

Going BI - Optimizing KPI Management Across the Enterprise

Presented by **Warren Armstrong**



Anglo American Platinum (AMPLATS)

World's leading primary producer of Precious Group Metals
Supplying ~40% of the world's newly refined Platinum.

Process Division:

- 14 Mines
- 18 Concentrators*
- 3 Smelters
- 1 Converter
- 2 Refineries
- 9 geographic operational areas



* Including managed and non-managed

Background

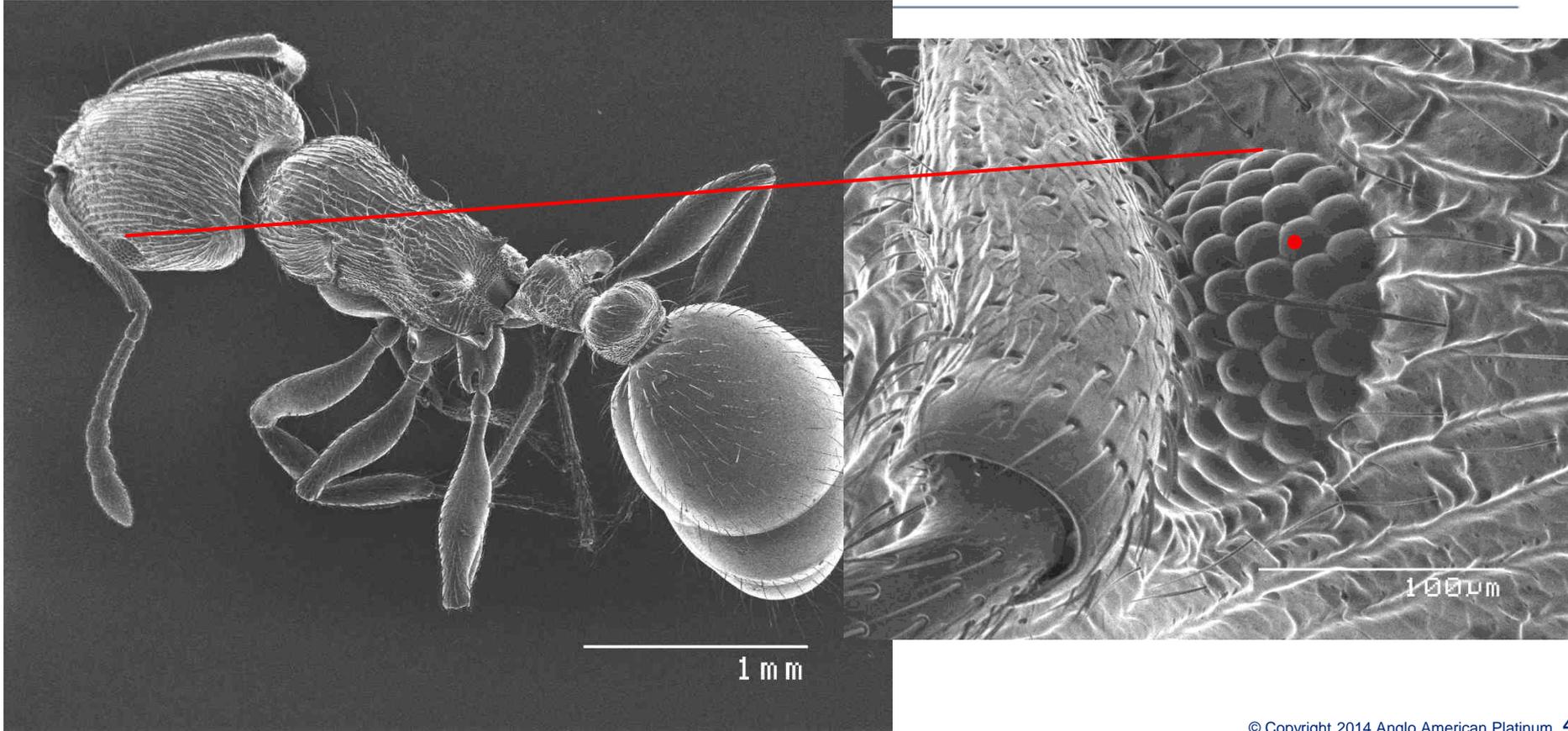
- **For 1gm of Platinum**
 - **Amplats mines 1400 kg of rock**
 - **Mills 600 kg**
 - **To 80% less than 75 microns (μm)
or 0.075 mm**
- 2013 tonnages**
100 million mined
44 million milled
71 tonnes Platinum

Why so fine?

