COMALCO
ALUMINA REFINERY

Presented by Ian Johnston

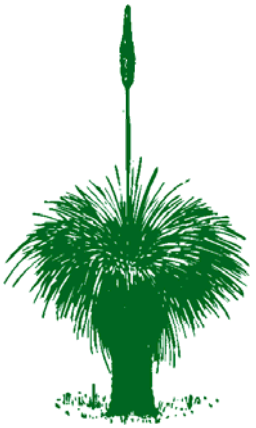
Monday, 9 November 2009

Wirth Pump On Line Condition Monitoring

National Instruments Technical Symposium

Sydney

March 9, 2006



"If it's not safe, don't do it that way"

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Outline

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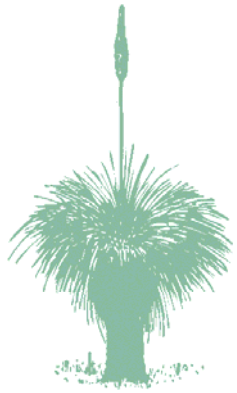
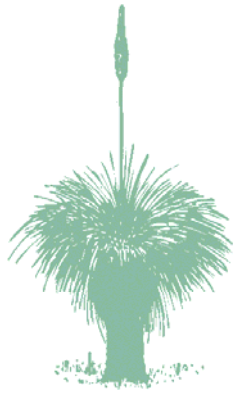
- Introduction to Application
- Hardware Features
- Software Features
- Results to Date
- Future Developments



Introduction to Application

- The Comalco Alumina Refinery was constructed at Yarwun,15km NW of Gladstone over the period 2002-2004
- The Process refines the oxide of aluminium (alumina) from bauxite – a naturally occurring mineral
- The nature of the process requires the bauxite be dissolved or “digested” in caustic liquor under temperature and pressure.
- CAR is a 1.4 Mtpa refinery. Currently the alumina is worth approximately US$630/t, business conditions are very favourable.



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Introduction to Application

- The Wirth Pumps drive the bauxite slurry though the Digester Train.
- There are 6 pumps, grouped into two units of three pumps per unit. 2 further pumps are on order for installation in 2006
- The Pumps are a three piston positive displacement pump
- Slurry properties: 80ºC, 15% solids, 260 gpl NaOH

- Suction Pressure – 270kPa
- Discharge Pressure – 6,000 to 9,000 kPa
- Driven by 1.275 MW Variable Speed Drive

