

# OPTIMIZATION OF ROTATING EQUIPMENT WITH CONTINUOUS RELIABILITY IMPROVEMENT (CRI)

## Reliability optimization through component condition monitoring, vibration analysis & root cause analysis

25-27 October, 2010

International 5 Star Hotel, Manama Bahrain



**Ralph W. "Pete" Peters**

President

**The Maintenance Excellence Institute (TMEI), USA**

**Peters** has over 35 years of practical engineering expertise, operation management and maintenance international experience at the shop level and corporate levels. Pete has taught companies in the US, Middle East and Asia. His clients include British Petroleum, UNC-Chapel Hill, Air Combat Command, Boeing, Heinz, General Foods, Marathon Oil, Polaroid, Great River Energy, Wyeth-Ayerst, Cooper Industries, National Gypsum, Lucent Technologies.

### **You will take away:**

#### **Four benchmarking tools in excel format:**

- The scorecard for maintenance excellence maximizes overall best practices
- THE CMMS BENCHMARKING SYSTEM optimizes your technology investment (CMMS)
- The maintenance and excellence index validates bottom-line results
- The ACE TEAM PROCESS assures reliable planning times

#### **2 Complimentary e-books**

- Maximizing maintenance operations for profit optimization
- Maximizing the value of facilities management operations +

#### **A maintenance toolbox:**

- Achieve results from your maintenance audit
- A guide to maintenance excellence in your organization
- Extensive material on the course CD that has been used in many consulting projects

#### **Bonus for early bird registration!**

Participants will receive the "Maintenance Benchmarking and Best Practices" book by Raph W. Peters published by McGraw-Hill's Professional Book Division Limited to strictly the first 10 delegates on board!



**Upon successful completion of the course, participants will be able to gain knowledge on the following:**

- Key elements of reliability centered maintenance
- Important risk based maintenance concepts
- Use the scoreboard for maintenance excellence
- Tackle all rotating equipment problems by identifying and understanding the root cause beyond with REAL LIVE CASE STUDIES
- Optimize the reliability of rotating equipment with the BEST PRACTICES learnt
- Learn a wealth of information with INDUSTRY COMPETITORS through OPEN DISCUSSIONS and INTERACTIVE SESSIONS

### **Course customization to your priorities**

**Today's most comprehensive benchmarking tool; THE SCOREBOARD FOR MAINTENANCE EXCELLENCE (A pre-course maintenance assessment) will be issued to delegates immediately upon registration. This important pre-course work allows each attendee to address their Top 5 specific improvement needs and concerns. The trainer will discuss these needs at the workshop during a group practical exercise.**

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## Overview:

Most organizations focus more on cutting maintenance cost. The root cause of this is shortsightedness and this results in reliability loss with crippled assets. When business is bad, companies typically do not have enough money to support improving their processes. This is a common conundrum - addressing the issue requires discipline and this brings about radical, yet positive change that will assure our future prosperity.

THE CONTINUOUS RELIABILITY IMPROVEMENT (CRI) and optimization of rotating equipment has been widely investigated by world class process companies during the last decade. Concentrating exclusively on redundancy allocation as per the old fashion maintenance is not the answer. To know how to effectively prevent equipment failures, conduct a successful root cause failure analysis and improve condition monitoring for rotating equipment are continuing challenges for engineers. Proper analysis and solving of chronic problems at the source saves time and money.

This course is designed to explain the following:

- Effective methods of component condition monitoring for use as both a predictive maintenance
- Major failure causes
- World class proven root cause analysis procedure with exercises and case histories and more.....

## Speaker's profile:



**Ralph W. "Pete" Peters**  
**President**  
**The Maintenance Excellence Institute(TMEI), USA**

Ralph W. "Pete" Peters is a highly recognized leader around the World in the areas of implementing maintenance best practices, developing effective productivity measurement and initiating long term operational improvement processes, within both the public and private sectors such as British Petroleum, Nigeria Liquid Natural Gas, UNC-Chapel Hill, Clemson University, Atomic Energy Canada Ltd, Boeing Commercial Airplane Group, Caterpillar, Ford, Honda, Anderson Packaging Inc, Polaroid, Lucent, Heinz, General Foods, BigLots Stores, Sheetz Inc, Marathon Oil Corporation, Great River Energy, Wyeth-Ayerst (US & IR), Cooper Industries, National Gypsum, Sarasota County Government-Operations and Maintenance Division, Carolinas Medical Center, NC Department of Transportation, NC Department of Health and Human Services and the US Army Corps of Engineers.