UG2 Platinum Group Metal mineral size!

Typically 5 microns

So how fine is bug dust?



Value Chain



Ore
3.2 g/t



Concentrate
125 g/t



Refineries
99.9200 %



Smelters
2700 g/t

Business Challenge

The KPI-calculation-maintenance needed to be streamlined!

“Please set up the KPI reports on our plant...”

“Please add these KPIs....”

- Creating a new KPI took 30 minutes
 - The one site had 320 unique KPIs, from multiple requests
- KPIs were difficult to trouble shoot
 - Multiple configuration linking
- 1 site had 9 KPI reports
 - With 3 sites to go...

KPIs

- **KPI-system started as an Excel automation**
- **Daily plant health check: (areas, sections, equipment)**
 - **Daily, Weekly, Monthly, Yearly values and standard deviation**
 - **With a run-condition**
- **The process engineers on site look after areas**
 - **KPIs are defined in areas of responsibility**
 - **So KPIs change as problems and people change**

KPIs

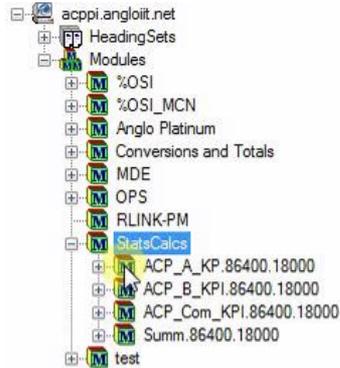
- **Needless to say; it grew!**
 - **From: 4 reports and 120 KPIs**
 - **To: 8 reports and 437KPIs**
 - **...**



How was it done

- **Daily values from PI Totalizers**
- **PI Advanced Computing Engine (PI ACE) for roll-ups**
 - **Rollup daily by weighting on run times**
- **PI Module Database for configuration: aliases, properties**
- **4 PI ACE calculation instances**
 - **Running 484 KPIs**
 - **Using 2969 tags**
 - **From 7409 PI Module Database entries**

Demonstration – PI ACE configuration



Old-System - To add one KPI

Procedure to add one KPI

1. Create 2 daily total tags; KPI, Standard Deviation, Weighting?
2. Create 4 roll up tags
3. Create PI Module Database import – 14 items per KPI
4. Create KPI targets in SharePoint list
5. Update Excel report
6. Upload Excel report to SharePoint (Excel web services)

