



ME182:

Excellence in Maintenance & Reliability Management Preventive/Predictive Maintenance, Machinery Failure Analysis (RCFA), Rotating Equipment Reliability Optimization & Continuous Improvement

Training Description:

Every year, industry in the United States alone is spending around one trillion dollars on plant and equipment maintenance. According to maintenance specialists, at least one third of this amount is wasted, and that's just the tip of the iceberg.

Bad maintenance management is responsible for equipment failures, disrupted production schedules, delays in deliveries, and poor product quality. Why is industry wasting one out of every three dollars spent on maintenance? The answer is simple: Poor management and poor systems.

The problem of reliability allocation and optimization of Rotating Equipment has been widely investigated by world-class process companies during the last decade. Instead of concentrating exclusively on redundancy allocation as per the old fashion maintenance, the minimum required reliability for each component of the equipment are now estimated in order to achieve the equipment reliability goal with minimum cost.

Thereafter, the engineer can decide whether this minimum required component reliability will be achieved via fault avoidance or redundancy. This new philosophy allocates reliability to a component according to the cost of increasing its reliability.

Continuous improvement of plant reliability by optimizing predictive maintenance for rotating equipment is one of the most important challenges plants face today. To know how to effectively prevent equipment failures, conduct a successful root cause failure analysis and improve condition monitoring for pumps, turbines and compressors are continuing challenges for engineers. Proper analysis and solving of chronic problems at the source saves time and money.

This intensive training course is designed to assist maintenance management personnel responsible for delivering maximum reliability and availability of equipment at the lowest possible cost. The course will present techniques designed to improve the effectiveness of maintenance management activities, to ensure that physical assets perform their required functions, operate reliably, and support corporate goals.

The course will explain the effective method of component condition monitoring for use as both a predictive maintenance and root cause analysis tool. It also details the major failure causes, the world-class proven root cause analysis procedure with exercises and case histories, installation, pre-commissioning planning, functional testing and commissioning, preventive maintenance strategies and more.

The course sessions will focus on the modern methods and techniques on the most critical aspects of maintenance management such as Organizing maintenance resource, Selecting the right maintenance work, analyzing failures, Setting and conducting a maintenance plan, planning spare parts, Estimating and controlling maintenance costs, Computerizing maintenance planning and measurement operations. The participants will also be introduced to Reliability tools and the effect human reliability has on plant availability.

To maximize the benefits of the course, participants should be prepared to actively participate in the course and bring examples of standard work plans, a list of plant performance metrics, the work priority system in-place, and any other maintenance or reliability material they would like to review and discuss.

Training Objectives:

By the end of the training, participants will be able to:

- ✓ Achieve the excellence in maintenance & reliability management including preventive & predictive maintenance, machinery failure analysis (mainly, the root cause failure analysis-RCFA) and strategic planning
- ✓ Recognize the world-class aspects of maintenance today through the various types of maintenance including maintenance strategy, business model, maintenance organization, R&M policy and productive maintenance
- ✓ Identify the different equipment failure patterns and execute system approach of machinery failure analysis, diagnostics testing and troubleshooting as well as identify the root causes of machinery failure (RCFA) and their contributing factors which are often overlooked
- ✓ Employ metallurgical failure analysis methodology as illustrated by failure analysis of bolted joints and shafts
- ✓ Carryout site reliability assessment and prepare a site reliability optimization plan
- ✓ Apply rotating equipment reliability assurance and machinery installation guidelines
- ✓ Identify the effects of misalignment on reliability and how it can be detected
- ✓ Perform machinery component analysis and reliability improvement by recognizing redesigned opportunities, bearings in distress, coupling failure avoidance opportunities and mechanical seal problems
- ✓ Employ proper machinery troubleshooting in various equipment including pumps, centrifugal and reciprocating compressors, blowers and fans, engines, gas turbines, etc.
- ✓ Carryout machinery root cause failure analysis (RCFA) and employ the methods of preventive maintenance including lubrication, time-based, dynamic-based and CLAIR
- ✓ Carryout the latest methodology of predictive maintenance and condition-based monitoring including vibration monitoring, pump monitoring frequency, infrared thermography, physical effect monitoring and lube oil analysis
- ✓ Identify the various elements, key factors, tasks & procedures toward achieving the roadmap to a world class PPM program
- ✓ Properly manage the work selection & prioritization, the work planning & scheduling, turnaround projects, the work execution & contracting, stewardship & performance and work quality
- ✓ Distinguish the factors of human reliability, utilize the various reliability tools and discuss the key elements of reliability engineering and CMMS

Training Designed for:

This course is intended for Maintenance Management Team delivering maximum reliability and availability of equipment at the lowest possible cost. This course will present techniques designed to improve the effectiveness of maintenance management activities, to ensure that physical assets perform their required functions, operate reliably, and support corporate goals. It is essential for all Maintenance and Reliability Management Staff.

