

Mine Operations Management System

Presented by **Johan de Villiers**



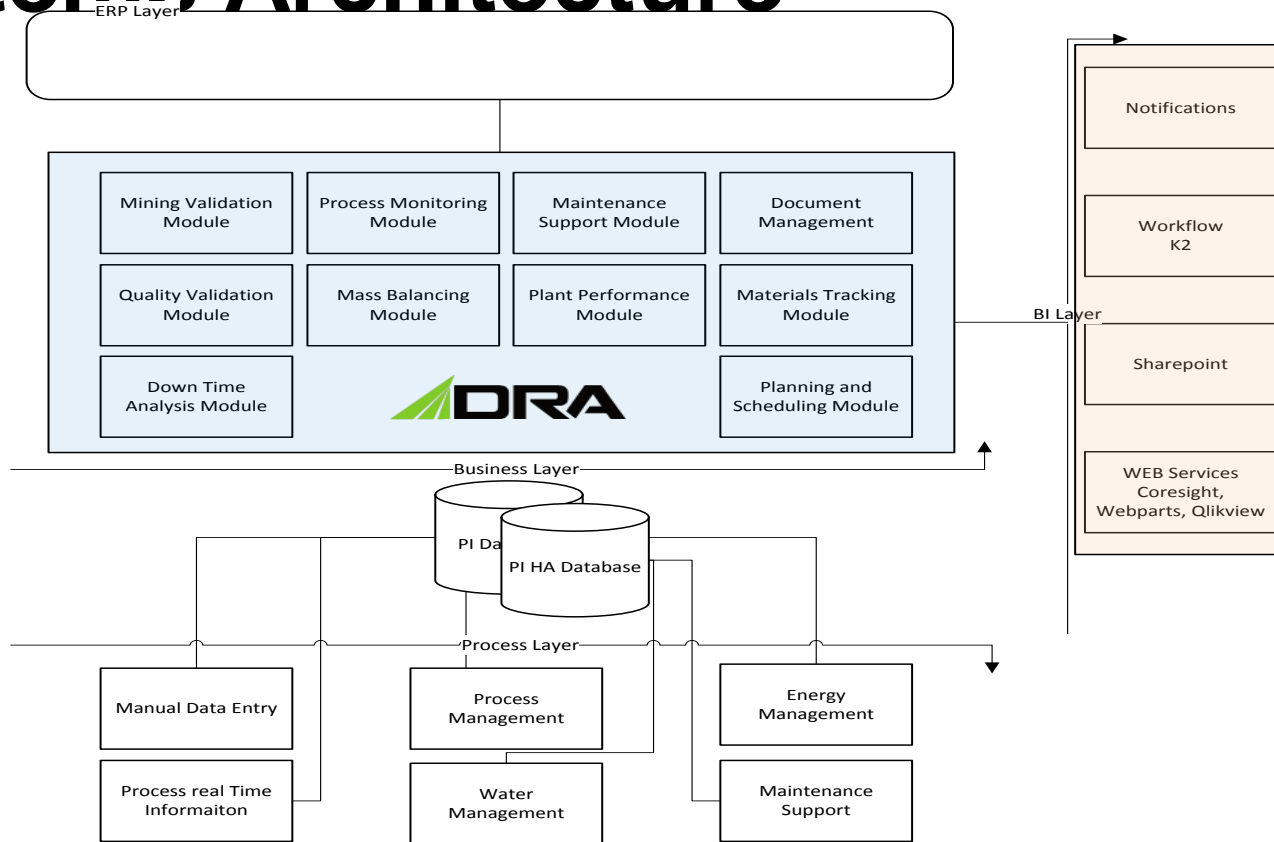
Agenda

- DRA Minerals Project Company Info
- System Architecture
- Mine Operations Management System
- Kibali Gold Mine Golden Shift – The PI Way
- PI System Products and Deployment
- Project KPI's
- Questions

DRA Minerals Projects (Pty) Ltd

- Established 1984
- Multi-disciplinary engineering group that delivers mining, minerals processing and infrastructure services from concept to commissioning as well as comprehensive operations and maintenance services
- Privately owned company with over 3 000 employees globally
- Head Office Johannesburg South Africa. Offices in nine African Countries, Canada, Brazil, Australia, India and China.