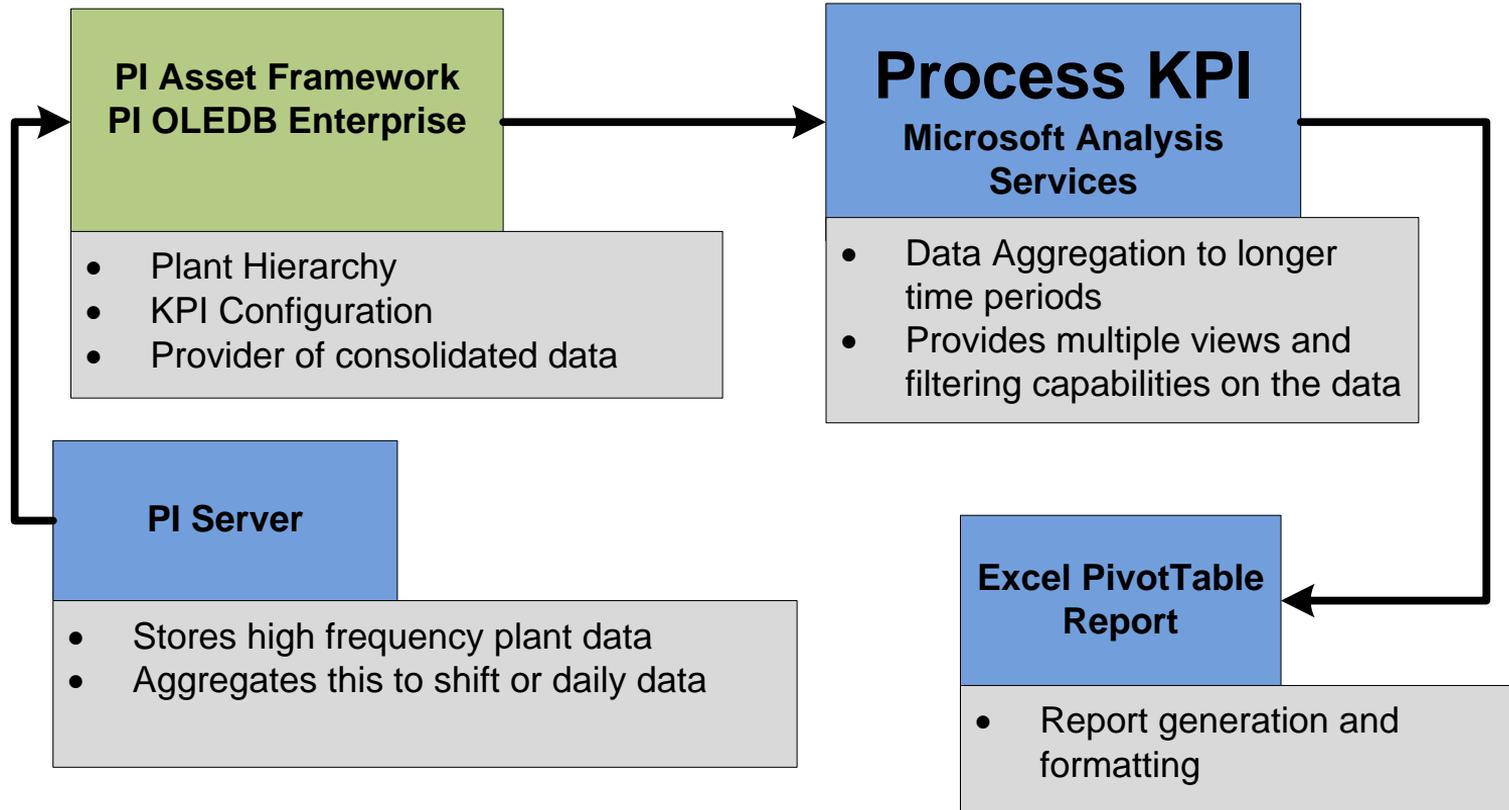
Start with a clean slate - Requirements

- **Maintainable**
- **Simplify configuration**
- **Let the reporting do the aggregations - dynamically**
- **Have one report**
- **Get users to start maintaining their own KPI's**

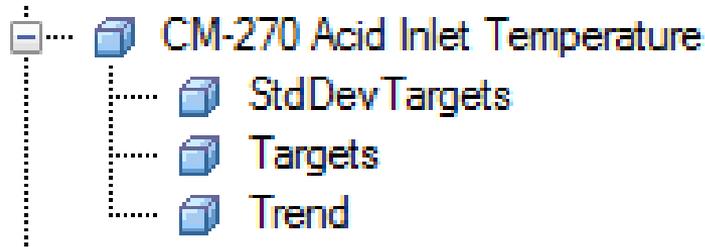
Design and Implementation

- **Consult with OSIsoft and Microsoft**
- **What has been done elsewhere?**
- **Centre of Excellence (CoE)**
- **Microsoft**
- **Used a 3rd party to implement ETL, Data Warehouse and Analysis services**

