Enterprise Manufacturing Services to Enhance Energy Effectiveness and Sustainability Management

Presented by Ales Soudek – Center of Excellence
OSIsoft, LLC
Agenda

• Key Initiatives
• Examples
  – Anglo American Platinum
    • Data Quality
    • Energy Monitoring
    • Condition Based Maintenance
  – Syncrude Canada
    • Mobile Asset Monitoring
Key Initiatives

• Energy
• Water
• Operational / Equipment Effectiveness
• No Magic Bullet - Big Bang
  – Lots of Little Bangs
Good Foundation

• Data Quality

How Good Is Your Data?
Data Quality Initiative at Anglo Platinum
Business Challenge

- 100,000+ Instruments
- 700,000 Tags
- Low Maintenance
- Scalable Solution
- Templatizable
- Improve Business & Operational Decisions
- Rapid Deployment
- Bad Quality Data
- Instruments Critical to Safety
- Automatically Handle Configuration Changes
Enterprise Architecture

- Distributed Architecture
  - Limited Network Bandwidth
- Local Calculations
- Select Data Rolled-up to Central PI System
- Master PI AF Replicated to Sites
Data Validation Methods

- Model based reconciliation
- Statistical
- Filters
- Gross Error Detection (GED)
# Gross Error Detection

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Fault state</th>
<th>Analogue</th>
<th>Digital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>Good data quality</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Missing Data</td>
<td>Data point is missing</td>
<td>Yes</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Not Running</td>
<td>Equipment or process not running</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>High</td>
<td>Data point is above the process high limit</td>
<td>Yes</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>Data point is below process low limit</td>
<td>Yes</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Not Updating</td>
<td>Data is not updating</td>
<td>Yes</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>ROC</td>
<td>High rate of change</td>
<td>Yes</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Simulated</td>
<td>Simulated data</td>
<td>Yes</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Qbad</td>
<td>Quality bad indicator from the control system</td>
<td>Yes</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
### Instrument Monitoring Results

#### Instrument Monitoring Dashboard

<table>
<thead>
<tr>
<th>Instrument Type</th>
<th>Last Two Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Last Two Hours

<table>
<thead>
<tr>
<th>Instrument Type</th>
<th>Last Two Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Mill Discharge</td>
<td>4</td>
</tr>
<tr>
<td>Primary Mill Feed</td>
<td>1</td>
</tr>
<tr>
<td>Secondary Mill Discharge</td>
<td>4</td>
</tr>
<tr>
<td>Secondary Mill Feed</td>
<td>1</td>
</tr>
<tr>
<td>AP Air Gap Meter</td>
<td>1</td>
</tr>
<tr>
<td>AP Level Meter</td>
<td>24</td>
</tr>
<tr>
<td>Density Meter</td>
<td>1</td>
</tr>
<tr>
<td>Flow Meter</td>
<td>15</td>
</tr>
<tr>
<td>Load Cell</td>
<td>1</td>
</tr>
<tr>
<td>Power Meter</td>
<td>5</td>
</tr>
<tr>
<td>Pressure Meter</td>
<td>2</td>
</tr>
<tr>
<td>Temperature Meter</td>
<td>25</td>
</tr>
<tr>
<td>Weighometer</td>
<td>1</td>
</tr>
<tr>
<td>AP Flow Switch</td>
<td>1</td>
</tr>
<tr>
<td>AP Level Switch</td>
<td>1</td>
</tr>
<tr>
<td>AP Limit Switch</td>
<td>2</td>
</tr>
<tr>
<td>AP Pressure Switch</td>
<td></td>
</tr>
<tr>
<td>AP Pull Switch</td>
<td></td>
</tr>
<tr>
<td>AP Speed Switch</td>
<td></td>
</tr>
<tr>
<td>AP Temperature Switch</td>
<td></td>
</tr>
<tr>
<td>AP Vibration Switch</td>
<td></td>
</tr>
</tbody>
</table>

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Anglo Platinum - Data Validation

“Data validation and instrument monitoring results in
• Better data quality
• Supports “One version of the truth”
• Better decisions”

Michael Halhead
Lead Process Control Engineer

Business Challenge
• Bad data quality
• Caused equipment failures
• Large number of instruments
• Business/Operational decisions need improvement

Solution
• Use PI AF to organize
• Use PI ACE to calculate
• Custom WebPart to visualize
• Use OLEDB Enterprise for reporting

Results and Benefits
• Better quality information
• Better decisions
• Clear visibility instrument status
• Prevention of equipment failures

Michael Halhead
Lead Process Control Engineer

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Energy Monitoring Initiative at Anglo Platinum
Business Challenge

