petroEDGE

Fundamentals and Advanced Reliability Maintenance Excellence for

Rotating Equipment

Maximise equipment uptime & maintenance costs through proven condition based monitoring and preventive maintenance techniques

27 – 30 July 2009, Kuala Lumpur, Malaysia

Your Expert Course Trainer:
Mike Sondalini
Maintenance management professional with over 30 years of practitioner experience. Previous head of technical services and maintenance manager for Coogee Chemicals.

Some key achievements from Mike's career as a maintenance manager:
- Introduced preventative maintenance of bearings that reduced bearings failures from 4 per month to 4 per year on bulk materials handling equipment.
- Championed and trained engineers on the use of shaft laser alignment that saw mechanical seal failures drop from 20 per year to 3 per year.
- Improved equipment design that boosted plant reliability from 85% to 98% and made the operation profitable.

Choose between 2 separately book-able training workshops:

Workshop A ● 27 – 28 July 2009
FUNDAMENTALS OF RELIABILITY MANAGEMENT FOR ROTATING EQUIPMENT
Course participants will learn how to:
- Identify the most common causes of shafts, bearings and seals fatigue and failures based on actual case studies
- Understand the fundamentals of PPM (precision/preventive maintenance) for rotating equipment through hands-on exercises
- Examine and understand the various condition monitoring techniques
● Tribology ● Thermography ● Vibration Analysis ● Non Destructive Testing

Workshop B ● 29 – 30 July 2009
ADVANCED RELIABILITY MANAGEMENT FOR ROTATING EQUIPMENT
Course participants will learn:
- Rotating equipment designs and limitations and their impact on equipment maintainability and reliability
- Shaft Seals design, selections, causes of fatigue and failure preventive methods
- Best practices in conducting RCFA (Root Cause Failure Analysis) practically in the workplace to prevent repeated equipment failures
- Optimising reliability of rotating equipment through applying best practice in the following methods:
● Risk reduction strategies during design ● Reliability Centered Maintenance (RCM)
● FMEA (Failure Mode and Effects Analysis) ● Techniques to measure reliability for components

Why this is the KEY 2009 training course on Rotating Equipment for maintenance professionals:

- **Focused Workshops:** Choose from two separately book-able workshops that are exclusively developed for the particular confidence level of participants. Or attend the entire 4 day training course to develop an in-depth understanding of the fundamentals as well as advanced processes of reliability management for rotating equipment

Rotating Equipment
27 – 30 JULY 2009, Kuala Lumpur

More than 60% of maintenance costs are spent on equipment wear & tear
The above fact was provided to us based on interviews and discussions with leading maintenance engineers across Asia. Predictably, continuous improvement of reliability by optimising predictive maintenance for rotating equipment is one of the most important challenges maintenance professionals face today.

To assist rotating engineers and maintenance professionals in improving their equipment serviceability, there are numerous innovative condition monitoring techniques and proven reliability based maintenance techniques.

PetroEdge's Maintenance & Reliability Excellence for Rotating equipment consolidates successful best practices and techniques into 2 highly focused, separately book-able training course. This training course will concentrate on the problems and solutions surrounding equipment failures, diagnostics and effective methods to prevent them.

.P.S. Take advantage of our early bird and attractive group booking discounts. See reverse for details on these offers!

Course registration begins at 8:30am on Day 1. The course will commence at 9am on all days. There will be breaks for mid-morning refreshments, lunch, and mid-afternoon refreshments. The course will end by 5pm on both days.

Workshop A • 27-28 JULY 2009
FUNDAMENTALS OF RELIABILITY MANAGEMENT FOR ROTATING EQUIPMENT

1. The Causes of Rotating Machinery Failures

• True Cost Of Failure
- Financial impact of downtime
- Understanding risk and consequence
- Preventing defects and failure

• Know The Process, Physical, Chemical Properties And Characteristics
- Process condition disruptions and process effects on components
- Corrosion, erosion and wear
- Material and product internal build-up

Participant Activity: Equipment material of construction selection exercise

• Supporting Structure, Foundations, Strength, Rigidity
- Attenuation of vibration
- Dissipating operating loads and forces
- Preventing equipment deformation

Participant Activity: Removing soft-foot activity

• Fatigue And Failure Modes
- Causes of Shaft Fatigue
- Causes of Bearing Failure
- Causes of Seal Failure

• Bearing Failures
- Fluctuating loads and forces
- Lubrication condition
- Tell-tale bearing failure signs

Participant Activity: Bearing failure case study

2. Precision Maintenance for Rotating Equipment

• Reliability, Availability, Maintainability, Safety (RAMS)
- Impact of special and common cause variation on RAMS
- Precision maintenance for rotating equipment
- Accuracy Controlled Procedures

• Balanced Shafts, Balancing Standards
- Causes of out-of-balance
- Engineering standards and limits for balancing
- Mechanical balancing

Participant Activity: In-situ shaft balancing case Study

• Shaft Alignment
- Effects of shaft misalignment
- Standards and limits for alignment
- Methods of precision shaft alignment