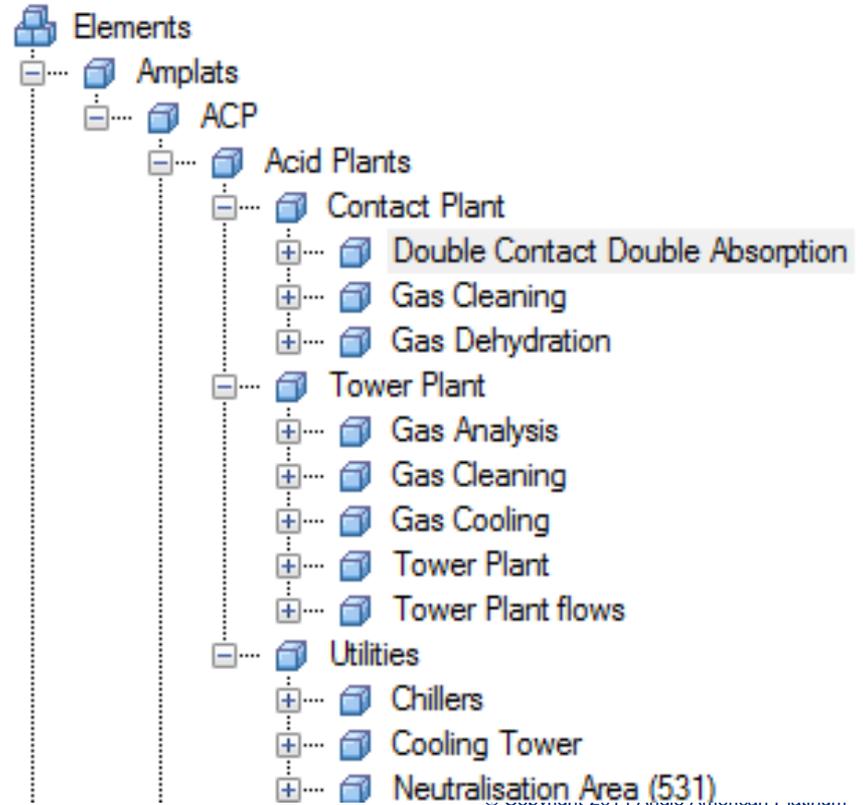
Architecture



Solution



- **PI AF Configuration**
- **Structure and Values**
- **Ad-hoc trends**



Solution

- 39 Attributes
- 14 are user configurable

CM-280 Acid Inlet Temperature

General Child Elements Attributes Ports Analyses Version

Filter

Name	Value
Plant	WACP
SQC_Status	not used
StdDevTargets	Range
TargetID	485
Targets	Range
Design	75
HI	80
HHI	85
Lo	70
LoLo	65
Month	NaN
TargetURL	http://acpweb.angloilt.net/ReportingUIBunker?AFServer=...

Group by: Category Template

Name: Targets

Description: Specifies Target type, Monthly

Configuration Item:

Categories:

Default UOM: <None>

Value Type: String

Value: Range

Data Reference: AP-String Concat

Settings...

.\Targets|TargetType

CM-280 Acid Inlet Temperature

General Child Elements Attributes Ports Analyses Version

Filter

Name	Value
Category: <None>	
AFPath	\\acpmes\WACPSite\Amplats\ACP\Acid Plants\Contact Plant\Do...
errString	calc
Format	0.0
FullTagName	\\acppi.angloilt.net\534TT522\PV.V
Plant	WACP
SQC_Status	not used
StdDevTargets	Range
TargetID	485
Targets	Range
TargetURL	http://acpweb.angloilt.net/ReportingUIBunker?AFServer=acp...
ValueFixURL	http://acpweb.angloilt.net/FixValue\acppi.angloilt.net\534TT...
ValueURL	http://acpweb.angloilt.net/RD/Displays/AdHoc?StartTime=*..30...
Category: User Configuration	
Aggregation	Average
ControlStatus	PI Point not found '\\acppi.angloilt.net\CM-280 Acid Inlet Temp...
DataAggregationPeriod	Daily
Display Name	CM-280 Acid Inlet Temperature
DisplayOrder	148
DV_perGood	PI Point not found '\\acppi.angloilt.net\CM-280 Acid Inlet Temp...
DV_Quality	PI Point not found '\\acppi.angloilt.net\CM-280 Acid Inlet Temp...
Ignore	False
Instrument Category	
PV	60.84488
Standard Deviation	0.7333928
UOM	°C
Value	61.3514977
WeightingValue	3.59786033630371 h

Demonstration – PI AF configuration

The screenshot displays the PI System Explorer (Administrator) interface. The main window shows the 'Amplats' configuration for the 'Display Order' element. The table below represents the data shown in the main pane:

Name	Value	Time Stamp	Description
Category: <None>			
Display Order	0	1970/01/01 00:00:00	
Point configuration	-	1970/01/01 00:00:00	Point configuration setting
Category: OPM Configuration			
Active	True	1970/01/01 00:00:00	Indicate the status of the element
Category: Run			
Run	True	1970/01/01 00:00:00	Equipment Run Status
Category: Run Expression			
Run	True	1970/01/01 00:00:00	Equipment Run Status

The right-hand pane shows the configuration details for the selected 'Display Order' Amplat:

- Group by: Category Template
- Name: Display Order
- Description: (empty)
- Configuration Item:
- Categories: (empty)
- Default UOM: <None>
- Value Type: Double
- Value: 0
- Data Reference: <None>
- Settings... button

Solution

Procedure to add one KPI

1. Create 2 daily total tags; KPI, Standard Deviation, Weighting?
2. Create PI AF Elements; KPI, (create Trend, Target only)
3. Check display order

Currently

- 656 KPIs
- 3 Sites

It took only 8 hours to translate the old KPIs (~450) into the new system.



