

# PRINCIPLES OF RELIABILITY ENGINEERING



**MRE105**  
**Maintenance &**  
**Reliability**  
**Engineering**

## **COURSE TITLE**

# **PRINCIPLES OF RELIABILITY ENGINEERING**

## **COURSE DATE/VENUE**

05th Feb-09<sup>th</sup> Feb

London, UK

## **COURSE REFERENCE**

MRE105

## **COURSE DURATION**

05 Days

## **DISCIPLINE**

Maintenance & Reliability Engineering

## **COURSE INTRODUCTION**

Reliability Engineering has moved forward enormously in recent years and it is often difficult to keep abreast of the latest thinking and techniques. This seminar bridges that gap and presents recent, but proven, developments in Risk Management to improve safety and uptime. It will also show how the application of fundamental reliability techniques can be used to improve equipment run-lengths. Failure rate is a key driver for improved uptime, but Mean Time to Repair is just as important. Maintainability requires equipment that is serviceable (easily repaired) and supportable (cost-effectively kept in or restored to a usable condition). Combine this with reliability (absence of failures) to significantly improve the safety and uptime of a facility.

There is a growing realization that a safe, reliable facility depends on how well we manage risk, so we begin with a discussion of quantitative and qualitative risks. Human failures are more difficult to manage, but they matter a lot, so we will address this subject in some detail. This leads us into techniques such as FMECA (Failure Modes, Effects, Criticality Analysis) and RCM (Reliability Centred Maintenance) that help plan our work and improve our equipment reliability considerably. For less critical equipment, using the REM (Review Existing Maintenance) technique is a highly effective risk management tool. In addition, the course will show how to maintain safety-critical instrumentation using the SIL (Safety Integrity Level) technique. Static equipment is given special consideration and the course will demonstrate how and where Risk-Based Inspection (RBI) should be used. You will also learn about Root Cause Analysis, a powerful reactive problem-solving

tool that uses a systematic and structured approach to eliminate failures permanently. The course will provide a good understanding of where and how to apply the method.

Implementation of the results of these analyses is the key to reaping the benefits. Analysis is the easy bit; implementing the results always poses challenges. So we will see how to grind away at the hard parts - writing new maintenance routines, scheduling work, then doing it on time, recording history, and then reaping the rewards. Finally, we will see how to implement change successfully. For this we need to understand critical success factors, change management, the importance of good communication and how to track progress. Sustained improvement needs a process to hold the gains.

Application of the reliability methods taught in this seminar will produce a positive impact on business goals, for example:

- Maintain and improve reliability and availability,
- Maximize safety,
- Achieve best practice maintenance, and,
- Develop world class performance.

This will be an interactive, enjoyable and interesting learning experience. It will utilize a variety of methodologies including lectures and slide presentations. The seminar is structured to give you an introduction to the key Reliability Engineering processes with a thorough grounding in the main elements. It offers practical advice and guidance on their use, particularly as they are applied in industry. Examples and group exercises allow delegates to acquire a more detailed and practical understanding. A comprehensive Case Study will reinforce learning. Examples of actual obstacles encountered during actual studies will be highlighted. The participation of delegates will be encouraged throughout. Delegates will also have opportunity to discuss issues relevant to their workplace if they so wish.

### **COURSE OBJECTIVE**

- To learn how to define, measure and predict reliability,
- To learn how to use key Reliability, Maintainability and Risk techniques to improve profitability and safety,
- To determine where, when and why each technique should be applied,
- To find out how to implement the analysis results effectively,
- To be able to determine value added by this work,

- To learn how to get started on a Reliability Improvement Program.

The effective use of proactive and reactive reliability-based methods will significantly improve the safety and uptime of your facility and this seminar will show you exactly how.

### **COURSE AUDIENCE**

Reliability engineering and operations personnel involved in improving reliability, availability, safety, maintainability and profit performance in existing or proposed process systems and equipment. Participants should have foundation skills in statistical analysis and reliability techniques for equipment.