Systems Architecture



Mine Operations Management (MOMS)

- Production Planning and Scheduling
- Production Performance
- Production Monitoring
- Cost Module
- Quality Control
- Grade Control and Stockpile Management
- Mass Balancing / Materials Tracking / Reagents Tracking
- Maintenance and Down Time Analysis
- Procurement and Supply Chain
- Asset Management
- KPI's and Reporting
- Document Module

Design Objectives of the Kibali MOMS

Performance Indicators for Managing Risk and Achieving “Golden Shift”			
High Level Goal: Manage Risk and Achieve “Golden Shift” Opportunities			
Operations Perspective	Reliability Perspective	Work Management Perspective	SHEQ Perspective
Goals: Reduce Operating Cost and Risk. Maximise Output	Goals: Maximise uptime. Preserve plant and asset integrity	Goals: Minimise corrective work. Restore asset condition	Goals: Safe audited operational capabilities
Strategic KPI <ul style="list-style-type: none"> - Plant Availability (percentage of calendar time) - Plant Uptime (percentage of schedule) - Number of LPO Events - Time operating outside deterioration limits (e.g. percentage) - Production Target Compliance (e.g. 200tph +) 	Strategic KPI <ul style="list-style-type: none"> - Plant Availability - Proactive work orders (e.g. percentage) - Emergency work orders on critical systems (e.g. percentage) - Asset deterioration monitoring - Inspection Compliance (based on SHEQ and HAZMAT) - Predictive Maintenance Compliance (based on maintenance strategy) - Protective device inspection compliance - Quantified asset reliability target 	Strategic KPI <ul style="list-style-type: none"> - Planning Compliance - Scheduling Compliance - Proactive Works Orders - Assessments of works orders completed - Completed Works Orders with in X% of planned costs - Quantified availability targets (e.g. Process, People, Plant) 	Strategic KPI <ul style="list-style-type: none"> - Incident Rate - Safety performance index - Significant environmental aspects defined / quantified
Operational KPI <ul style="list-style-type: none"> - Process availability variance - Utilities variance (e.g. Power) - Mass balance, material tracking and WIP - Quality Limit Excursions (e.g. Reagents) - Start-up and Shut-down Indicators (linked to production schedule) - Liberation indicators (e.g. grams/ton) - Inventory Tracking 	Operational KPI <ul style="list-style-type: none"> - MTBF (by equipment type, area) - MTBR (by equipment type, area) - MTBM (by equipment type, area) - MTBF Growth/Change - Completed work order records on significant failures - Current mechanical availability - OEE - AU 	Operational KPI <ul style="list-style-type: none"> - Emergency work orders - Reactive work orders - Backlog work orders - Overtime Hours - Work orders planned - Cumulative Maintenance costs for standing - Average direct cost per maintenance event - Rework - Closed work orders within X days of schedule 	Operational KPI <ul style="list-style-type: none"> - Outstanding Items from Monthly safety inspection report - SHEQ incidents - Total Lost days due to injury

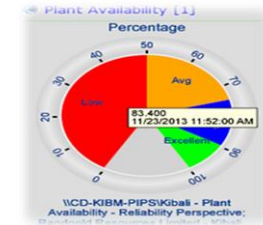
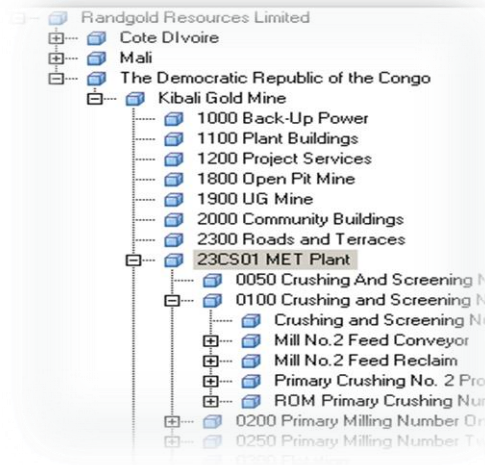
Operations Perspective

Strategic KPI

- **Plant Availability**
(percentage of calendar time)
- **Plant Uptime**
(percentage of schedule)
- **Number of LPO Events**
- **Time operating outside deterioration limits**
(e.g. percentage)

Goals:

Reduce Operating Cost
and Risk. Maximise
Output

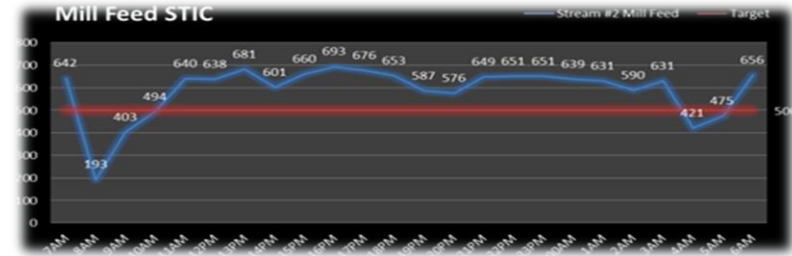


Name	Value
Category: <None>	
Coresight Display	http://192.168.88.99/coresight/#/Displays/16/RDM-Cr
Process Book Display	C:\Displays for presentation\0250-1.Mill No 2 Feed Inlet
Process Design Criteria	http://qb-cdc-costracd/Process/Kibali-Crushing-No-2-Re
Category: Parameters	
Overall Equipment Efficiency	25.5675969415052 %
Shift Availability	39.3541521808007 %
Shift Utilisation	28.2801058941898 %

Operations Perspective

Operational KPI

- Process availability variance
- Utilities variance
(e.g. Power)
- Mass balance, material tracking and WIP
- Quality Limit Excursions
(e.g. Reagents)
- Start-up and Shut-down Indicators
(linked to production schedule)



Elements

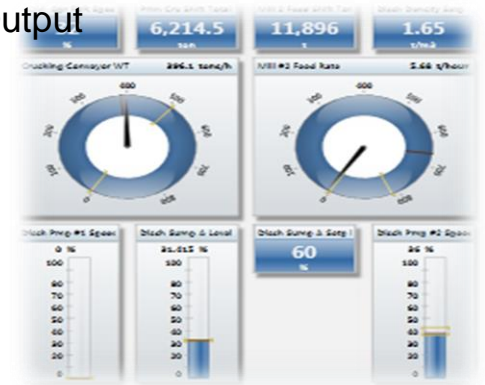
- CD-KIBM-PIPS ModuleDB
- MET Plant Mass Balance
 - Flotation Mass Balance
 - Stream 1 Mass Balance
 - Stream 2 Mass Balance

Category: CILFeedOx

CIL Feed Oxide SG	2.89 t/m3
CIL Oxides Feed % Solids(v/v)	18.1151005620326 %
CIL Oxides Feed % Solids(w/w)	39 %
CIL Oxides Feed Gold	961.2 g
CIL Oxides Feed Gold Head ...	2.15902964959569 g/t
CIL Oxides Feed Gold Recov...	0 %
CIL Oxides Feed Mass Pull C...	0 %
CIL Oxides Feed Pulp	850.386904445036 m3/h
CIL Oxides Feed Pulp Density	1.34237540062242 t/m3
CIL Oxides Feed Solids	445.2 t/h
CIL Oxides Feed Water	696.338461538461 l/h

Goals:

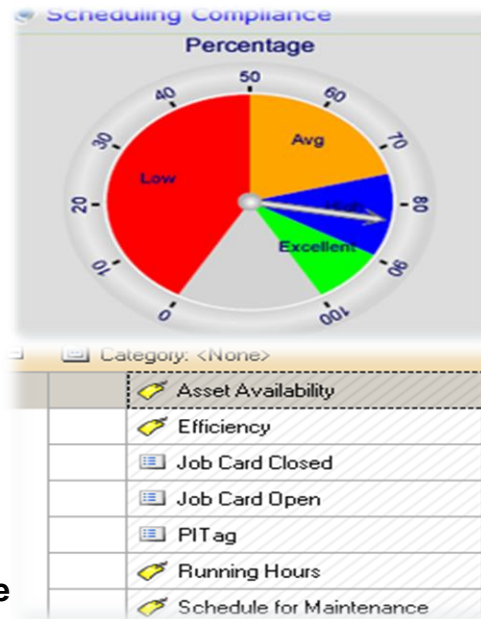
Reduce Operating Cost and Risk.
Maximise Output



Reliability Perspective

Strategic KPI

- **Plant Availability**
- **Proactive work orders**
(e.g. percentage)
- **Emergency work orders on critical systems**
(e.g. percentage)
- **Asset deterioration monitoring**
- **Inspection Compliance**
(based on SHEQ and HAZMAT)
- **Predictive Maintenance Compliance**
(based on maintenance strategy)