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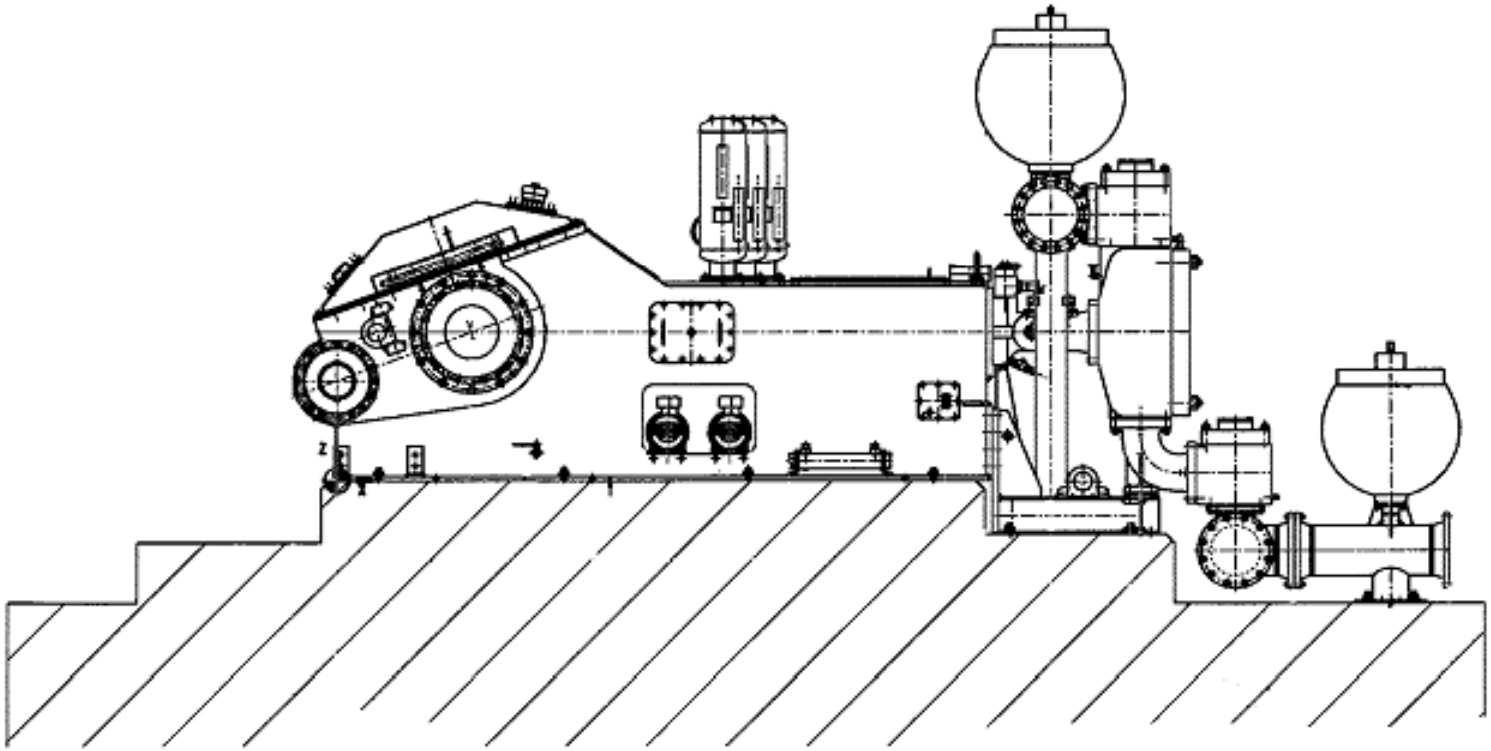
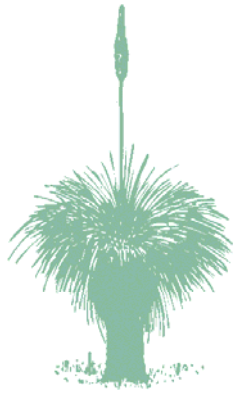
Introduction to Application



Introduction to Application

- Design requirement of the Wirth Pumps is 96% availability – 2005 achieved 87% availability. Represents 120,000 t lost production.
- Factors affecting availability:
  - Valve Failures
    - 2 to 6 hours downtime
    - Actual life < 4 weeks vs design life 8 weeks
  - Diaphragm Failures
    - 6 to 24 hours downtime
    - up to 10 failures per month
  - Crankshaft Failures
    - 5 Failures, 3 catastrophic
    - Up to 1 month downtime
    - Piping redesign required whilst 2 pumps failed on Unit 1



