

Introduction to Reliability Centred Maintenance 2 (RCM2) Course Programme

Course lecturing material is presented by the means of datashow connected to a personal computer and worked examples on flip charts by the tutor. All delegates receive a folder in which they may place the class and syndicated case studies and other handouts. Delegates also receive a copy of John Moubray's book "RCM2" which forms the basis of course material. Reference is made to the relevant chapter of the book in the course content below.

Course Venue: At client site or off-site or public seminar

Course Duration: The course will be for 3 days, required to develop competency of participants to actively engage as team members in RCM2 analyses.

Day 1

Introduction to RCM2

Delegates are introduced to the background and concepts of Reliability-Centred Maintenance. Its evolution from research into the technical problems confronted by the aviation industry in the 1960s and refinement in the International Air Transport Association (IATA) Maintenance Steering documents MSG-1, MSG-2 and MSG-3 and the tremendous improvements in airline safety and cost reduction that their adoption brought about are highlighted. RCM2's development from the MSG documents is traced and the outline of the RCM2 approach to be covered in the three days of the course is detailed.

The introduction covers Chapter 1 of John Moubray's book which is distributed to delegates at the conclusion of this session.

Functions and Failures

Functions and Failures covers the steps required to complete the RCM2 Information Worksheet, or FMEA, by defining the problem and gathering the basic information required.

The topics covered are:

- Defining the **Functions** of any asset by identifying what is required of it and assessing if it is capable of delivering the performance required. The types of functions are covered and the need to list all the functions and quantify them wherever possible is highlighted. Delegates will also learn that identical pieces

of equipment may have different functions if their operating context is different. Delegates participate in a class exercise to define the functions of a simple piece of equipment.

- Defining **Functional Failures** by identifying the way in which an asset can fail to meet its operating standards. The concept of multiple functional failures is introduced and the importance of identifying all functional failures are highlighted. Delegates complete the class exercise for the simple piece of equipment by identifying its functional failures.
- Identifying the **Failure Modes** or the technical reason why a functional failure occurs. Delegates learn the importance of identifying the root causes of failures and listing only those failure modes which are considered "reasonable". Again, the fact that different failure modes may occur for identical pieces of equipment if the operating context is different is highlighted.
- The importance of identifying the full **Failure Effects** of each failure and how this information should be recorded.

Functions and Failures covers Chapter 3 of the book. The remainder of Day 1 is devoted to a **case study** with delegates working in syndicate groups to define the Functions, Functional Failures, Failure Modes and Failure Effects for a piece of equipment.

Day 2

Failure Consequences

Delegates are introduced to **Failure Consequences**. The concept that preventive maintenance is only worth doing if it successfully deals with the consequences of the failure it is meant to prevent is highlighted and demonstrated.

The type of failure consequences are covered in detail and are supported by class exercises. These are:

- **Hidden Failures** which are normally associated with protective devices which are not fail safe and only matter if the protected functions also fails.
- **Safety Failures** which could result in loss of life or injury.
- **Environmental Failures** which could lead to a breach of an environmental standard or regulation.

- **Operational Failures** which result in an organisation incurring costs in addition to the cost of repair due to reduced output, poor product quality, or higher energy costs.
- **Non Operational Failures** which result in the direct cost of repair only.

The RCM2 Decision Diagram is introduced, and delegates learn how it is used to determine when a preventive task is worth doing.

Delegates complete two class exercises on determining failure consequences.

Failure consequences are covered in Chapter 4 of the book.

Maintenance Policies I - Preventive Tasks

Maintenance Policies I covers **Preventive Tasks**. Delegates are introduced to the types of Preventive Tasks and how they fit into the RCM2 Decision Diagram. These are:

- **On Condition Maintenance** where items are left in service provided they continue to meet satisfactory performance standards.
- **Scheduled Restoration Tasks** where items are removed at fixed intervals regardless of their condition at the time and are restored or overhauled.
- **Scheduled Discard Tasks** where items are removed at fixed intervals regardless of their condition and discarded.

Delegates learn the technical criteria which a failure mode must satisfy for each preventive task to be applicable and to assess if a task is worth doing by assessing if it successfully deals with the consequences of failure. Preventive tasks are covered in Chapter 5 of the book.

The **case study** is continued for the remainder of Day 2 with delegates working in their syndicate groups. They are supplied with a completed Information Worksheet on which to base their selection of Failure Consequences and Preventive Policies.

Day 3

Maintenance Policies II - Default Tasks

Maintenance Policies II deals with **Default Task**, or those tasks which must be

selected if a Preventive Tasks cannot be selected. Delegates are introduced to three types of Default Tasks:

- **Failure Finding Tasks** which involve the checking of protective devices to determine if they are still functioning. Delegates learn when Failure Finding tasks will be applicable and the techniques used to determine their periodicity.
- **Redesign** where the failure cannot be successfully dealt with by a Preventive Task and its consequences are unacceptable.
- **No Scheduled Maintenance** where a preventive or Failure Finding Task is not applicable and Redesign cannot be justified.

Maintenance Policies are covered in Chapter 6 of the book.

Delegates then continue the **case study**, concentrating on determining the Maintenance Policies for protective devices.

Maintenance Schedules

Delegates learn how to take outputs of the RCM2 process and translate them into **Maintenance Schedules** which can be practically implemented and carried out at the shop floor level. The steps which may be followed are:

- **Determine the Operating Context** so that any constraints to which the maintenance schedules must comply can be identified.

These typically include availability of assets for preventive maintenance, operating cycles, resource and facilities requirements and maintenance planning and control systems.

- **Package** the Tasks according to the same initial interval. Multiple tasks for the same item may be "rolled up" and simplified into a smaller number of tasks where applicable.
- **Sequence** the Tasks into a logical order so that "non value adding" activities such as travelling and waiting are minimised.
- **Balance** the resource requirements (if required) between individual schedules by "spreading" low frequency tasks throughout higher frequency schedules.

Maintenance schedules is covered by Chapter 8 of the book and a supplementary

paper issued during the session.

Implementing RCM2

An approach to implementing RCM2 which will result in successful implementation is outlined. The Basic Steps to successful implementation in any organisation are:

- ***Learn About RCM2*** - Decision makers and key people within the organisation must be aware of RCM2 concepts and must decide where it should be applied for maximum benefit.
- ***Select the Asset(s) to be Analysed*** - a simple method for identifying and prioritising candidate assets for the RCM2 analysis is demonstrated.
- ***Estimate the Resources Required*** - the asset(s) to be analysed by the review group must be functionally broken down as required and an assessment of the number and skills of people required to take part in the analysis made.
- ***Training of Review Group members*** - review group members are trained, to appropriate levels, in RCM2 techniques.
- ***Application*** - RCM2 review groups meet and carry out the RCM2 analysis of the assets and their output is audited.
- ***Compile the Maintenance Schedules*** - the outputs of the Review Groups are compiled into Maintenance Schedules for implementation.

Summary and Close

The course is concluded by a final summary of the benefits of RCM2. Delegates are invited to complete a course appraisal form and ask any further questions.