If you are a manager, supervisor, engineer, logistics specialist, an academic or other professional seeking to understand reliability and uptime improvement, this workshop will be able to help you. It is aimed at people with a stake in Operational Success working in the Oil & Gas Industry such as the Reliability Team, Maintenance Engineering Team, Shutdown & Campaign Team, Barge & Subsea Team. The course has also been specifically designed to be of substantial benefit to both technical and non-technical personnel employed in the activities that support the O&M sector.

### **COURSE CONTENT**

**The course content will include the following will be covered in 5 days of time.**

- Introduction to Reliability Engineering
- Basic Reliability Theory
- Reliability Engineering Fundamentals – Reliability engineers vs. maintenance engineering; and the Engineered Maintenance Strategy.
- Series and parallel reliability
- Reliability failure analysis and reporting
- Reliability Statistics – Mean, Median and Mode; Standard Deviation; Linear Regression;
- MTBF and MTTF; Reliability Predictions; Basic System Analysis; Weibull Calculations.
- Failure rate/MTBF
- Using statistical analysis to predict system performance
- Life Cycle Cost Analysis – LCC Philosophy and Benefits; Financial Statements; the Cost of Money; ROI & ROA; and Life Cycle Cost Calculations.

- Reliability Block Diagrams
- Maintainability Engineering
- Quantitative Risk
- Qualitative Risk
- Failure mode and effects criticality analysis (FMECA)

**– Different Types of FMECAS; Functions – Primary and Secondary; Functional Failures & Hidden Failures; Failure Modes; Effects; and Criticality.**

- Fault-tree analysis (FTA)
- Weibull Analysis - Introduction; Definition of Reliability; Weibull Shapes; Maintenance Tactics; Understanding Failure Distributions; Weibull in Complex Systems; and Weibayes.
- Simulation Modelling
- Performance Measurement
- Human Error and its Causes
- Learning from Failures
- Performance Measurement
- Reliability Centred Maintenance – Definition of RCM; Types of Maintenance; Failure Patterns; Underlying Analysis Philosophies; Foundational Changes; 7 Steps of RCM; and RCM Decision Logic.
- Condition Monitoring - Quantifying Mechanical Asset Health; Quantifying Electrical Asset

**Health; and Quantifying Stationary Asset Health**

- Total Productive Maintenance / OEE
- Safety Integrity Levels
- Task-bundling
- Problem solving process - Root Cause Analysis Root Cause Analysis (RCA) – Examples of RCA techniques improving OEE; Discuss and demonstrate Logic Trees; Discuss and demonstrate Causal Factor Mapping; Using Pareto analysis to

select chronic failures to address with RCA; and Selling the benefits of RCA to management.

- Human Factors Engineering – Procedures Based Maintenance; Basic Job Mapping; and Introduction to Work Procedures.
- Work execution
- Compliance
- Reliability Centred Design (RCD) – Purpose of RCD; Importance of RCD; RCD Process; RCD FMEA; and Ramifications of RCD.
- Performance Monitoring
- Implementation
- Failure Reporting, Analysis and Corrective Action System (FRACAS) – Basic Elements; Failure Reporting; Roles and Responsibilities; Analysis Methods; and Database Elements.
- Reporting Results
- Holding the Gains



### **COURSE CERTIFICATE**

**TRAINIT ACADEMY** will award an internationally recognized certificate(s) for each delegate on completion of training.

### **COURSE FEES**

£5,500 per Delegate. This rate includes participant's manual, Hand-Outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

### **COURSE METHODOLOGY**

The training course will be highly participatory and the course leader will present, guide and facilitate learning, using a range of methods including formal presentation, discussions, sector-specific case studies and exercises. Above all, the course leader will make extensive use of real-life case examples in which he has been personally involved. You will also be encouraged to raise your own questions and to share in the development

of the right answers using your own analysis and experiences. Tests of multiple-choice type will be made available on daily basis to examine the effectiveness of delivering the course.

- 30% Lectures
- 30% Workshops and work presentation
- 20% Case studies & Practical Exercises
- 10% Role Play
- 10% Videos, Software or Simulators (as applicable) & General Discussions

### **COURSE VENUE IMAGES**

**Hyatt Regency London - The Churchill, London, UK**



