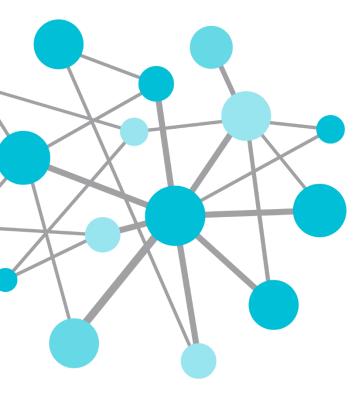


Presented by Geff Wood

## **Presentation Agenda**

- Background on Ma'aden and the Ma'aden Aluminum Smelter
- History of OSIsoft PI Server Adoption at the Site
- Critical Process Dashboard and Notifications
- Potroom Performance Reporting
- Water Treatment Improvements in the Casthouse
- Monitoring of the PI Interfaces (Technology Team)
- Planned Next Steps
- Questions?



## **Background on** Ma'aden and the Ma'aden Aluminum **Smelter**

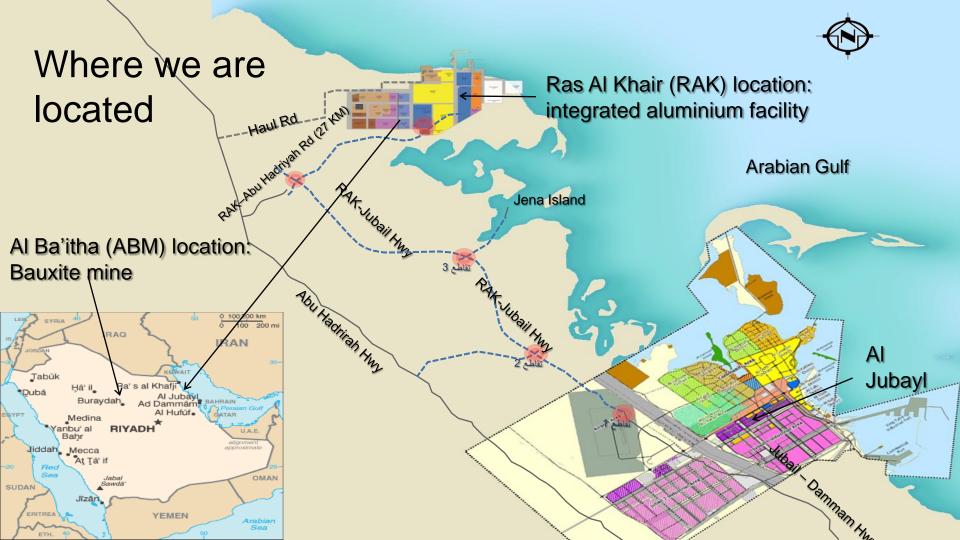


Joint venture between Saudi Arabian Mining Company (Ma'aden) & Alcoa.

Once completed, US\$10.8b project will be largest / most efficient integrated aluminium complex in the world.

Facilities: bauxite mine at Al Ba'itha, connected by rail to alumina refinery, aluminium smelter & rolling mill at Ras Al Khair.





#### **Our integrated operations**

#### Mine

#### Refinery

#### **Smelter**

**Rolling Mill** 



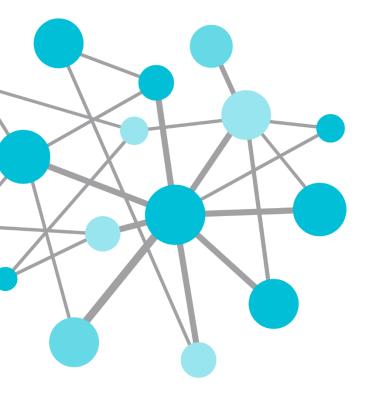
- Located at ABM, 600km from RAK
- 4 MMT annually
- 30+ years of reserves
- Railway to transport bauxite
- First bauxite 2014

- Located at RAK
- First Alumina Refinery in GCC
- 1.8 MMT annually
- Designed for expansion
- First alumina 2014

- Located at RAK
- 740 KMT annually, designed for expansion
- Ingots, billets, T-bar and slabs for Rolling Mill
- First hot metal 2012

- Located at RAK
- 380 KMT annually, designed for expansion
- Body, end & tab stock for aluminum cans & Automotive and other aluminium coil
- Can Reclamation Unit
- First coil Dec 2013