Participant Activity: Shaft alignment case study

• Rotating Equipment Vibration
- Allowable vibration severity
- Bearing vibration causes
- Machinery vibration isolation

• Lifting Maintenance Performance

- Measuring maintenance outcomes and KPIs
- Maintenance Quality Systems for RAMS
- Using visual management to control performance

3. Optimising Reliability – Fundamentals of Condition Monitoring and Predictive Maintenance for the following equipment:
- Rotors
- Roller and hydrodynamic bearings
- Pump and compressor seal systems (liquid and dry/gas)
- Couplings
- Lube systems (for pumps, compressors, steam turbines and gears)

• Condition Monitoring Methods For Rotating Equipment
- Tribology and lubrication analysis
- Thermography
- Rotating equipment non-destructive testing
- Operating performance monitoring

• Bearing Vibration Analysis
- Vibratory condition based monitoring
- Vibration signatures
- Vibration analysis

Participant Activity: Bearing vibration signature analysis case study

• Tribology and Lubrication Overview
- Wear particle analysis
- Properties of lubricants
- Sustaining lubricant health

• Thermography
- Temperature signature analysis
- Mechanical/Electrical equipment

• Maintenance Strategy Mix
- The PM - PdM - Breakdown mix
- Total Productive Maintenance
- Operator driven reliability

Participant Activity: Select a maintenance strategy mix activity

End of course

Workshop B • 29 – 30 JULY 2008
ADVANCED RELIABILITY MANAGEMENT FOR ROTATING EQUIPMENT

1. Design of Rotating Equipment
• Strength of Materials for Shafts and Rotors
- Metallurgy - stress and stress raisers
- Metal fatigue
- Bending and deflection of shafts

• Horizontal Shaft Design, Vertical Shaft Design
- Axial and radial loads
- Shaft and equipment expansion considerations
- Shaft manufacture, diameter and tolerances

Participant Activity: Design a shaft
• Bearing Design And Selection, Radial And Axial Bearings

- Roller bearings and plain bearings – uses and limitations of each
- Bearing lubrication and selection
- Bearing housings and construction

Participant Activity: Select a bearing for the shaft exercise

• Lubrication Selection
- Properties of lubricants
- Lubricant operating environment
- Lubricant life-extension additives

• Shaft Seals – Methods, Types, Designs, Process Effects
- Seal design overview
- Seal failure modes
- Seal selection

• Vibration Prevention and Isolation
- Basics of spring/damper systems
- Natural frequency
- Machinery vibration isolation

Participant Activity: Perform a simple vibration isolation calculation

2. Root Cause Failure Analysis Procedure
• Root Cause Failure Analyses (RCFA)
- RCFA fundamentals
- The RCFA process
- Developing and implementing solutions

• Finding the Evidence and Proof
- Operating and maintenance records and analysis
- Creative disassembly
- Importance of keeping accurate records and history

• Applying RCFA in the Workplace
- Cross-functional teams
- The 5 Whys
- Operator and maintainer buy-in for improvement

Participant Activity: RCFA exercise
Participant Activity: Design Screening (Component Function) Examples

• Optimising Reliability of Rotating Equipment
- Life cycle operating cost
- Cost impact calculations
- Design review and optimisation

Participant Activity: Failure impact cost analysis
Exercise

• Risk Reduction Strategies in Design and Operation
- Understanding and measuring risk
- Chance vs. consequence risk reduction methods
- Applying risk reduction during design and operation

• Lifting Lifetime Reliability
- Equipment reliability overview
- Measuring reliability: for components – Weibull; for systems - Crow/AMSAA
- RCM/FMEA fundamentals

Participant Activity: FMEA exercise

End of course

WHO SHOULD ATTEND:
This 4-day separately bookable training course is specially designed for maintenance and operations professionals who are responsible for the operation and care of rotating equipment:

- Application Managers
- Condition monitoring professionals
- Electrical engineers
- Equipment Engineers
- Equipment support maintenance
- Machinery engineer
- Mechanical engineering managers/ superintendents/ supervisors
- Machinist/ Machine Operator
- Maintenance managers/ superintendents/ supervisors
- Mechanical managers/ superintendents/ supervisors
- Operations supervisors
- Plant Maintenance Superintendent
- Plant Operator/ Engineer
- Predictive Maintenance Engineer
- Production managers/ supervisors
- Reliability engineers
- Rotating equipment managers/ superintendents / engineers
- Technical services professionals

About Your Expert Trainer:

Mike Sondalini's 30 years in maintenance spans from mechanical engineering, strategic asset management to rotating equipment. He was previously a mechanical engineer with the State energy commission of Australia, where he conducted equipment failure investigations and constructed improvement plans. He was then the maintenance manager for the Swan Brewery, responsible for overall plant reliability and project engineering. Mike then spent over 10 years as maintenance manager and head of engineering services for Coogee Chemicals. In this role, he successfully introduced condition monitoring and maintenance strategies that reduced production down time and maintenance costs. An achievement was reducing bearing failures from 3 a month to 3 a year. As a maintenance manager, Mike also successfully initiated and trained other reliability centered techniques focused towards rotating equipment, including vibration analysis, particle analysis, thermography, equipment criticality analysis, root cause analysis reviews.