Training Requirement:

"Hand's on practical sessions, equipment and software will be applied during the course if required and as per the client's request."

Contents can be adapted to your specific wishes. It is therefore possible to focus on specific modules of the training course as per client's learning needs and objectives. Further, it should be forwarded to us a month prior to the course dates.

Training Program:

DAY ONE:

- ❖ PRE-TEST
- ❖ Introduction
 - What are the Strong Points of Your Maintenance Organization? What Areas Do You See Needing Improvement?, What Concerns About Planning and Scheduling?, What Do You Know About Preventive & Predictive Maintenance (PPM), World Class PPM, Importance of Physical Asset Management
- ❖ Maintenance Excellence & World Class Maintenance
 - Framework for Maintenance Excellence, Overall Philosophy, Maintenance Principles, Work Environment, Equipment, Information Systems, Elements for Effective Maintenance, Establishing the Environment for Improvement, Types of Maintenance, Maintenance Strategy Development, Productive Maintenance, Maintenance Methods Compared, What Type of Maintenance is Your Plant Doing?
- ❖ Machinery Failure Patterns
 - Understand the Nature of Failures, Types of Equipment Failures, Failure Classifications & Failure Patterns, Why Equipment Fails, Failure Analysis & Root Cause, How Does Most of Your Equipment Fail?
- ❖ Machinery Diagnostic Testing
 - Diagnostic Objectives, Mechanical Inspection, Test Plan Development, Data Acquisition and Processing, Data Interpretation, Conclusions and Recommendations, Corrective Action Plan
- ❖ Metallurgical Failure Analysis Methodology
 - Failure Analysis of Bolted Joints, Shaft Failures and their Origins, Ductile vs. Brittle Failures of Shafts, Stress Raisers in Shafts
- ❖ Machinery Component Analysis and Reliability Improvement
 - Redesign Opportunities, Analyzing Wear Failures, Bearings in Distress, Rolling Element Bearing (AFB) & Bearing Failure Analysis, Journal and Tilt Thrust Bearings, Gear Failure Analysis

DAY TWO:

- ❖ Machinery Component Analysis and Reliability Improvement (cont'd)
 - Coupling Failure Avoidance, Determining the Cause of Mechanical Seal Distress, Mechanical Seal Selection Strategies, O-Ring Failures and their Causes
- ❖ Site Reliability Assessment
 - Site Reliability Audit Form, Reduction of Data, Identifying Targets for Improvement, Forms and Worksheets
- ❖ Preparing a Site Reliability Optimization Plan
 - Introduction, Identifying Opportunities for Optimization, Determine the Root Cause of Each Identified Opportunity, Establish Steps to Prevent Reoccurrence of Problems, Setting Up an Effective Multi Disciplined Site Reliability Initiative, Obtain and Maintain



Management Support, How to Maintain Continuous Improvement of the Established Program

❖ **Rotating Equipment Reliability Assurance**

- Introduction, The Pre-FEED Phase, The Specification and ITB Phase, Pre-Bid Activity and Degree of Audits, Bid Evaluations, Pre-Award Meeting, The Coordination Meeting, Design and Manufacturing Audits, Document Review, Testing Phase

❖ **Machinery Installation Guidelines**

- Introduction, Site Procedures, Foundations, Piping, Shaft Alignment, Couplings, Cleaning of Equipment and Associated Pipe, Final Inspection and Start-Up Checks, First Start, Run-In and Initial Operation

❖ **The Effects of Misalignment on Reliability**

- Introduction, Why Misalignment Reduces Rotating Equipment Reliability, How Misalignment Effects Can Be Detected, Alignment Methods and Guidelines

DAY THREE:

❖ **Machinery Troubleshooting**

- The Matrix Approach to Machinery Troubleshooting, Pumps, Centrifugal Compressors, Blowers and Fans, Reciprocating Compressors, Engines, Gas Turbines and Others

❖ **Machinery Root Cause Failure Analysis (RCFA)**

- Structured Problem Solving and RCFA, Cause Analysis, Two-Track Approach, Failure Types, The Three Levels of Cause, Collecting Failure Data, Parts and Position, The Analysis Process Describing the Process, Data Analysis I, Data Analysis II, Data Analysis III, Another Way, Human Root Causes, Solutions, Stewardship of RCFA Results

❖ **Maintenance Management Methods & Objective Setting**

- Managing Maintenance, Basic Principles, Maintenance Business Model, Business Elements, Maintenance Organization, Do You Have a Maintenance Model? What is Your Organization Structure?, Business Plan, R&M Policy, Maintenance Plans, Does Your Plant Have an R&M Policy?, Are the Yearly Goals Disseminated throughout the Plant?, Objectives

❖ **Preventive Maintenance (Lubrication)**

- Cost of Poor Lubrication, Fundamentals-Oil & Grease, Storage & Handling Methods, Oil Analysis, Organization, Comparative Viscosity, Classifications

DAY FOUR:

❖ **Preventive Maintenance (Time-Based/Dynamic-Based)**

- General Philosophy, Upside, Downside, CLAIR Activities

❖ **Predictive Maintenance & Condition-Based Monitoring**

- Types of Condition Based Monitoring, Vibration Monitoring, Pump Monitoring Frequency, Infrared Thermography, Physical Effects Monitoring, Lube Oil Analysis, What Kinds of Monitoring are Being Used Today? Has the Monitoring Program Been Effective?, Is the Monitoring Scheduled Being Adhered to?