Failure Modes - Valves

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Failure Modes - Diaphragm

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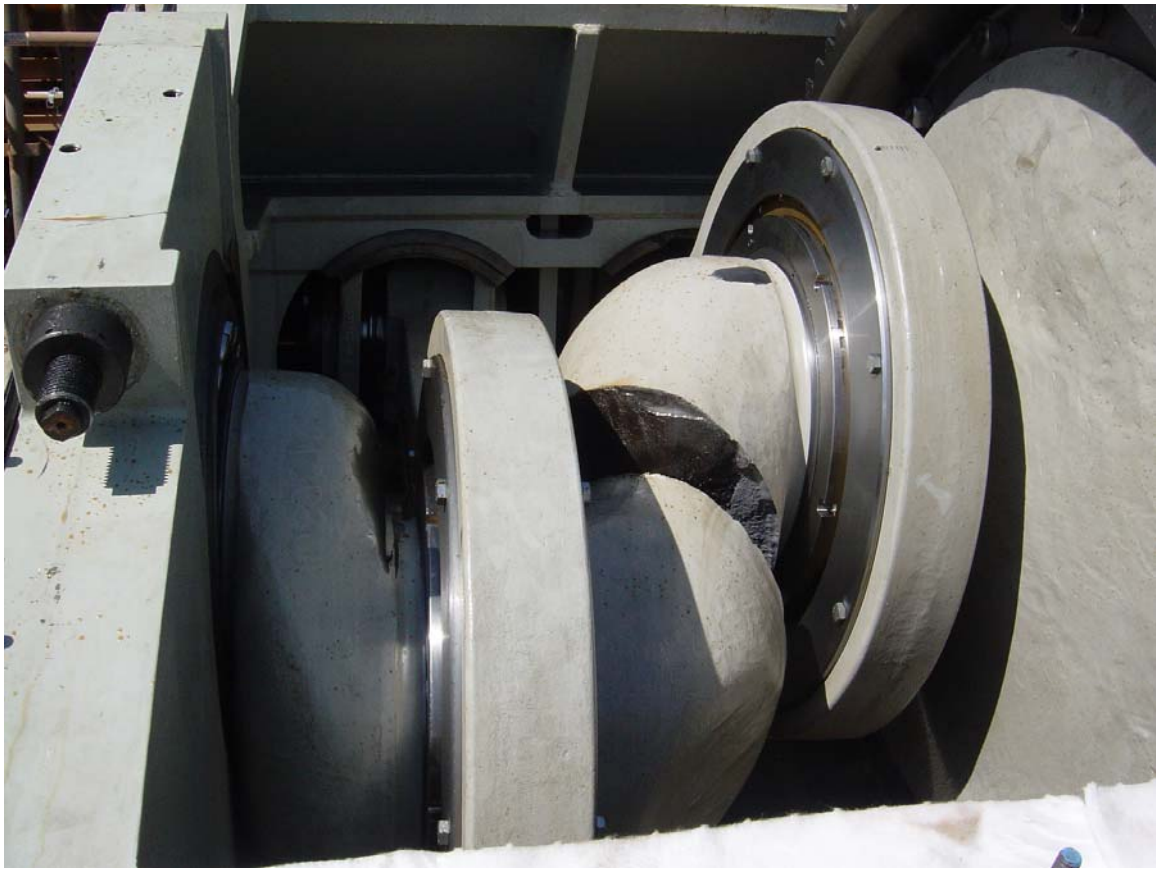
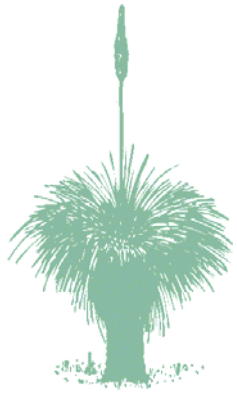
Failure Modes - Crankshaft



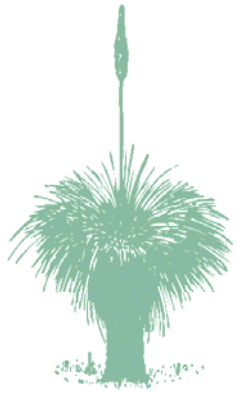
Wirth Pump Team

- Management decided to assemble a Team of Specialists in various fields to tackle the pump related issues.
- One of the first objectives was to collect process data which would hopefully uncover some of the reasons why the failures have been occurring.
- Throughout the procedure Comalco have been in close liaison with the OEM, Wirth. However without a large installed base on similar applications we do not have a repository of information and experience to draw upon.
- Comalco have invested $900K in the Wirth Pump Condition Monitoring System



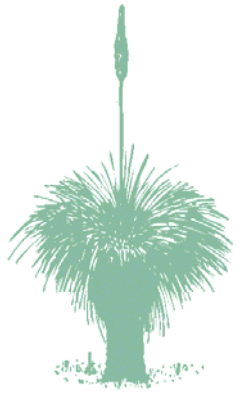
Selection of Hardware

- White Rock Engineering
  - Positive Displacement Pump design and application specialists
  - Initial Site Survey was carried out using a tablet PC using a PCMCIA DAQ-Card attached to an SCC box.
  - System designed for data collection, off line review and reporting.



Selection of Hardware

- Comalco Application
  - Permanently installed On-Line and Real Time presentation of data
  - See the data in real time
  - High Performance – processing speed an issue with large files
  - Equipment standards – permanent installation
  - Options for future expansion

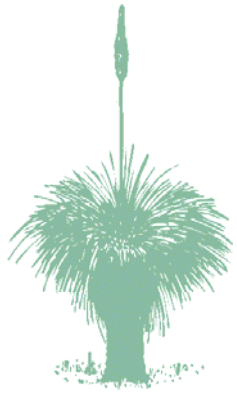


Selection of Hardware

- Selection of PXI Hardware
  - PXI-1052 Chassis
  - PXI-8196 Processor
  - PXI-6259 DAQ Card
  - SCXI-1225/1338
  - SCXI-1530
- LabVIEW 8.0
- Remote Interface
- OPC Server
- Environmental Factors