![Chart showing energy consumption trends from 2005 to 2013. The chart displays the monthly GWh consumption with different categories: Eskom limit, Actual consumption, Business as usual, and Operational target. The chart indicates a 15% decrease in consumption across the years.]
Organize

- Totalizers, Performance Equations (PEs) and PI ACE.
- Totalizers and PEs configured using PI AF Templates
- The AF-Link facilitates ACE
Corporate Visibility
Data Analysis

- Data is rolled up using PI AF
- Show clearly where the power is being used
OSIsoft Software and Services Used

- The following OSIsoft Products were used to provide this solution:
  - PI Server
  - RDBMS Interface
    - ION Data
    - LIMS Data
  - OPC Interface
    - Real time process data
  - PI ACE
  - PI AF
    - Including custom Data References (Rollup DR)
  - PI DataLink and PI DataLink Server
  - PI ProcessBook for displays
  - PI WebParts
  - PI OLEDB Enterprise
Anglo Platinum - Energy Monitoring

“Implementing high level metrics and analyses linked to production clearly shows were the power is used allowing focused energy reduction initiatives. A roll out to the concentrators is in the planning stages. Due to the scale of the concentrator operations the potential benefits are enormous.”

Thobile Mukuna
Process Engineer

Business Challenge

• Large electricity consumption - 450 GWh/month
• Target 15% reduction in electricity consumption 2008 to 2014
• Company-wide integrated approach to energy saving is required

Solution

• Use PI AF - granularity and roll-up
• Visibility - power use at every level
  • PI WebParts and SharePoint, Silverlight
• High level metrics - KPIs
• Provided ability for users to drill down to every level of granularity

Results and Benefits

• Enterprise visibility of all electrical consumption
• Significant time reduction for analysis
• Easy construction of BI cubes
• Just making the data visible resulted in a 1% reduction in electrical power use.

“Implementing high level metrics and analyses linked to production clearly shows where the power is used allowing focused energy reduction initiatives. A roll out to the concentrators is in the planning stages. Due to the scale of the concentrator operations the potential benefits are enormous.”

Thobile Mukuna
Process Engineer
Condition Based Maintenance Initiative at Anglo Platinum
Business Challenge

- Time Consuming
- Non Standard Methods
- Non Standard Reason codes
- Everyday Task
- Easy Rollout
- Done in Excel Spreadsheets
- One Enterprise System
- Change Insensitive and Scalable
- No Client Installs
- User Configurable
Solution – Process Diary

• Operational States

Example: Use any or all of the conditions below;
- Create Event When > 7       with template A
- Create Event When < 5       with template B
- Create Event When between 5 and 7 with template C
- Create Event When not between 5 and 7 with template D
- Create Event When = “Digital State” with template E
Solution – Based on Event Frames

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Start Date</th>
<th>End Date</th>
<th>Duration</th>
<th>Source</th>
<th>Discipline</th>
<th>PLC Reason</th>
<th>User Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Down Time</td>
<td>01 Dec 2010 5:00</td>
<td>01 Dec 2010 7:33</td>
<td>02H33</td>
<td>ACP Area</td>
<td>Electrical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Down Time</td>
<td>01 Dec 2010 7:57</td>
<td>01 Dec 2010 7:58</td>
<td>00H00</td>
<td>ACP Area</td>
<td>Instrumentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Down Time</td>
<td>01 Dec 2010 11:16</td>
<td>01 Dec 2010 17:06</td>
<td>05H49</td>
<td>ACP Area</td>
<td></td>
<td></td>
<td>Planned Maintenance</td>
</tr>
<tr>
<td>Down Time</td>
<td>01 Dec 2010 17:22</td>
<td>01 Dec 2010 17:22</td>
<td>00H00</td>
<td>ACP Area</td>
<td>Electrical</td>
<td></td>
<td>Stopped</td>
</tr>
</tbody>
</table>
Anglo Platinum – Process Diary

“Started out with condition based maintenance in mind. The resulting “Process Diary” can be used for Downtime, Slowtime, KPI’s, basically anything that can be configured.”

Michael Halhead
Lead Process Control Engineer

Business Challenge

- Non-standard methods
- Time consuming
- Replace Excel solution
- Provide Enterprise easily configurable solution

Solution

- PI Event Frames and PI AF
- PI ACE to create events
- Custom Silverlight screens using PI AF controls

Results and Benefits

- Time savings
- Enterprise-wide standardization
- Flexibility – not just CBM
- Compare years of data
- User configurable

"Started out with condition based maintenance in mind. The resulting “Process Diary” can be used for Downtime, Slowtime, KPI's, basically anything that can be configured."