## **History of OSIsoft PI Server Adoption at the Smelter**

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## **PI Systems were part of Original Design**

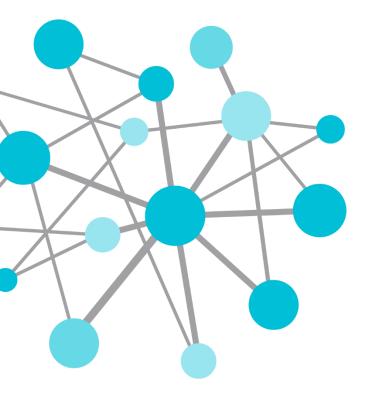
Alcoa was technology partner and was in process of establishing an Enterprise Agreement

Smart Infrastructure" was key element of Alcoa Architecture

> Ma'aden team had limited "PI System" experience so opted for infrastructure, but very small point count

➢PI Data Archive up and running from day 1

>Multiple tag count increments



## Critical Process Dashboard and Notifications

## **Dashboard - Key Process Indicators (KPIs)**

KPIs to monitor the operation on a shift/daily basis
 The KPIs depend on area & level. Normally 10-15 per area

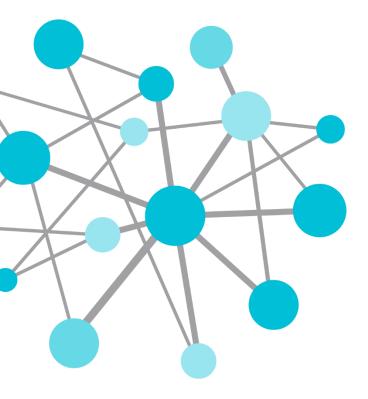


## PI Notifications on real time (e-mail & SMS) to monitor critical process

There are 202 PI Interfaces to monitor the critical Smelter process. Fast answer in case of issues

The messages are sent instantly using SMS and e-mail format

🖀 Database 🛗 Query Date 👻 🕼 Back 💿 🗟 Check In 🦃 🖌 😰 Refresh 🛛									
Notifications	230KV_0107_MAIN_TRANSFORMER_CB_STATUS								
🤤 New 🔻 🗙 📔 📄 🖬 🔹 🤹	Overview Tr	igger   Message   Subscriptions   History							
230KV_0107_MAIN_TRANSFORMER_C	Name:	230KV_0107_MAIN_TRANSFORMER_CB_STATUS							
380KV_0109_MAIN_TRANSFORMER_C	Unique ID:	2ceb66b3-50a8-4706-a050-5eaa1b75e426							
280KV_0201_MAIN_TRANSFORMER_C 380KV_0309_MAIN_TRANSFORMER_C	Description:								
🔄 Anode Assembly System IS Available									
Anode Assembly System is NOT Available Anode Delivery System IS Available	Status:	Running							
🖻 Anode Delivery System is NOT Available	Template:								
Anode Former 1 Density below 1.62 Anode Former 1 Paste Temperature is abc	Categories:	Power HV&MV							
Anode Former 1 Pitch Temperature is abo	Trigger —	,							
🔄 Anode Former 1 Preheating Screw Blade I	Target: Pov								
Anode Former 2 Density below 1.62 Anode Former 2 Paste Temperature is abc	Condition: 2	<u>30KV 0107 MAIN TRANSFORMER CB_STATUS = 0</u>							
Anode Former 2 Pitch Temperature is abo	Message -								
Anode Former 2 Preheating Screw Blade I	0 item(s) of	0 item(s) of custom content available to subscribers							
Anode Former 3 Density below 1.62		1 customized delivery format(s) configured for Email 1 customized delivery format(s) configured for SMS							
•									

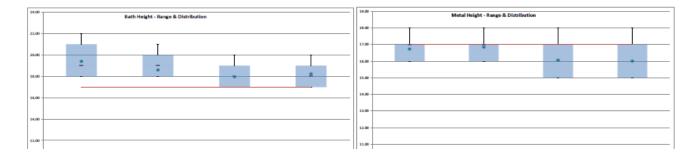


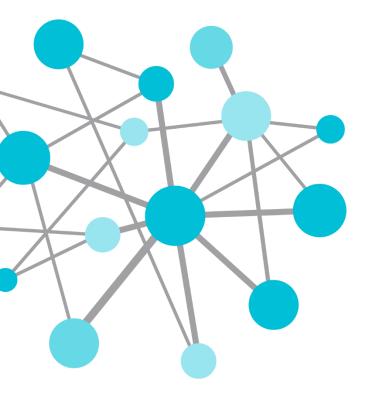
## Potroom Performance Reporting

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### Automatic Daily Report to the manager e-mail using PI DataLink (no code)