Pete has helped achieve success and return on investment in plant, fleet, healthcare operations and pure facilities maintenance operations as well as golf course maintenance and for the "green industry". As a frequent speaker, he has delivered speeches and seminars on maintenance-related topics worldwide. He is also the author of a best selling McGraw-Hill Professional Division book; Maintenance Benchmarking and Best Practices- A Profit and Customer-Centered Approach. His 35 years of experience has made him an expert in maintenance with a vision that "Maintenance is forever!"

## Who Should Attend?

- *Engineers, Managers, Supervisors, Superintendents, Specialists and Technicians responsible for:*

- *Application*
- *Condition Monitoring*
- *Equipment Operation*
- *Equipment Support*
- *Mechanical Engineering*
- *Maintenance*
- *Operations*
- *Plants*
- *Predictive Maintenance*
- *Production*
- *Reliability*
- *Rotating Equipment*
- *Technical Services*

*From sectors such as: oil, gas and power, petrochemical, pharmaceutical, water treatment plants, automation, construction, food and beverage, mining, textile, pulp and paper, chemical and etc.*

# OPTIMIZATION OF ROTATING EQUIPMENT WITH CONTINUOUS RELIABILITY IMPROVEMENT (CRI)

25-27 October, 2010

Day  
One

Workshop commences at 09.00 and ends at 17.30

## Course overview

- Course objectives
- Delegate expectations
- Exercise: review of top 5 priorities by attendees

**Discussion:** what concerns and obstacles do you have in your current organization

## Rotating equipment failure patterns

- Distinguishing between repairable and non-repairable equipment
- Types of equipment failure
- Areas of the Bath-Tub curve
- Actions to minimize failure effect

**Discussion:** how does most of your equipment fail?

## Mastering the basic best practices of reliability maintenance for rotating equipment

- Introduction of scoreboard for maintenance excellence for applying today's best practices
- Framework for reliability and maintenance excellence
- Plant and machinery downtime and how to measure accurately
- Troubleshooting key pieces of equipment
- Machinery design Issues for reliability & maintainability
- Introduction to condition based maintenance
- Factors contributing to excessive maintenance

**Discussion:** has your plant implemented basic best practices?

Wrap up of Day One and assignment for day two

Day  
Two

Workshop commences at 09.00 and ends at 17.30

## Mastering the advanced reliability maintenance for rotating equipment (Part 1)

### Root cause failure analysis (RCFA)

- Structured problem solving and RCFA
- Failure types
- Collecting failure data
- Describing the process
- Solutions to human root cause
- Cause analysis
- The three levels of cause
- The analysis process
- Human root causes

**Exercise:** RCFA practical exercise

### Rotating equipment operating problems

- 6 major rotating equipment problems
- Vibration and its control
- Balance and its control
- Lubrication and its control

**Exercise:** Operating problems with case studies on gearboxes, axial and centrifugal fans, compressors

- Looseness and its control
- Distortion and its control
- Alignment and its control

**Exercise:** Operating problems with case studies on pumps, bearings, valves, bucket elevators

# OPTIMIZATION OF ROTATING EQUIPMENT WITH CONTINUOUS RELIABILITY IMPROVEMENT (CRI)

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Day Three Workshop commences at 09.00 and ends at 17.30

## Mastering the advanced reliability maintenance for rotating equipment (Part 2)

### Component condition monitoring techniques

- Types of condition-based monitoring
- Vibration monitoring
- Pump monitoring frequency
- Temperature based monitoring
- Infrared monitoring

#### Discussion:

1. What monitoring techniques are employed at your plant?
2. Have they proven effective?
3. CBM case studies

- Analytical-case tools
- Data analysis
- Weibul analysis

#### Discussions:

1. Is CMMS providing data or true reliability information?
2. Is data routinely analyzed and used for decision-making?
3. What kind of analysis is done?

### Measuring results from continuous reliability improvement – Changing to reliability focus operation

- The scoreboard for maintenance excellence
- 1. Defining global best practices and your baseline
- 2. Defines “where you are”

### Case study: Marathon Oil

- The CMMS benchmarking system
- 1. Evaluates existing CMMS' support to reliability of rotating equipment
- 2. Why CMMS implementation fail to achieve planned benefits
- The maintenance excellence index: A proven method to define your results to top leaders
- Key metrics and KPI's to consider for your maintenance excellence index
- Other measures to validate reliability

Exercise: Developing metrics and KPI's for your operation using the maintenance excellence index

Case study: Steel mill operation

### Case Studies:

- Bearing failure case study
- Bearing vibration signature analysis case study
- In-situ shift balancing case study
- RCFA exercise
- FMEA exercise
- Failure impact and cost analysis exercise
- Removing soft-foot activity

### “Put on Your Thinking Cap!” session - Open forum:

- a) Define Top 5 Areas for Best Practice Improvement
- b) Define Top 5 Reasons for Reliability Problems in Your Current Operation

Presentation of certifications and wrap up of day three