OSIsoft

- CoE (Centre of Excellence)
- PI Server, Totalizers
- PI Asset Framework
- PI AF Builder add-in for Excel
- PI OLEDB Enterprise

Microsoft

- SQL Server
- SQL Server Integration Services (SSIS)
- SQL Server Analysis Services (SSAS) in tabular mode
- Excel Pivot Tables

Results

- **KPI creation was reduced from 6 to 3 steps**
- **One report**
- **Quick rollout (30min for a new site)**
- **More user control**
- **Flexible reporting (Period comparisons)**
- **Quicker access to data**

Demonstration – Report

Site		Process Area		Date	KPI Type		Values											
ACP	ACP Converter	2014-07-28	All	Design	StdDev Design	Daily	Variance	StdDev	Condition	StdDev Condition	Weekly	Weekly Variance	StdDev Condition Weekly	MTD	Variance MTD	StdDev Condition MTD	YTD	Variance YTD
USML	Acid Plants	ACP	USML Charge-Prep	Site	All	7.17	-7.17	5.50	3.00	1.00	12.61	-7.39	1.00	14.90	-5.10	1.00	14.25	-5.10
WSML	WSML Charge-Prep	ACP	USML Charge-Prep	Process Cell	All	7.71	0.710	0.667	5.00	1.00	7.49	0.487	1.00	8.05	1.05	1.00	8.30	1.05
Unallocated	Charge-Prep	USML	WSML Charge-Prep			9.43	-10.57	1.48	3.00	1.00	9.58	-10.42	1.00	8.81	-10.19	1.00	10.58	-10.19
	WSML Hot Metals	USML	Charge-Prep			8.64	1.64	0.706	5.00	1.00	8.63	1.63	1.00	8.58	1.58	1.00	8.46	1.58
		USML	WSML Hot Metals			66.00	3.37	0.672	5.00	5.00	69.72	3.72	5.00	69.32	3.32	5.00	66.99	3.32
		USML				74.00	5.61	2.604	6.00	7.00	77.48	3.48	7.00	77.99	3.99	7.00	77.14	3.99
		USML				3.00	2.91	8.91	5.00	7.00	8.62	5.62	7.00	9.25	6.25	7.00	8.56	6.25
		USML				51.00	-6.73	14.38	5.00	5.00	48.84	-2.16	5.00	48.63	-2.35	5.00	47.55	-2.35
		USML				62.00	11.05	6.06	6.00	5.00	73.74	11.74	5.00	72.33	10.33	5.00	73.36	10.33
		USML				10154	-4682	8808	3.00	7.00	7198	-2961	7.00	7704	-2450	7.00	7702	-2450
		USML				240.0	160.0	160.0	5.00	5.00	230.5	-9.47	5.00	227.8	-12.10	5.00	217.8	-12.10
		USML						0.271	1.00	1.00	-0.726		1.00	-0.859		1.00	-0.554	
		USML				81.00	-4.45	1.43	5.00	5.00	76.35	-4.05	5.00	76.74	-4.28	5.00	76.39	-4.28
		USML				73.00	0.350	3.01	6.00	6.00	76.60	3.60	6.00	74.15	1.15	5.00	73.76	1.15
		USML				15.00	1.27	2.63	5.00	5.00	16.24	1.24	5.00	15.88	0.891	5.00	17.40	0.891
		USML				69.00	-15.69	1.79	5.00	5.00	53.65	-15.35	5.00	53.27	-15.73	5.00	53.47	-15.73
		USML				26.00	-13.08	1.59	5.00	5.00	16.59	-9.41	5.00	6.71	-19.23	5.00	7.69	-19.23
		USML				27.00	-14.28	1.60	5.00	5.00	16.68	-10.32	5.00	6.77	-20.23	5.00	7.87	-20.23
		USML				27.00	-14.28	1.60	5.00	5.00	16.27	-10.73	5.00	4.25	-22.75	5.00	6.69	-22.75
		USML				26.00	-13.08	1.65	5.00	5.00	16.37	-9.63	5.00	4.23	-21.73	5.00	6.62	-21.73
		USML				50.00	6.28	2.03	7.00	5.00	56.90	6.90	5.00	87.00	7.02	5.00	87.20	7.02
		USML				35.00	17.48	7.18	5.00	5.00	55.76	20.76	5.00	58.72	23.72	5.00	60.91	23.72