Goals:

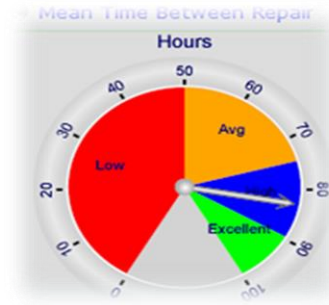
Maximise uptime. Preserve plant and asset integrity

Generator 13 MWh 0.95104 MWh	Generator 19 MWh 0.89932 MWh	Generator 25 MWh -0.012632 MWh	Generator 31 MWh 0.74244 MWh
Generator 14 MWh 1.0019 MWh	Generator 20 MWh 0.82672 MWh	Generator 26 MWh 0.48278 MWh	Generator 32 MWh 0.79828 MWh
Generator 15 MWh 0.98565 MWh	Generator 21 MWh 0.94274 MWh	Generator 27 MWh 0.69407 MWh	Generator 33 MWh 0.41353 MWh
Generator 16 MWh 0.95546 MWh	Generator 22 MWh 0.84563 MWh	Generator 28 MWh 0.82213 MWh	Generator 34 MWh 0.58145 MWh
Generator 17 MWh 0.76635 MWh	Generator 23 MWh 0.70653 MWh	Generator 29 MWh 0.73493 MWh	Generator 35 MWh 0.46559 MWh
Generator 18 MWh 0.86922 MWh	Generator 24 MWh 0.72187 MWh	Generator 30 MWh 0.75669 MWh	Generator 36 MWh 0.695786 MWh

Reliability Perspective

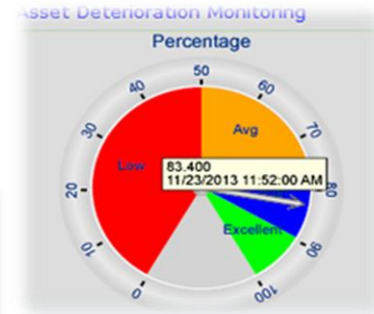
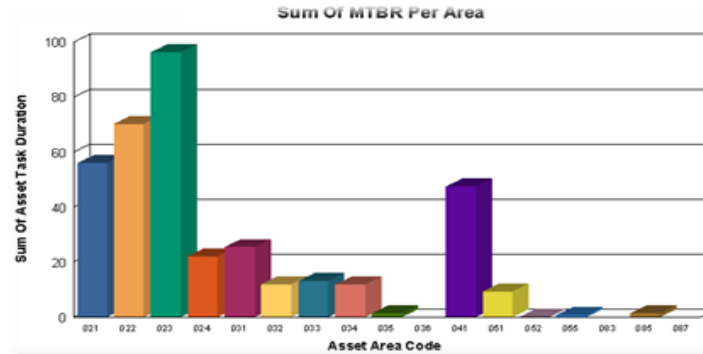
Operational KPI

- **MTBF**
(by equipment type, area)
- **MTBR**
(by equipment type, area)
- **MTBM**
(by equipment type, area)
- **MTBF Growth/Change**
- **Completed work order records on significant failures**
- **Current mechanical availability**
- **OEE**
- **AU**



Goals:

Maximise uptime. Preserve plant and asset integrity



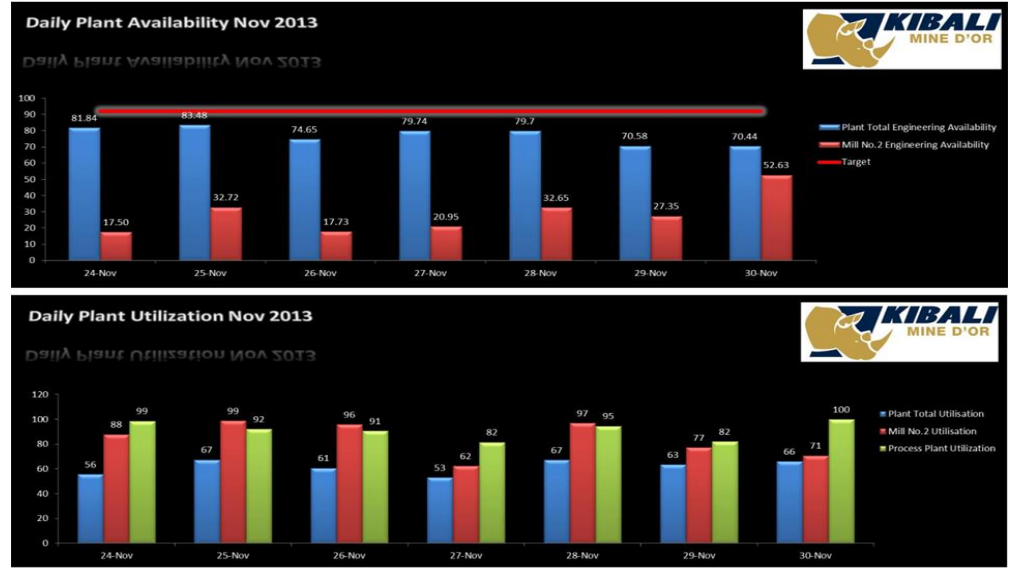
Work Management Perspective

Strategic KPI

- Planning Compliance
- Scheduling Compliance
- Proactive Works Orders
- Assessments of works orders completed
- Completed Works Orders with in X% of planned costs
- Quantified availability targets (e.g. Process, People, Plant)

Goals:


Minimise corrective work. Restore asset condition

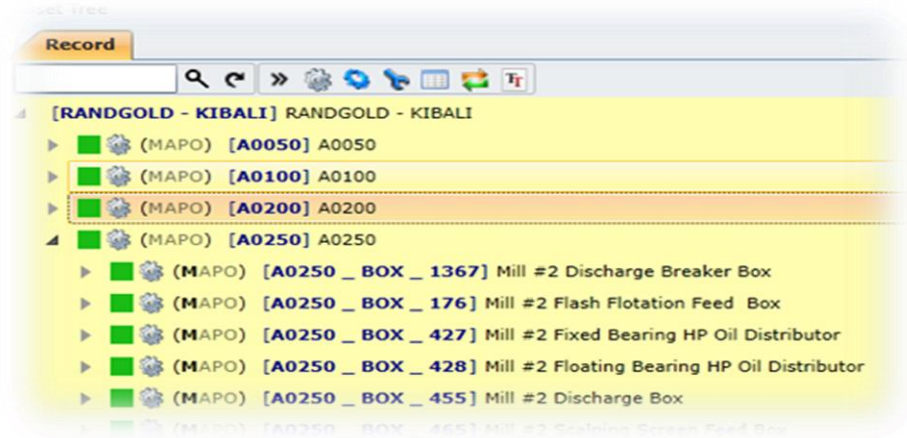


Work Management Perspective

Operational KPI

- Emergency work orders
- Reactive work orders
- Backlog work orders
- Overtime Hours
- Work orders planned
- Cumulative Maintenance costs for standing
- Average direct cost per maintenance event
- Rework
- Closed work orders within X days of schedule

		KIBALI Engineering Jobcard Number R50253	Received on: 2013/11/08 05:35:44PM Required by: 2013/12/02 06:00:00AM
Responsible Foreman Equipment: Cost Centre: Tag & Lockout Equipment	Plant Mechanical Fitter A0950 _ PUMP _ 1504 Fire Water Diesel Pump #1 ENG Yes <input type="checkbox"/> No <input type="checkbox"/> N/A <input type="checkbox"/>		Originator: Charl Knighton Contact Person: Phone number: Est Duration: 1.00 Hrs Priority: 3
MINI RISK ASSESSMENT			
Date:	Time:	Area:	Activity:
Supervisor/Contractor:			
What could go wrong?			
What can be done to prevent incident?			

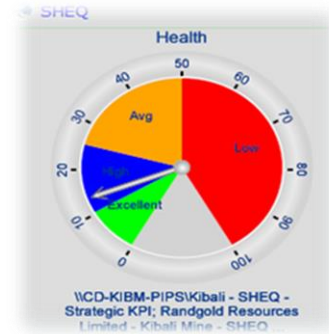


SHEQ Perspective

Strategic KPI

- Incident Rate
- Safety performance index
- Significant environmental aspects defined / quantified
- Outstanding Items from Monthly safety inspection report
- SHEQ incidents
- Total Lost days due to injury