Selection of Hardware - Sensors

- Instrumentation
  - Suction Manifold Pressure (4-20mA)
  - Discharge Manifold Pressure (4-20mA)
  - 3 x Oil Chamber Pressure (4-20mA)
  - Vibration of Crankshaft (Piezo-Electric Accelerometer)
  - Crank position (Inductive Proximity Sensor)
  - Sample rate 4096 Hz



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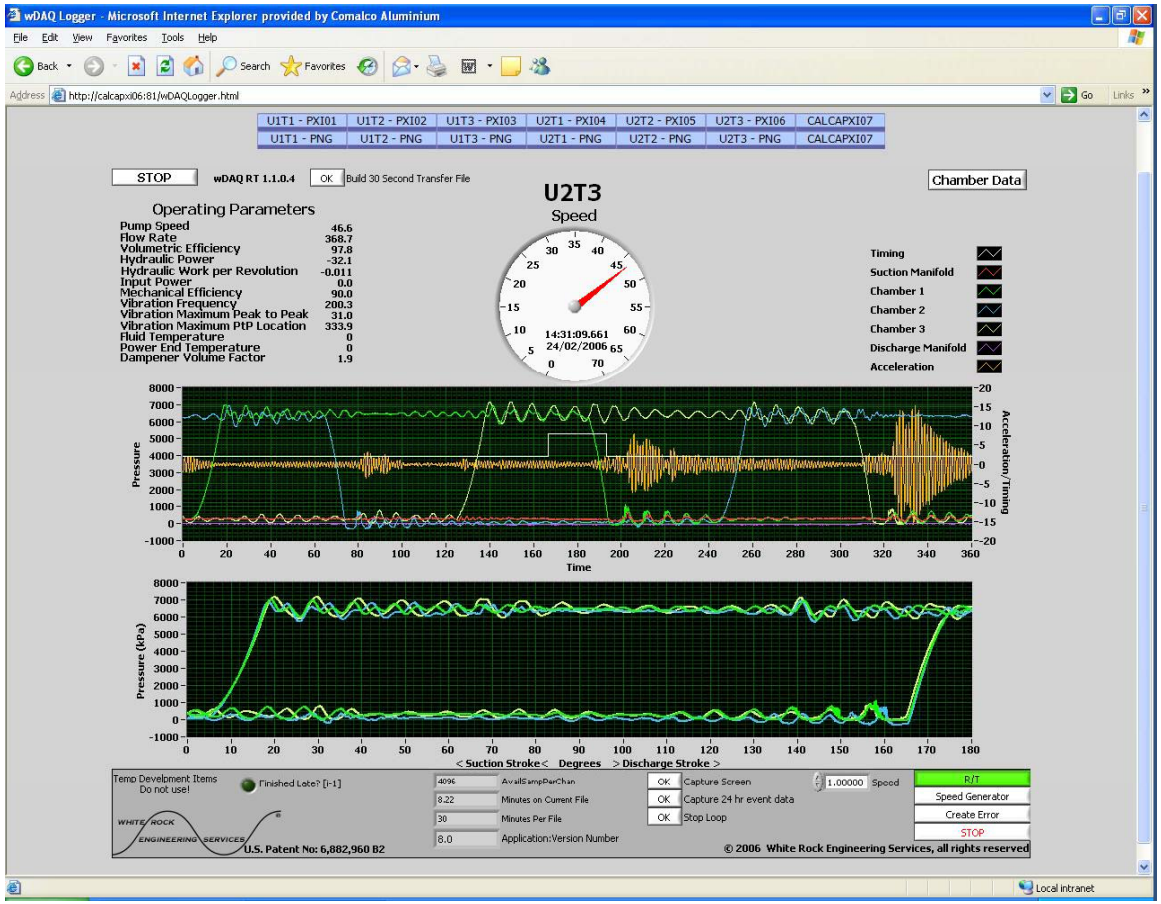
Selection of Hardware - Sensors