Last update:							-		<b>Г</b> 1		VA		A C								
5/7/2014								POT LIN	EI	JAIL	. Y IN	πΑΝ	AG	EIV	IEI		ĸυ				
Description	UOM	Li	ne 1	Li	ne 2	ISSUES		Description	UOM	Line 1		Line 2		ISSUES	[	Description	Line 1		Line 2		ISSUES
occuption .		PLAN	ACTUAL	PLAN	ACTUAL		1			PLAN	ACTUAL	PLAN	ACTUAL				PLAN	ACTUAL	PLAN	ACTUAL	
OPERATING POTS			322		359		1	LINE VOLTS	v		1423.801		1571.203			PTA Room-A/C					
LINE LOAD	kA		371.9626		372.7321		1	ANODE EFFECT RATE	AE/pot	< 0.2	0.0967	0.2	0.0919			PTA Room-B/D					
METAL TAPPED	mt		686.465		759.58		1	BATH TEMP	C°	964 +/- 5	967.0433	964 +/- 5	966.7682			TAPPING BEAM					
METAL TAPPED (MTD)	mt		11309.04				1	BATH HEIGHT	cm	17 +/- 1	19.0226	17 +/- 1	18.0919			ABRF					
ALF3 ON HAND	mt						1	METAL HEIGHT	cm	17 +/- 1	16.7179	17 +/- 1	16.0362			BTV					
# POTS PREPARED							1	Fe CONTENT	ppm	< 1000	630.3855	< 1000	592.9106			WEDGE EXTRACTOR					
# POTS ENERGIZED							1	SI CONTENT	ppm	< 1000	463.4008	< 1000	482,4385			ALF3 HOPPER					
# POTS STARTED			0		0		1	INSTABILITY	nμ	< 100	47.2805	< 100	45.1355			APTV					
Quality	Room	A	в	с	D		1	POWER INTERRUPTION	sec	0	No Deta	0	No Dete			FORKLIFT					
HIGH Fe POTS > 2.000	ppm						1	LATE WORK	Α	в	Total	c	D	Total		CRUCIBLES (M)					
high re Pois 2,000	ppm	-	•	•	•			SETTING ANODE								CRUCIBLES (B)					
HIGH SI POTS > 2,000	ppm	1	3	0	0			ANODE COVERING								THTV					
				-			4	METAL TAP								BATH LIFTING BEAM					L
CURRENT EFFICINCY TODAY	*		No Data		No Deta			ALF3								SCHEDULED PM					
CURRENT EFFICINCY (MTD)	*		No Deta		No Deta		1	Beam Raising								MISSED PM					
RWO MATERIAL		GTC 1	GTC 2	GTC 3	GTC 4			BATH TAP													
FRESH ALUMINA	*	81.46	72.98806	67.55	74.53633		1			-	-										
FLUORINATED ALUMINA	*	80.06	79.92407	80.53	78,45836		1	CONCERNS								MAINTENANCE					
CRUSHED BATH	*	61.39	51.54327	60.62	51.98584		1								1						

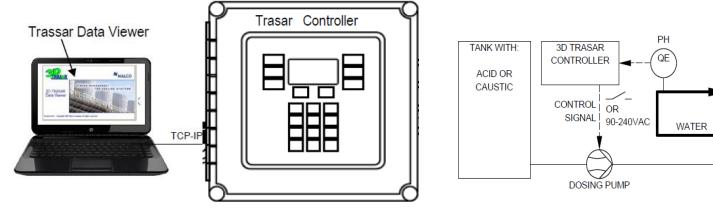




## Water Treatment Improvements in the Casthouse

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### Case Study: Bring Water Treatment Controller information into PI Data Archive



Target: 3DTrasar Controller

Location: 3 nos. Field Mounted. 200meters from nearest substation

Function: Control Cooling Water PH, Corrosion, Bacterial Growth etc.