As a current maintenance and reliability consultant, Mike continues to assist organisations such as BHP, Smorgon Steel and State Energy Commission in improving equipment reliability. He is also reputed publisher of numerous online technical white papers and training materials that are widely sought after by maintenance professionals. Mike is also a past Chairman of the WA Chapter of (MESA) the Maintenance Engineering Society of Australia

Testimonials from past participants from these companies:

Very good mix of theory and company applications
– Engineering Manager, Chevron Corporation

Excellent presentations on diverse subjects
– Maintenance Manager, Premier Oil

Rotating Equipment
15-18 SEPTEMBER 2008, Kuala Lumpur

REGISTRATION FORM

Kuala Lumpur, Malaysia	Early Bird Price	√	Normal Price	√
Workshop A - 2 days : FUNDAMENTALS OF RELIABILITY MANAGEMENT FOR ROTATING EQUIPMENT	SG$ 2,369		SG$ 2,639	
Workshop B - 2 days : ADVANCED RELIABILITY MANAGEMENT FOR ROTATING EQUIPMENT	SG$2,369		SG$2,639	
Workshop A and B – 4 days	SG3,399		SG$3,889	

TEAM DISOUNTS

PetroEdge recognises the value of leaning in teams. Group bookings at the same time from the same company receive the following:

3 or more at 5% off
5 or more at 7% off
8 of more at 10%

AsieEdge Ons-site Solutions

{ } Yes, I would like to organise this training on-site and save over 40% of total course fees!
For further information about On-site Solutions, please +65 67478737 or email info@asiaedge.ent

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Mr ☐Mrs ☐Ms ☐Dr ☐Other ☐

Telephone: ---------- Email: ----------

Job Title: ----------

Department: ----------

Delegate 2: ----------
Mr ☐Mrs ☐Ms ☐Dr ☐Other ☐

Telephone: ---------- Email: ----------

Job Title: ----------

Department: ----------

Head of Department: ----------

Company: ----------:----------

Address: ----------

Country: ----------

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4 Easy Ways to Register
Online: www.asiaedge.net
Email: suzana@asiaedge.net
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Please note:
- indicate if you have already registered by Phone ☐Fax ☐Email ☐Web ☐
- if you have not received an acknowledgement before the training course, please call us to confirm your booking.
- photocopy this form to register multiple delegates.

Payment Methods

By Cheque/ Bank Draft: Make Payable to Asia Edge Pte. Ltd.
By Direct Transfer: Please quote AE1 with the remittance advise
Account Name: **Asia Edge Pte. Ltd.**
Bank Number: 508 Account Number: 762903-001Swift Code: **OCBCSGSG**
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PAYMENT POLICY: Payment is due in full at the time of registration. Full payment is mandatory for event attendance. I agree to Asia Edge Pte Ltd. payment terms

CANCELLATIONS & SUBSTITUTIONS: You may substitute delegates at any time. ASIA EDGE PTE LTD does not provide refunds for cancellations. For cancellations received in writing more than seven (7) days prior to the training course you will receive a 100% credit to be used at another ASIA EDGE PTE LTD training course for up to one year from the date of issuance. For cancellations received seven (7) days or less prior to an event (including day 7), no credits will be issued. In the event that ASIA EDGE PTE LTD cancels an event, delegate payments at the date of cancellation will be credited to a future ASIA EDGE PTE LTD event. This credit will be available for up to one year from the date of issuance. In the event that ASIA EDGE PTE LTD postpones an event, delegate payments at the postponement date will be credited towards the rescheduled date. If the delegate is unable to attend the rescheduled event, the delegate will receive a 100% credit representing payments made towards a future ASIA EDGE PTE LTD event. This credit will be available for up to one year from the date of issuance. No refunds will be available for cancellations or postponements.

ASIA EDGE PTE LTD is not responsible for any loss or damage as a result of a substitution, alteration or cancellation/postponement of an event. ASIA EDGE PTE LTD shall assume no liability whatsoever in the event this training course is cancelled, rescheduled or postponed due to a fortuitous event, Act of God, unforeseen occurrence or any other event that renders performance of this training course impracticable or impossible. For purposes of this clause, a fortuitous event shall include, but not be limited to: war, fire, labor strike, extreme weather or other emergency.

PROGRAM CHANGE POLICY: Please note that speakers and topics were confirmed at the time of publishing; however, circumstances beyond the control of the organizers may necessitate substitutions, alterations or cancellations of the speakers and/or topics. As such, ASIA EDGE PTE LTD reserves the right to alter or modify the advertised speakers and/or topics if necessary. Any substitutions or alterations will be updated on our web page as soon as possible.

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