Software Features

- Presentation of Data



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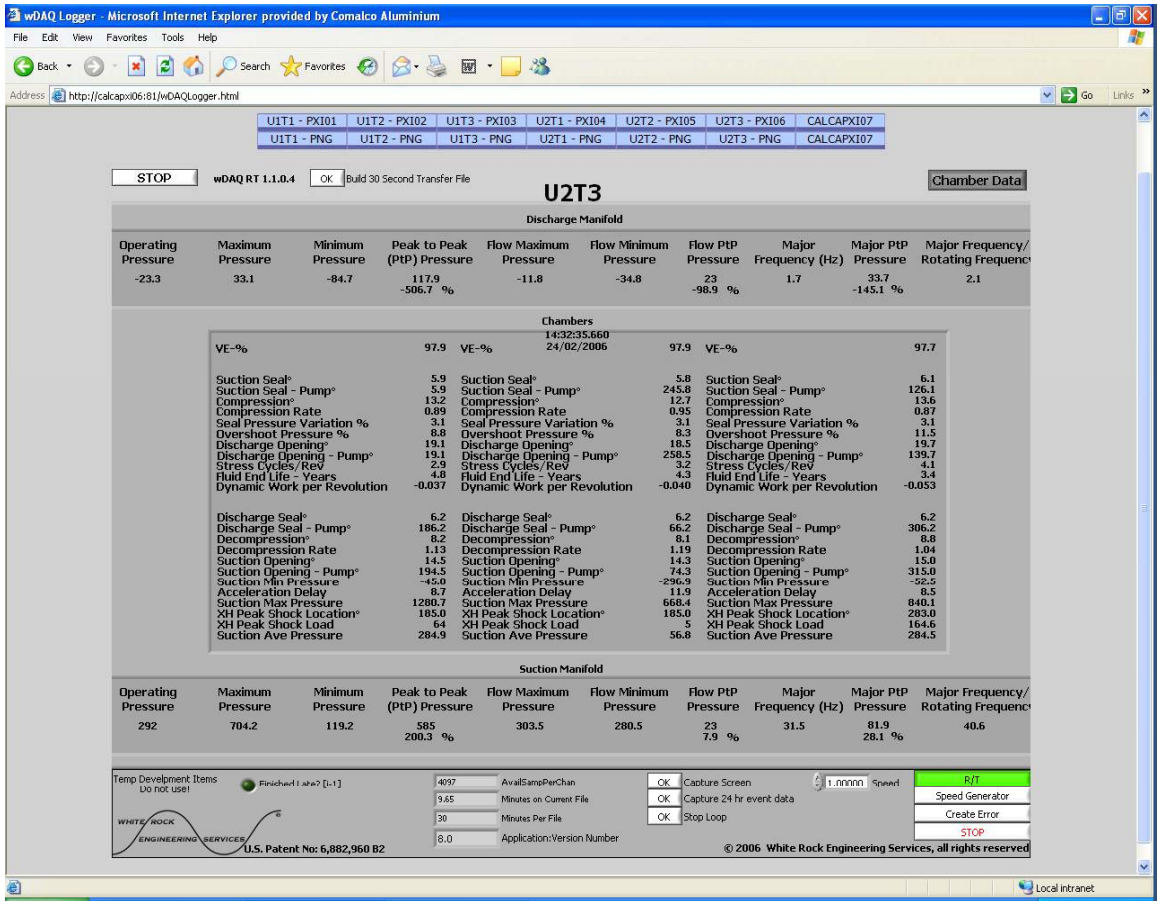
Software Features

