

Reliability Centered Maintenance & Practical Asset Management for Electric Utilities

Overview:

Interactive 4-day seminar combines theoretical background with practical experience to provide asset managers, substation maintenance supervisors and substation engineering asset specialists with reliability-centered maintenance (RCM) and performance focused maintenance (PFM) to develop maintenance strategies to improve network reliability and optimize asset life-cycle costs. Doble's approach will leverage research from organizations such as CIGRE, IEEE, CEATI, Doble client conference as well as Doble's direct experience working with dozens of comparable global utilities.

A growing number of global utilities are currently using RCM whereas PFM further extends RCM to asset life-cycle management optimization. Its goal is to minimize costs of maintenance to achieve an acceptable performance, to increase the mid-term and long-term profitability under acceptable risk conditions. Balance is thereby sought between performance, cost and risk. For many, implementation of the broader view to asset care has been by adopting the PAS 55 specification and now ISO 55000.

Learning Outcomes:

Upon completion of this course, the participant will be able to:

1. Understand why electric power utilities have embraced RCM as part of its business strategy.
2. Overview of ISO 55000 Asset Management standard.
3. Understand the role RCM plays in an overall Asset Management Strategy.
4. Understand the seven fundamental requirements of all RCM based maintenance programs.
5. Understand the 14 goals of RCM and PFM.
6. Identify important RCM stakeholders and their roles in an RCM study.
7. Identify key factors that influence the application of RCM; functional requirements, data etc.
8. Be comfortable with the 13 steps of an RCM/PFM analysis.
9. Know the different types of maintenance tasks an RCM study identifies to ensure an asset meets its functional requirements.
10. Recognize the importance of a "living" RCM program and stakeholder roles for continuous improvement in asset performance. Identifying and understanding metrics/KPIs.
11. Understand how Root Cause Analysis plays an important role in the continuation of RCM/PFM success.
12. Develop maintenance strategies to improve network reliability and optimize asset life-cycle costs
13. Monitor asset and maintenance program performance.

Course Audience:

Asset managers, substation maintenance supervisors and asset specialists who have responsibility for developing maintenance strategies to improve network reliability and optimizing asset life-cycle costs.

Duration:

4 Days

Class Size:

15 Attendees

Credits:

Up to 3.2 CEUs or 32 Professional Development Hours

COURSE OUTLINE

Reliability Centered Maintenance & Practical Asset Management for Electric Utilities

The course program contains the following training outline:

The course will be comprised of four parts:

1. **Asset Management and the Role of RCM/PFM**
2. **Overview of RCM and PFM Principles**
3. **Application of PFM and RCM to a small set of T&D assets during Breakout sessions:**
 - Creating a skeleton PFM/RCM base maintenance plan for the selected assets
 - Transferring knowledge of the PFM/RCM processes and the asset's technical issues
 - Reinforcing process training for developed RCM processes
4. **Monitoring asset and maintenance program performance**

During course, there will be several breakout sessions where groups of 4 to 6 people will apply the RCM/FPM/RCA concepts to specific equipment and present their analysis to the group.

Day 1:

- **Overview of Maintenance Strategies**
- **Maintenance Strategy Development, Implementation, Procedures and Standards**
 - o RCM (Reliability Centered Maintenance)
 - o CBM (Condition Based Maintenance)
 - o RBM (Risk Based Maintenance)
 - o PFM (Performance Focused Maintenance)
- **Reliability Centered Maintenance**
 - o History of RCM
 - o RCM Goals & Objectives
 - o Why Are There So Many Different Version of RCM?
 - o 13 Step RCM Process Overview
- **Performance Focused Maintenance**
 - o Life Cycle Planning
 - o On-line Monitoring
 - o On-line and Off-line Diagnostics
 - o Routine Inspection and Servicing
 - o Inspections
 - o Hidden Failure Finding
 - o End-of-life Replacement
 - o Performance Data
- **Leveraging available data to make better maintenance decisions**
- **Adaptive maintenance programs**
- **Identification of assets and teams for breakout sessions.**

Typical asset could include:

 - o Power Transformers
 - o Load Tapchanging Transformers
 - o Surge Arresters
 - o Circuit Breakers
 - o Instrument Transformers
 - o Batteries
 - o Protective Relays
 - o MV Cables
 - o Ground Grids
 - o Poles
- **Detailed RCM/PFM Process Steps 1-3**
 - o System Selection
 - o Critical Function Identification
 - o Dominant Failure Modes
 - o Group Presentation



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The course program contains the following training outline:

Day 2-3:

- **Detailed RCM/PFM Process Steps 4-7**
 - o Cause Identification
 - o Failure Modes and Effect Analysis
 - o Aging
 - o Task Selection
 - o Group Presentation
- **Detailed RCM/PFM Process Steps 7-9**
 - o Task Selection (continued)
 - o Risk
 - o Reconciliation
 - o Program Development
 - o Group Presentation
- **Detailed PFM Process Steps 10-13**
 - o Measures and Data Gathering
 - o Age Modeling
 - o Metrics
 - o Key Performance Indicators
 - o Group Presentation
 - o Implementation
 - o Program Documentation

Day 4:

- **Root Cause Analysis - Preventing recurring problems**
 - o Overview of Root Cause Analysis Techniques
 - o Extending 5-why Analysis to Cause Mapping
 - o Integrating Root Cause Analysis into the PFM Program
 - o Example Application to T&D Assets
 - o Applying RCA to Real Maintenance Problems
 - o Wrap-up



Presenter(s):

John Skog - RCM Consultant & Business Performance Analyst

Mr. Skog has more than 40 years' experience in the electric utility industry, 21 years as a consultant and more than 20 years as an electric utility substation, metering, system protection and maintenance supervisor. More than three-quarters of his professional experience has been focused on customer metering, utility operations, substation equipment procurement, testing, maintenance, and life extension. He is a leader in the area of maintenance program optimization in the electric utility industry and is recognized around the world as an authority on the use of Reliability-Centered Maintenance (RCM) and Performance-Focused Maintenance (PFM), techniques for optimization of routine maintenance. He has provided maintenance optimization training and consulting services for utility clients across the U.S., Africa, Australia, the Middle East, and Europe.

Division of Responsibilities:

If the course is hosted at a customer location, to ensure smooth training course delivery, Doble requests the following division of responsibilities:

Doble will provide:

- Confirmed training dates upon receipt of a purchase order.
- Technical agenda for program.
- One experienced instructor including their travel/living expenses.
- Training manual (soft copy) to each participant.
- If applicable, all required measurement test equipment and tools for class and site training.
- All personnel safety equipment for Doble's instructor.

Customer will provide:

- Confirmed training schedule at least 60 days in advance.
- Training coordinator through whom all contractor requests will be coordinated.
- Training facility, AV equipment, whiteboard and pens.
- Printing hard copy training material as required.