❖ **Roadmap to a World Class PPM Program**

- Writing Tasks and Procedures, Developing Equipment Manuals, Scheduling PPM Tasks, Quality Assurance & Continuous Improvement, Measuring the Results, Role of the Maintenance Organization, Implementation – Steps to Developing a PPM Program

❖ **Work Selection & Prioritization**

- Mission, Work Screening Procedure, Work Request Requirements, Prioritization Systems, Cost Benefit Analysis, What Systems are You Using to Identify and Prioritize Work? Do You Have a Plant-Wide Risk Matrix?, Is the Same Risk Matrix Used throughout The Plant?

❖ **Work Planning & Scheduling**

- Planning Objectives, Planning Effectiveness, Planning Metrics, Planners and Staffing, Routine Maintenance Planning, Work Plan, Planning Tools, Scheduling & Considerations,
- Types of Schedules, Work Execution Packages, Maintenance Backlog, How Effective is Your Planning? What Metrics are Tracked for Planning and Scheduling?, Is Backlog a Concern?

❖ **Simulator (Hands-on Practical Sessions)**

- This hands-on and includes simulator, real-life case studies and exercises

DAY FIVE:

❖ **Proven Turnaround Practices**

- Success Factors, T/A Concern Areas, Management Practices, Milestone Plan, Work Scope, Projects, Material Procurement, Process Operations, PreT/A Reviews, how are You Approaching Turnarounds? Who Does the Planning? Self? Contractor? Does Planning Started Early Enough?

❖ **Work Execution & Contracting**

- Objective & Actions, Job Completion, Supervisor, Contracting Types, Advantages & Disadvantages, How Effective is Work Execution? Are You Using Mixed Crews, Contractors or Own Crafts Men?, What Kind of Contracting is Most Done by Your Plant?

❖ **Stewardship, Performance Metrics & KPIs**

- Performance Indicator Characteristics, Business Results Indicators, Process Unit Run-Length Goals, Work Management KPIs, Maintenance Effectiveness Metrics, Equipment Specific Indicators, Work Force Utilization Metrics, What KPI or Indicators is Your Plant Tracking? Have they been Effective in Improving Reliability and Reducing Maintenance Cost?, How Frequently are they Being Reported or Tracked?

❖ **Quality Assurance & Continuous Improvement**

- Objectives & Implementation, Data to be Screened, Bad Actors & RCFA, Quality Audits, Does Your Plant have Quality Assurance & Continuous Improvement Programs in Place for R&M? How Effective is it?, What is Monitored to Identify Improvement Opportunities?, How to Use a Quality Audit as a Tool for Improvement?

❖ **Human Reliability & Reliability Tools**

- Classification of Human Error, Human Reliability Analysis, Has Your Plant Experience Human Error and How Has it Gone About Resolving it? Life Cycle Cost Analysis, Does Your Plant Use Life Cycle Cost Analysis?, Life Data Analysis ("Weibull Analysis"), Does Your Plant Use Life Data Analysis?

❖ **Computerized Maintenance Management Systems (CMMS)**

- Components, Benefits, Implementation Plan and Issues, SAP Maintenance, What System Installed? Are All the Features Used?, How Long did it Take to Implement?, Do You Have a SAP System? Do You Know How to Use it? What Difficulties You Face with SAP?

❖ **Course Conclusion**

❖ **POST-ASSESSMENT and EVALUATION**

Training Methodology:

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:

- 30% Lectures, Concepts, Role Play
- 70% Workshops & Work Presentations, Techniques, Based on Case Studies & Practical Exercises, Gamification, Software & General Discussions
- Pre and Post Test

Training Certificate(s):

CMCT Internationally recognized certificate(s) will be issued to each participant who completed the course.

Training Fees:

TBA as per the course location - This rate includes participant's manual, hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Note: The 5% VAT (Value Added Tax), will be effective starting 01st of January 2018 as per the new regulation from the UAE Government. The VAT applies for all quotation both for local and abroad.

Training Timings:

Daily Timings:

07:45 - 08:00	Morning Coffee / Tea
08:00 - 10:00	First Session
10:00 - 10:20	Recess (Coffee/Tea/Snacks)
10:20 - 12:20	Second Session
12:20 - 13:00	Recess (Prayer Break & Lunch)
13:00 - 14:00	Last Session

For training registrations or in-house enquiries, please contact:

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