## Implementing Reliability Centered Maintenance RCM
### From Analysis to Action (online course by distance education)

### Module 1

<table>
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<th>Item</th>
<th>Key Topics</th>
<th>Design/Topics</th>
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</table>
| 1    | Foundation Reliability Knowledge | Physics of Failure  
- Why parts fail  
- Equipment Failure Curves  
  - Early Life – Random – Age  
  - Maintenance strategy selection  
- Risk Management  
  - The components of risk  
  - Measuring risk  
- Maximum Reliability  
  - Series and Parallel Systems  
  - Life-cycle considerations  
  - Quality and Precision  
  - Human Factors |  
- Identifies the types of situations that cause equipment failure  
- Explains why maintenance is done  
- Explains equipment life-cycle strategies |
| 2    | Recognising Equipment Risk | Equipment Criticality  
- Identifying systems critical to plant safety and profitability and matching the maintenance effort.  
  Activity 1 – Perform Equipment Criticality Analysis |  
- Match maintenance and reliability management strategies to operating risk |
| 3    | Identifying Effects of Failure | Failure Modes and Effect Analysis (FMEA)  
- Identifying failures and ways to eliminate them  
- Identifying the root-cause  
- Feasible ways (technically) of analysis  
  Activity 2 – Perform an FMEA  
  Activity 3 – Access Failure Consequences  
  Activity 4 – Identify Hidden Failures |  
- Methods to eliminate possible failure increases the reliability and integrity of equipment |
| 4    | Proactive Maintenance | Maintenance Strategy Selection  
- Selecting Preventive and Predictive Tasks to maintain reliable plant equipment in the most cost-effective manner while meeting the challenge of regulatory compliance.  
- Operating Risk Reduction with RCM to identify the most practical, cost-effective and technically correct tasks in maintaining equipment function  
- Precision Maintenance and how workmanship quality produces high reliability  
  Case Study1: Maintenance Strategy for Gas Compressor/Turbine from RCM Analysis  
  Activity 5: Maintenance Strategy Selection from FMEA Activity |  
- Highlight possible issues/challenges of maintenance  
- Getting the bigger picture of the issues, possible solutions and benefits of implementation  
- Which selections will actually deliver reliability improvements |
| 5    | Making Reliability Centered Maintenance Work | Changing to Better Maintenance Practices  
- Purpose of RCM – on-condition based maintenance  
- RCM – The 7 basic questions  
- Describing and listing functions  
- Performance Standards  
- Applying the RCM process  
- What RCM achieves: Example RCM Maintenance Strategy Development  
  Case Study2: Fuel Terminal Automated Valve RCM  
  Activity 6 – Confirm Value of a Chosen Maintenance Strategy |  
- To get the increased reliability and integrity of equipment that RCM can deliver needs the proper practices to be introduced and used |
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| 6    | Integration of RCM and Implementation of Strategies | Design Principles of Low-Cost, Usable, Reliable, Maintainable & Safe System  
- Identifying Project and Operating Risk  
- Setting Reliability Standards  
- Reducing Operating Risk at Design  
- Maximizing Availability  
- Controlling Human Factors  
- Quality Control – setting pass/fail criteria  
- Importance of Standardization  
- Accuracy controlled procedures  
Activity 7 – Develop an ACE 3T error proof procedure  
Case Study 3: RCM of a Flow Control Valve  
Activity 8 – Do an RCM on a Pump Set  
Case Study 4: Change Management – How a Power Provide moved from Third Quartile to Top Decile Ranking  
Metrics to track effectiveness of equipment  
- Metrics to check the effectiveness of RCM implementation  
- Proactive Condition Monitoring  
- MTBF improvement measures  
- Duane/Crow-AMSAA plots  
- Operational improvement measures | • The principles of reliable and maintainable, high performance plant  
• Ways of integrating all the knowledge obtained in Day 1 and implementing it for the benefit of the organization  
• Effective implementation uses key metrics to better utilize resources, enhance coordination among related projects and improve project planning and estimation;  
• Proactively identify the risks of failing to complete the schedule and budget targets; reduce the process overhead of measurement data collection, consolidation and analysis at different levels in the project hierarchy  
• How to make RCM really work |
| 7    | Optimize Your Maintenance Systems | • Creating a Useful Maintenance Management System  
Access, standardize all relevant information regardless of location and format (work orders, maintenance schedules, regulatory requirements, resource skills)  
• Maintenance Planning and Scheduling  
Optimize RCM plans and schedules (taking into account priorities, skill sets, time and Resource constraints, etc); track work orders and resource usage  
• Developing and Implementing RCM with a Limited Staff  
- Standardize equipment and parts  
- Precision Operation – degradation management  
- TPM - Operator Maintenance activities  
- Precision Maintenance skill set  
- Teamwork Organisation Structure  
- Error-proofing work activities | • Easily share RCM knowledge — benchmark standards best practices, maintenance history, regulatory guidelines, etc. among those who need it, in a form that works best for them  
• Establish a mature maintenance process early in the plant life to maximize the effectiveness of the RCM program, minimize unnecessary activities, and increase the reliability and worth of plant & equipment  
• RCM for sites with a small number of maintenance and operations staff |
| 8    | Looking Forward - Modernization in Reliability | Techniques of Reliability Growth  
- Weibull Analysis – recognizing failure causes  
- Human Factors Management  
- Reliability Growth Cause Analysis (RGCA)  
Activity 9 – Conduct an RGCA | • Apart from the short RCM method covered in the course, there are new Maintenance Optimization ideas that can be used |
| 9    | Take Home Plan | Case Study 5 – Implementing RCM in the Australian Coal Industry  
Activity 10 – Attendees identify list of activities to increase or optimize reliability at their facility and develop first-steps implementation plan | • Provide Attendees with initial actions to improve their plant performance by using RCM |

DO A WORKPLACE RCM ACTIVITY