Inputs: Sensors for PH, Conductivity, Fluorometer, Tagged Polymer etc.

Outputs: Relays for 6 Dose Pumps

Program Access: Local LCD Display, Data viewer on Laptop

Communication: RS485 Serial Port

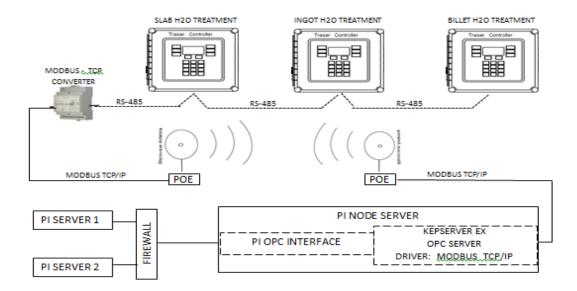
OPEN

RECIRCU-

LATING COOLING

SYSTEM

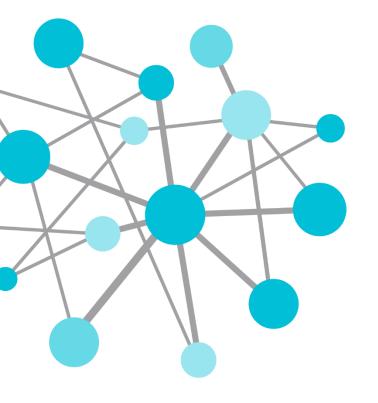
## **OSI interface using KepServer (OPC protocol)**



- OPC Server KepServer EX with Modbus TCP/IP driver
- 114 PI Tags created for 114 3DTrasar water treatment parameters (38/Controller).
- Tags used to create PI ProcessBook Display showing all 3 Trasar controllers with Trends of critical parameters.

### **Dashboard for the Water Treatment**

			PRESS F1:	1 FOR FULL SCREEN							
CASTHOUSE WATER COOLING SYSTEMS - WATER TREATMENT											
							-				
	SLAB CASTING COOLING WATER SYSTE	м	41	GOT CASTING COOLING WATER SYS	TEM	EII	LLET CASTING COOLING WATER SYS	TEM			
OPERATING DATA	SYSTEM PERFORMANCE	RELAY STATUS	OPERATING DATA	SYSTEM PERFORMANCE	RELAY STATUS	OPERATING DATA SYSTEM PERFORMANCE RELAY STATUS					
FRESHR DOSC         31.19         RMT           FAIL POLYMER DOSE         45.02         RMT           CONDUCT MIPY         657.91         USH           ORP         462.03         RMT           RMT         8.33         FMT	n NAUCO SCALE INDEX		FRAME COSC         307.20         00m           FASE POLYMER COSC         45.16         00m           CORDUCT/MIYY         2475.376         v2ion           QRSP         1475.376         v2ion           0H         7.855         1475.376	NULDI DI DI PEEX         0           NULDI VEULE PEEX		FRAME DOSC         33.76         Rom           FAIL POLYAGER DOSC         50.700         Rom           CONDUCT WITY         606.65         4/30m           DSP         610.00         mf/           CH         5.31         1					
VIATER TEMPERATUR 20.54 degi TURSEDITY 2.52 NTU HISLONG I NE NEEK 171.90 his EELL FOLLING 2.00 N		NewSX EXISTER FELKY	WARGE FOMPERATURE 33.24         degC           FUENDIFY         0.30         NFU           HOLDING FINE NEEX 137.00         ha         CELL FOULING         5.00         N	EXERCISE C.11 cm EXERCISE C.12 cm EXERCISE CM EXERCISE CM EXECUSE	NAMOX BITCHE RELAY O	VATER FEMPERATUR 25.02 degC FURRIDITY 1.93 NPU HEILDING FINE REEK 30.07 has CELL FOULING 0.03 N	BATERPORTER         0.02         mb           BATERTOLICY         0.02         mb           BATERTOLICY         0.02         mb           BATERTOLICY         0.02         mb           BATERTOLICY         0.02         mb	NHARLAY O RECEIVED RELAY O			
TREADECT TRACE         GMI           TREADE USAGE         GMI           TREADE USAGE         GMI           BID REFORMER USAGE         GMI           RELEVEN USAGE         GMI           HOTHOR & BROCK USAGE         GMI           HOTHOR & BROCK USAGE         GMI	HEAT FELECT 561,121 KETU RECERCIENT KIN RATE 7,245 gpm SYSTEM VOL AVERAG SVG gpl		PEODECT TALGE         GRI           FRASHR USAGE         GRI           FAS FRASHR USAGE         GRI           BEI REPORTER USAGE         GRI           BEI REPORTER USAGE         GRI           HOTHOR & USAGE         GRI           HOTHOR & USAGE         GRI           HOTHOR & USAGE         GRI	WATEL&ENERGY         1.3         00"           BURDHERNE         1.5         00"           NORGHERNE         9.5         00"           NECHDARNE         1.5.75,164"         00"           PECENDLY DRIVE         42,467         00"           SYSTEMINEL ANDROLE         1.4,60"         00"	EXTERNAL INPUTS SMPLE/LON O DEI/AL NEW NO.3 OE/AL NEW NO.4 OU/AL NEW NO.4 MULIOS NEW 1 0 MULIOS NEW 1 0 0	TRADURCT TRANCE         00 <sup>4</sup> FRADAR USAGE         00 <sup>4</sup> FAG RADARE USAGE         00 <sup>4</sup>	WATER & ENERGY         gm           BOHDONN RAVE         73         gm           MREDP RAVE         73         gm           HEXY RESET         0         ks/u           REERDLAY RANGE         8         gm           SYSTEM VOL AREROLUS         get	ESTERAL INVESS SARELFLOW 0 NYCROCK SYANDS DEFINE NOU NO.3 DEFINE NOU NO.4 NUMBER NOU NO.4 NUMBER NOU S			
	PENS: 3L			TRENDS		PENS: SUR IN					
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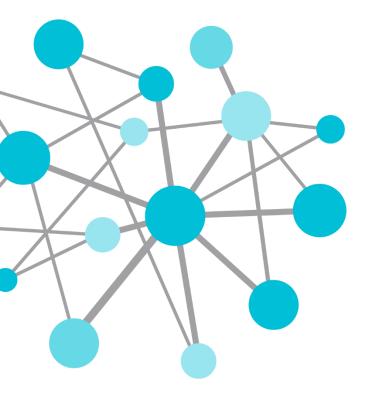