- Presentation of Data



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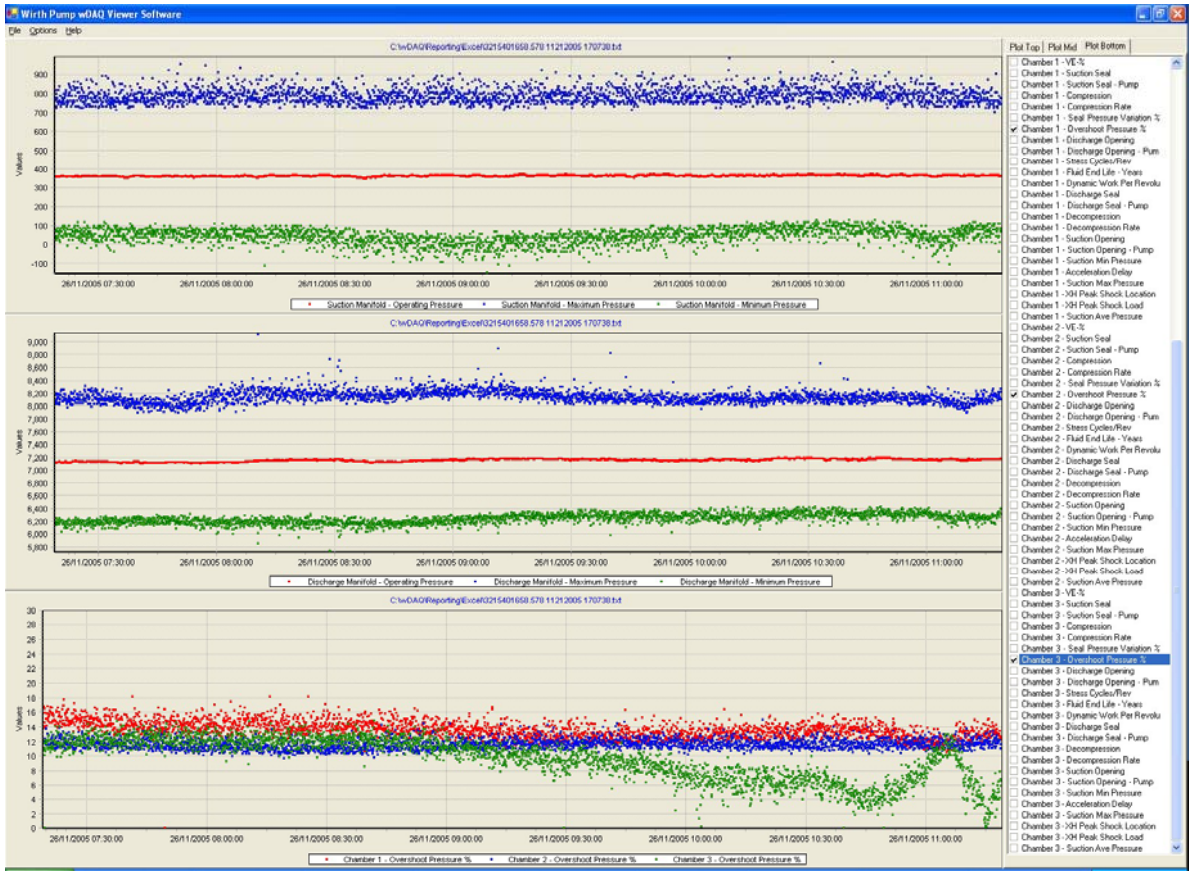
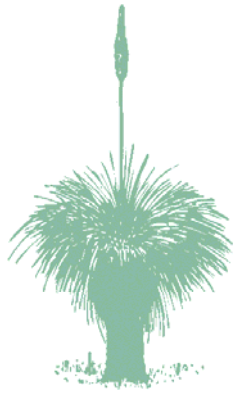
Software Features

- Report Function for long term trends



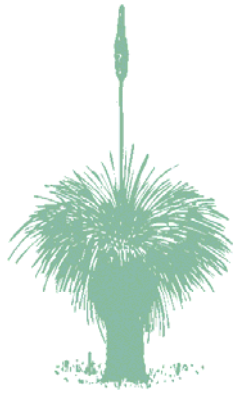
Software Features

- OPC Interface
  - The Pump Data is collected by the Plant Historian which allows the data generated by the Condition Monitoring System to be correlated to Process Data – ie Tank Levels, Flow Rates, Pressures etc.
  - Usually we need to know what is happening in the process when we identify issues in the pump data



Benefits

- Examples of where the Condition Monitoring System has brought improvements to Pump Operations
  - CSSM – Redesign of Suction Manifold
  - Mill Screen Failure
  - Valve Failure



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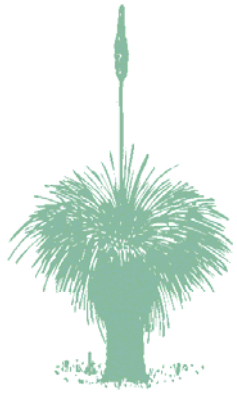
Future Developments

- Fully Integrate Fault Detection DCS interface
  - Pump Alarm – Immediate Response
  - Pump Warning – Requires investigation but not immediately
  - System fault – Card fault/low disk space etc
  - Develop a catalogue of scenarios which will allow CROs to identify pump failures/issues in real time
- Evaluate new components
  - New valve types, fluid types, PSVs etc
- Implement Work History of Pump Components
  - Accumulated total of work done by pump components



Conclusion

- Questions???