Demonstration – Report Modifying

Date: 2014-07-28
 Site: ACP
 KPI Type: All
 Process Cell: Tower Plant

Apply Formatti

Process Unit	KPI Name	Values															
		StdDev Design	Daily	Varian ce	StdDev	Condi tion	StdDev Condi tion	Week ly	Weekly Varianc e	StdDe v Weekl y	MTD	Varian ce MTD	StdDev MTD	YTD	Varian ce YTD	StdDev YTD	Lo
Tower Plant flows																	
CM-300 Flow 535FIT590			173.5	23.53	4.26	5.00	1.00	172.6	22.59	4.85	172.7	22.72	4.54	158.0	8.01	4.00	100.0
CM-310 Flow 535FIT610			159.1	9.14	7.97	5.00	1.00	158.8	8.76	7.35	155.2	5.22	7.69	171.1	21.06	7.79	50.00
CM-330 Flow 535FIT630			250.4	-49.60	1.03	4.00	1.00	250.8	-49.17	2.34	245.7	-54.30	2.77	249.3	-50.70	2.70	270.0
CM-350 Flow 535FIT651			532.5	82.47	5.10	5.00	1.00	515.9	65.91	20.40	484.3	14.30	7.99	476.8	26.80	5.76	400.0
CM-400 Flow 535FIT675			512.1	62.07	5.37	5.00	1.00	507.3	57.31	14.17	495.0	44.97	7.62	494.4	44.43	5.79	400.0
CM-410 Flow 535FIT715			46.36	-33.64	2.16	4.00	1.00	48.34	-31.66	5.79	56.47	-23.53	6.33	78.55	-1.45	2.52	60.00
TK-340 Flow 535FIT635			469.2	19.19	3.85	5.00	1.00	470.3	20.27	4.18	471.8	21.76	5.75	420.1	-29.94	3.75	270.0
TK-360 Flow 535FIT655			880.1	-119.9	10.48	3.00	1.00	888.1	-113.1	18.99	895.8	-54.24	12.58	812.4	-132.2	13.48	400.0

Site: ACP
 Process Area: Acid Plants
 Process Cell: Tower Plant
 Process Unit: Tower Plant flows
 Time Selector: Daily

Benefits

- **Many of the savings are intangible**
- **Improved Maintainability**
 - **2 sites added – 8 hours saved**
 - **172 KPI's added – 52 hours saved**
- **User Interaction**
 - **Added 10 KPI's – 3 hours saved**
 - **Modified 50 – 4 hours saved**
- ...

Next Steps

- **Continue rollout**
- **PowerView in Excel 2013**
- **Production reports**
- **Office 365, SharePoint and BI in the Cloud**



Learning: Use the highest granularity from the start

Going BI with KPIs

“KPI building and maintenance was a nightmare, creating a lot of frustration due to long lead times”



Date	2014-03-05	Apply
Site	(Multiple Items)	Formatti
KPI Type	All	
Process Cell	(Multiple Items)	

Process Unit	KPI Name	Values						
		Design	StdDev Design	Daily	Variance	StdDev	Condition	StdDev Condition
WSML FD2 HGG	Bed Temperature			890.1		38.46	1.00	1.0
Gas Cleaning	CM-120 Circulation	65.00		80.23	25.23	0.645	5.00	1.0
	CM-120 Outlet Temperature	60.00		46.06	-13.94	1.33	5.00	1.0
	DC-160 Voltage	30.00		35.37	5.32	1.88	5.00	1.0
	DC-161 Voltage	30.00		30.06	-29.98	0.006	3.00	1.0
Gas Cooling	DC-162 Voltage	30.00		34.55	4.56	1.91	5.00	1.0
	VT-140 Circulation	450.00		529.3	79.27	2.17	5.00	1.0
	CM-170 Outlet Temperature	27.50		29.29	1.79	4.69	5.00	1.0
	DC-190 Voltage	20.00		3.46	-10.52	2.00	3.00	1.0
Tower Plant flows	DC-191 Voltage	20.00		27.02	7.92	0.757	5.00	1.0
	CM-300 Flow 535FIT590	150.0					3.00	1.0
	CM-310 Flow 535FIT610	150.0					3.00	1.0
	CM-330 Flow 535FIT630	300.0					3.00	1.0
	CM-350 Flow 535FIT651	450.0					3.00	1.0
CM-400 Flow 535FIT675	450.0					3.00	1.0	