## Monitoring of the **PI Interfaces** (Technology Team)

### **Dashboard to Monitor the PI Interface Node**

- There are 22 PI OPC Interfaces
- There are 8 PI RDBMS Interfaces that fetch data from Oracle and MSSQL
- > PLC Watchdog to monitor the critical PLCs.





## Planned Next Steps

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## **Develop Business Case for Value Add**

> With Smelter entering Stabilization phase there is great pull from Operations for multitude of Value Add Opportunities

≻OEE

≻...

- ➤Metal Flow Visibility
  - ≻Operations at a Glance
  - Bottleneck Highlights

#### $\triangleright$

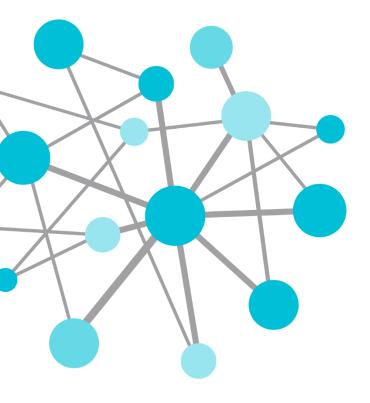
Evaluate Enterprise Agreement with Value Add \$\$ in Equation

### Marshall Mahala IPS Manager / CH MES SME Ma'aden Aluminium

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- <u>mahalam@ma.maaden.com.sa</u>

## **Geff Wood - Alcoa**

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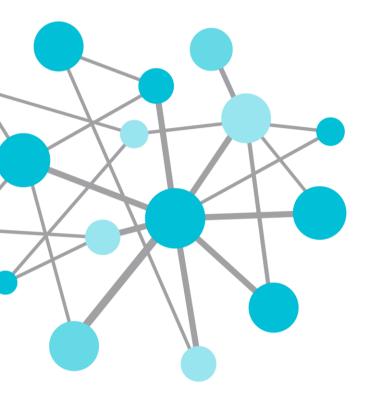


## Questions

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

> State your name & company





# -HANK YOU



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