Michael Halhead
Lead Process Control Engineer

Solution

Results and Benefits
Asset Monitoring Initiative at Syncrude
Business Challenge

• Prolong Life of Mobile Assets
• Data Shadows
• Need Real-time Events
• Fit into Existing Application
• Low Maintenance
• Scalability
Business Challenge

<table>
<thead>
<tr>
<th>Test Case#</th>
<th>Area</th>
<th>Complexity</th>
<th>Test Case Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>001</td>
<td>General Monitoring</td>
<td>Minor</td>
<td>Out of Range</td>
</tr>
<tr>
<td>002</td>
<td></td>
<td>Minor</td>
<td>MDSP Offline</td>
</tr>
<tr>
<td>003</td>
<td>Power Train Management</td>
<td>Minor</td>
<td>Torque Converter Overheating</td>
</tr>
<tr>
<td>004</td>
<td>Lubrication Management</td>
<td>Minor</td>
<td>Auto-lubrication Frequency</td>
</tr>
<tr>
<td>005</td>
<td>Engine Management</td>
<td>Minor</td>
<td>Throttle Position Condition</td>
</tr>
<tr>
<td>006</td>
<td></td>
<td>Minor</td>
<td>Turbo Failure</td>
</tr>
<tr>
<td>007</td>
<td></td>
<td>Minor</td>
<td>Injector Failure</td>
</tr>
<tr>
<td>008</td>
<td></td>
<td>Minor</td>
<td>Engine Oil Dilution</td>
</tr>
<tr>
<td>009</td>
<td></td>
<td>Minor</td>
<td>Coolant Temp Delta</td>
</tr>
<tr>
<td>010</td>
<td>steering Braking Management</td>
<td>Minor</td>
<td>Service Brake Applied at Speed</td>
</tr>
<tr>
<td>011</td>
<td></td>
<td>Minor</td>
<td>Brake Overheating</td>
</tr>
<tr>
<td>012</td>
<td></td>
<td>Major</td>
<td>Steering Pumps Cycle</td>
</tr>
<tr>
<td>013</td>
<td></td>
<td>Major</td>
<td>Braking Pumps Cycle</td>
</tr>
<tr>
<td>014</td>
<td>Frame Management</td>
<td>Minor</td>
<td>Improper Strut Charge</td>
</tr>
<tr>
<td>015</td>
<td></td>
<td>Minor</td>
<td>Deflation</td>
</tr>
<tr>
<td>016</td>
<td></td>
<td>Minor</td>
<td>airborne</td>
</tr>
<tr>
<td>017</td>
<td></td>
<td>Minor</td>
<td>Side Load</td>
</tr>
<tr>
<td>018</td>
<td></td>
<td>Minor</td>
<td>Front Load</td>
</tr>
<tr>
<td>019</td>
<td></td>
<td>Major</td>
<td>Max Rack</td>
</tr>
<tr>
<td>020</td>
<td></td>
<td>Major</td>
<td>Max Pitch</td>
</tr>
<tr>
<td>021</td>
<td></td>
<td>Major</td>
<td>Max Roll</td>
</tr>
<tr>
<td>022</td>
<td></td>
<td>Minor</td>
<td>Abusive Dumping</td>
</tr>
<tr>
<td>023</td>
<td></td>
<td>Minor</td>
<td>Abusive Loading</td>
</tr>
</tbody>
</table>

Graph showing rack data with annotations for different phases of operation.
Syncrude Canada – Mobile Asset Monitoring

Syncrude chose the PI System and an Enterprise Agreement as an integral part of their tar sands mining and refining operation.

Derek Hatchey
PC&A Applications Team

Business Challenge

• Large number of trucks and other mobile equipment
• Existing system - allows analysis of events days later
• Data shadows – maybe up to 72 hours
• Prolong life of assets

Proposed Solution

• Data from onboard systems to PI Archive via the UFL interface
• Truck templates in PI AF & PI ACE to trigger calculations
• Event Frame Interface to generate Events
• PI OLEDB Enterprise to populate Events to existing Oracle database

Potential Benefits

• Data shadows are handled by PI ACE and Event Frame interface
• Real-time generation of events and analysis
• Ability to make decisions in real-time

Syncrude chose the PI System and an Enterprise Agreement as an integral part of their tar sands mining and refining operation.

Derek Hatchey
PC&A Applications Team
Conclusion

• Lots of Little Bangs
• Keep it Simple
• Enterprise Deployment
Ales Soudek

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OSIsoft, LLC

“A wise man never tries to warm himself in front of a painting of a fire” – Czech proverb
THANK YOU

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