Goals: Safe audited operational capabilities



Human Resources	Safety Health and Environment	Maintanace
<ul style="list-style-type: none">• Submit Travel Requisition• Submit Leave application• Submit Greivance Procedure	<ul style="list-style-type: none">• Report An Incident	<ul style="list-style-type: none">• Open Job Card

SHEQ – Injury Submit Form



Submit Incident or Injury Notification:

INR -150		12/2/2013	
Date of Incident: <input type="text" value="Select a date"/>		Site: <input type="text" value="Site Name"/>	
Classification: <input type="text" value="Classification"/>		Department: <input type="text" value="Department"/>	
Name of Injured: <input type="text" value="Name of Injured"/>		Incident Location: <input type="text" value="Location"/>	
Supervisor Name: <input type="text" value="Supervisor"/>		Occupation: <input type="text" value="Occupation"/>	
Please select Category <input type="text" value="Please Select"/>			
PHOTO		Description of the Incident	
<div>No Image Click here to attach an image</div> <div>No Image Click here to attach an image</div> <div>No Image Click here to attach an image</div>		<div>Type a value</div>	
PRELIMINARY ROOT CAUSES:		Preventative Measures, learning points:	
SWP Available? <input type="checkbox"/>		<div>Type a value</div>	
Risk Assessment Completed? <input type="checkbox"/>			
Hazards Identified <input type="checkbox"/>			
DSTI Completed <input type="checkbox"/>			
Risks and Precautions communicated <input type="checkbox"/>			
Adequate and competent Supervision <input type="checkbox"/>			

Notifications – K2



Mon 2013-11-18 06:16 AM

K2 Service

KibaliMES - Process Operation Daily Report

To: Wessel Els

Cc: WesleyT@drasa.co.za

Message

Process operation daily report.xlsx (28 KB)

Good Morning,

Please find the Process Operation Daily Report attached.

Thank you,

KibaliMES Admin

KIBALI OPERATION REPORT										
Item		Unit	Daily Actual	Daily Target	% Variance	Week Actual	Week Target	% Variance	QTD Actual	QTD F/C
Date			15-Nov-13			Week 45			QTD	
LTI free days		days								
Crusher										
	Tonnes crushed	t	4 967,23	10 000		28 100,07	70 000			
	Primary crusher Utilization	%	62,99	100						
Milling										
No of Days						5				45
	Plant Total Mill Feed Tonnes	t	8 537,84	10 000	-15%	48 182	70 000	-31%	399 450	288000
	Tonnes treated	t	2 300,00	10 000	-77%	19 298	70 000	-72%	311 265	288 000
	Hourly treated (tph)	tph	148,07	453	-67%	190,02	455	-58%	401,19	290
	Plant Running time	Hr	15,53	22,1	-30%	101,6	155	-34%	775,9	995
	Plant utilization	%	64,72	100	-35%	78,86	100	-21%	68	100
	Mill 01 utilisation	%	No Data		#VALUE!					
	Mill 02 utilisation	%	68,22	100	-32%	82,71	100	-17%	72	100
	Mill 01 running time	Hr	#VALUE!	22,1	#VALUE!					
	Mill 02 running time	Hr	16,37	22,1	-26%	108,68	155	-30%	861,17	995
	Milling 01 rate per mill (tph)	tph	#VALUE!	453	#VALUE!					
	Milling 02 rate per mill (tph)	tph	521,43	453	15%	443	452	-2%	353	290
Oxygen										
	Oxygen plant RT	hours								
	Oxygen plant Tonnes	t								
Recovery										
	Plant Head Grade (BCH)	g/t		3,223	-100%			#DIV/0!		3,220
	Plant Total Residue	g/t		0,327	-100%			#DIV/0!		0,300
	Plant Solution Loss	g/t		0,005	-100%			#DIV/0!		0,005
	Recovered Grade	g/t	0,00	2,896	-100%	-	0,000	#DIV/0!	-	2,920
	Plant Overall Recovery	%	0,00	89,9	-100%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	90,7
	CIL Final Tails	g/t		0,327	-100%			#DIV/0!		0,300

Enterprise Asset Management (Example)

OSIsoft - Friday 31 January 2014 - (ADMIN) SYSTEM ADMINISTRATOR - DEMO - [Repair Schedule]

File Edit Window Navigation Selection Windows 2

Enterprise Asset Management > EAM Setup > Repair Schedule

Last Read

Repair Schedule

Repair Schedule	Description
XWA130000000001	Daily
XWA130000000002	Weekly
XWA130000000003	Monthly
XWA130000000004	Yearly
XWA130000000005	2 Yearly
XWA130000000006	3 Month