Business Challenge

- KPIs were onerous to create and troubleshoot
- Configuration was complex
- KPIs were growing
- More plants wanted KPI reports
- KPIs were inflexible

Solution

- PI System for daily/ shift totals
- PI Asset Framework for KPIs and hierarchy configuration and data extraction
- Microsoft Analysis Service tabular model to aggregate up
- Excel Pivot table for reporting

Results and Benefits

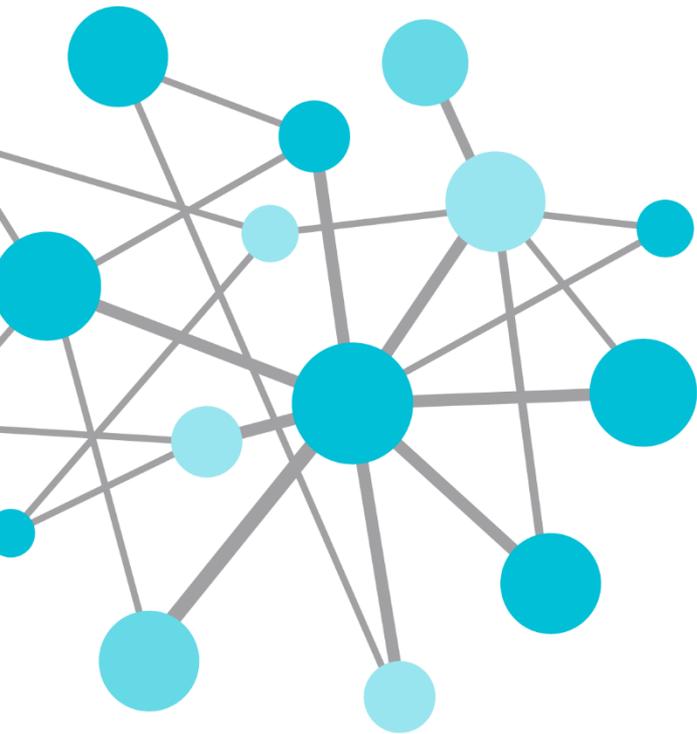
- KPI creation from 6 to 3 steps
- One report
- Quick rollout (30min)
- More user control
- Flexible reporting
- Over 70 hours saved ...

Warren Armstrong

Warren.Armstrong@AngloAmerican.com

Control Technology Specialist

Anglo American Platinum

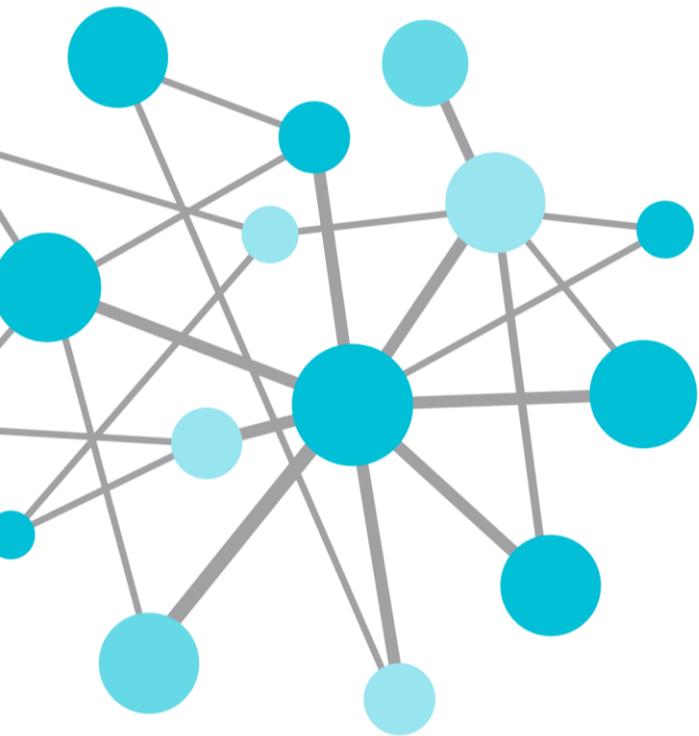


Questions

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



State your
**name &
company**



THANK
YOU

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this session

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