Reliability Engineering and RCM: FMEA, Weibull Analysis and Maintenance Strategy

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Dubai - Five-star CBD venue



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Introduction:

Reliability engineering and reliability-centred maintenance RCM matter when maintenance plans are copied from vendor manuals, failure histories go unanalysed and the same critical pumps, compressors and conveyors keep failing. Tasks are then chosen by habit rather than by failure mode and consequence. This Core Concept course equips reliability and maintenance engineers to define functions and functional failures, analyse failure modes, fit Weibull models to failure data and select maintenance tasks with RCM decision logic. Participants leave with an RCM Analysis Worksheet and a Reliability Improvement Programme for a critical system.

Course Objectives:

- Calculate MTBF, MTTR, inherent and operational availability and failure rates from equipment failure records
- Conduct an FMEA or FMECA on a critical system using IEC 60812 and rank failure modes by criticality or action priority
- Apply the RCM decision logic of SAE JA1011 and SAE JA1012 to select on-condition, scheduled restoration, scheduled discard, failure-finding or run-to-failure tasks
- Fit Weibull models to failure and suspension data and interpret the shape parameter to set task intervals
- Rank assets by criticality and identify bad actors from reliability KPIs to focus engineering effort
- Build a Reliability Improvement Programme with RCM analysis scope, KPI targets, owners and review cycle

Target Audience:

- Reliability engineers who analyse equipment failures and set maintenance strategy for rotating and static assets
- Maintenance engineers who own preventive maintenance programmes and equipment performance
- Asset integrity and inspection engineers responsible for failure-finding and on-condition tasks
- Condition monitoring specialists who define inspection intervals and alarm limits
- Process and plant engineers who participate in RCM and FMEA review teams

Course Outline:

Day 1: Reliability Fundamentals and Failure Behaviour

- Reliability, Maintainability and Availability Definitions with the Bathtub Curve
- Six Age-Reliability Failure Patterns and Their Maintenance Implications
- MTBF, MTTR and Failure Rate Calculation from Equipment History
- Inherent, Achieved and Operational Availability Models
- Maintenance Strategy Health Check of an Existing Preventive Maintenance Plan

Day 2: FMEA, FMECA and the RCM Standards

- Functional Block Diagrams and System Boundary Definition
- FMEA and FMECA Procedure Under IEC 60812 and MIL-STD-1629A
- RPN Weaknesses and AIAG-VDA Action Priority Ranking
- SAE JA1011 Seven Questions and Minimum Criteria for an RCM Process
- SAE JA1012 Guidance on Functions, Performance Standards and Operating Context

Day 3: RCM Decision Logic and Maintenance Task Selection

- Failure Consequence Evaluation: Hidden, Safety, Environmental, Operational and Non-Operational
- On-Condition Task Selection with the P-F Interval and Inspection Frequency
- Scheduled Restoration and Scheduled Discard Technical Feasibility Tests
- Failure-Finding Task Intervals for Protective Devices and Hidden Functions
- Run-to-Failure and One-Time Change Decisions with the RCM Decision Diagram

Day 4: Life Data Analysis, Criticality and Bad Actors

- Weibull Plotting with Failures and Suspensions: Shape and Characteristic Life
- Interpreting Weibull Shape: Infant Mortality, Random and Wear-Out Failures
- Optimal Replacement Interval Using Cost and Risk Trade-Off Models
- Asset Criticality Ranking Matrix for Consequence and Likelihood
- Bad-Actor Identification with Pareto of Downtime and Maintenance Cost

Day 5: Case Practice and the Reliability Improvement Programme

- Centrifugal Pump Train Case: RCM Analysis Worksheet Completion
- Conveyor Drive Case: Weibull Analysis and Task Interval Setting
- Reliability KPI Set: MTBF Trend, Availability and PM Effectiveness Targets
- Reliability Improvement Programme Drafting with Scope, Owners and Review Cycle
- Programme Presentation and Peer Challenge Panel

Skills You Will Gain:

- Failure Mode Analysis
- Life Data Analysis
- Maintenance Task Selection
- Availability Modelling
- Asset Criticality Assessment
- Bad-Actor Management
- Reliability Performance Measurement
- RCM Facilitation

Why Attend This Course:

- Return with an RCM Analysis Worksheet and a Reliability Improvement Programme for a critical system at your own site
- Justify each maintenance task by failure mode and consequence instead of vendor recommendation or habit
- Set inspection and replacement intervals from your own failure data rather than fixed calendar guesses
- Compare reliability practice with engineers from oil and gas, utilities, mining and manufacturing plants

Conclusion:

Reliability improves when every maintenance task answers a specific failure mode, its consequences and the evidence in the failure data. This course moves from reliability measures and failure patterns, through FMEA, FMECA and the RCM standards, to consequence-based task selection, Weibull life data analysis, criticality ranking and bad-actor elimination. The final day applies these methods to plant cases and produces an RCM Analysis Worksheet with a Reliability Improvement Programme ready for review with maintenance and operations leaders.