatic Equipment Runhours Reporting (AF and Totalisers)
- Automatic Equipment Utilisation & Availability Reporting (AF and PI System Analytics)

Contact Information

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Director
Convergio

Questions

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

State your **name & company**

Please remember to…

Complete the Online Survey for this session

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감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado

Cheers Mate