Repair Schedule Header

Repair Schedule: XWA130000000001 Repair Description: Daily

Audit

Date created	11/21/13	Creation user	ADMIN	SYSTEM ADMINISTRATOR
Change date	11/21/13	Change user	ADMIN	SYSTEM ADMINISTRATOR

Repair Components Instructions Template Instruction

Repair Schedule Instructions

Instruction Type	Instructions
1 Instruction	Do a Risk and Assessment
2 Safety Warning	Have the correct PPE for the job: Gloves/ear plugs/protective eye wear
3 Check List	Is the area safe to work in/no hazards?
4 Instruction	Check all moving parts are clear of any debris.
5 Instruction	Check all bearings and lubrication points been supplied with grease according to prescriptions.
6 Check List	Check any Noises at the bearings/bearing temperature.
7 Check List	Housing: Check all inspection flaps/doors been well closed and locked.
8 Safety Warning	Housing: Check whether all inspection flaps,doors,flanges etc are dust tight
9 Check List	Feeding Chute: Check all inspection flaps/doors been well closed and locked.
10 Check List	Feeding Chute: Check whether all inspections flaps,doors,flanges,etc are dust tight.
11 Check List	Discharge Chute: Check all inspection flaps/doors been well closed and locked.
12 Check List	Discharge Chute: Check whether all inspections flaps,doors,flanges,etc are dust tight.
13 Check List	Drive System: Check bearings, lubrication points been supplied with grease acc to prescriptions.
14 Check List	Drive System: Check drive components for leakages
15 Check List	Drive System: Check the specified lubricants are being used.
16 Check List	Screws and screwed connections: Visually check correct fastening of connections
17 Check List	Gears: Check oil temperatures
18 Check List	Gears: Check for unusual gear-unit noise
19 Check List	Gears: If layer of dust has built up, the air filter must be clean,whether or not has expired.
20 Check List	Grease nipples: Missing or damaged grease nipples must be replaced immediately

Save Create Delete Cancel End

Ready

EN 7:21 AM 1/31/2014

Enterprise Asset Management (Example)

Friday 31 January 2014 - (ADMIN) SYSTEM ADMINISTRATOR - DEMO - [Job Card]

File Edit Window Navigation Selection Windows ?

Enterprise Asset Management > EAM Daily Processing > Job card

Last Read

Job Card ID	Equipment Component	Planned date	Job card Status
T9913XWJ029	A0100-CRUS-1949	12/12/2013	Job Requested

Job Card Header

Job Card ID: T9913XWJ029 Job Card Status: Job Requested

Equipment Number: A0100-CRUS-1949

Parent ID: A0100-CRUS-1949

Workshop Site: T99 J.C Supervisor:

Type

Job Card Type: ☒ Maintenance Job Card ☐ Once Off Job card

Internal/External JC: ☒ Internal Job Card ☐ External Job Card

Job card Component Detail Instructions Open Documentation Resources Ledger Costs Component Returns Comments Finance

Job card

Requested By: ADMIN Reason: 014 Description: Planned Maintenance

Primary Failure Code: Secondary Failure Cd:

Time Planning

Repair Schedule: XWA130000000001 Daily

Default Trans Type: CK Planned date: 12/12/13

Planned Down Time: 2: Estimated down time: 0.0000

Actual Down time: Meter Reading Closed: 0

Defect Slip: Resource recovery:

Priority

Impact: ☒ High ☐ Normal ☐ Medium ☐ Low

Priority: ☐ Normal ☒ Urgent ☐ Very Urgent

Audit

Creation user: ADMIN SYSTEM ADMINISTRATOR Created Date: 12/05/13

Updated By: Updated date: Closed date:

Trigger

PM Schedule Number: XWM130000000001 Daily PM ☐ Single - Used once ☒ Recurring

Meter Reading Open: 10 Meter UOM: UN Unit:

Reference

Ownership Site: T99 FA Training Site Equipment Manager:

Registration no. User Defined Field 1: User Defined Field 6:

Serial number User Defined Field 2:

Telematic ID User Defined Field 3:

Tare Weight: 0 User Defined Field 4:

Capacity: 0.00 User Defined Field 5: User Defined Field 7: User Defined Field 8: User Defined Field 9: User Defined Field 0:

Save Create Delete Cancel Create Documents Resource recovery End

Ready

Start

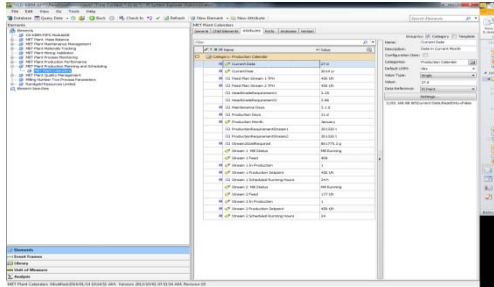
EN 7:27 AM 1/31/2014

PI Product and Deployment

PI System Components

- PI System
- AF Analytics
- Datalink
- Process Book
- Webparts
- Coresight
- Interfaces

• Scheduling

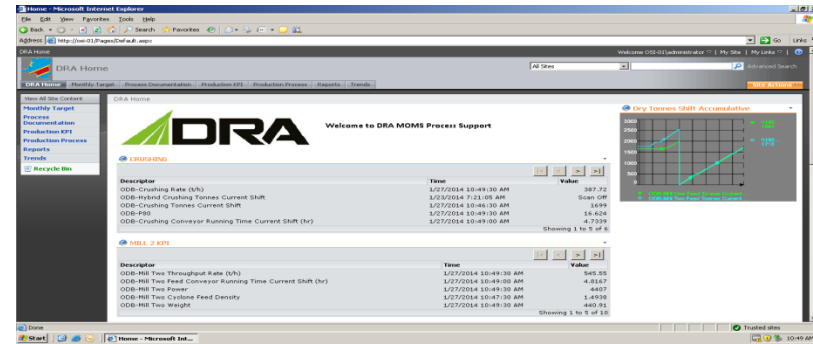


• Benefits

Name	Value
Category: <None>	
Stream 2 LPD	83.4 %

• LPO

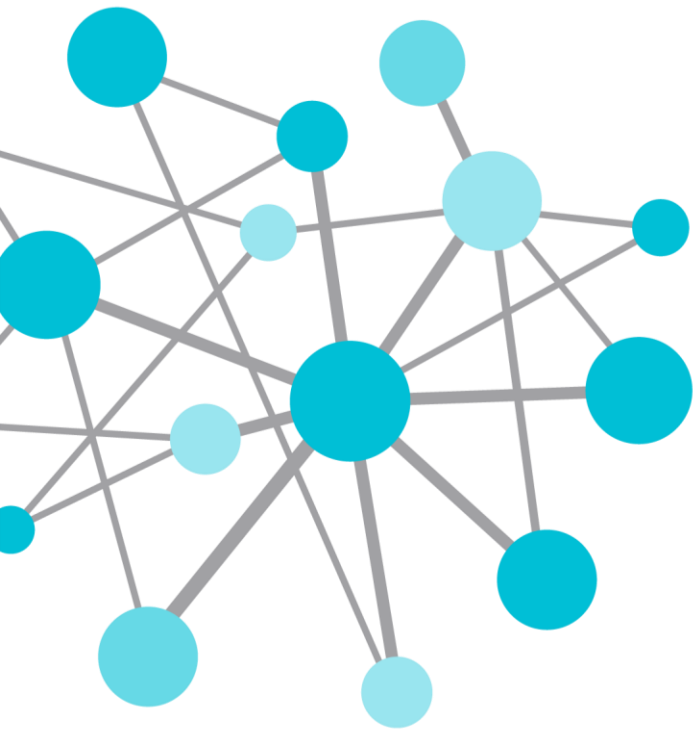
Name	Value
Category: <None>	
Coresight Display	http://192.168.88.99/coresight/#/Displays/16/ROM-Cr...
Process Book Display	C:\Displays for presentation\0250-1 Mill No 2 Feed Inlet...
Process Design Criteria	http://qb-cdc-costrad/Process/Kibali-Crushing-No-2-Re...
Category: Parameters	
Overall Equipment Efficiency	25.5675969415052 %
Shift Availability	39.3541521808007 %
Shift Utilisation	28.2801058941898 %



Questions

Johan de Villiers

- Johan.deVilliers@DRAGlobal.com
- Consultant
- DRA Minerals Project (Pty) Ltd



THANK
YOU

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