Course Syllabus and Training Plan

Operating Plant Applied Reliability Improvement for Reliability Improvement Teams Training Course

Purpose

This course focuses on explaining and applying the vital concepts, practices and processes of industrial plant and equipment reliability creation in an organisation.

Course Activity Summary

<table>
<thead>
<tr>
<th>Contact Type</th>
<th>Coverage</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning and Assignments</td>
<td>Explanation of concepts and answer assignment questions</td>
<td>32 – 34</td>
</tr>
<tr>
<td>Workplace Project</td>
<td>Apply concepts to improve workplace</td>
<td>14 – 16</td>
</tr>
<tr>
<td>Workplace Assessment</td>
<td>Report and explanation of workplace project improvements</td>
<td>4 – 5</td>
</tr>
</tbody>
</table>

TOTAL HOURS 50 – 55

Training Delivery Materials

- Training course workbook
- Course PowerPoint presentation slides
- Course reading materials provided
- Internet research

Explanation of Course Content and Coverage

Learning and Assignments

Learning involves review of the presentation materials, including viewing each slide, reading the slides notes where provided and reading the course book. A PowerPoint presentation is used to show key concepts. Slides identify and develop each concept and describe methodology, application/use and value to the organisation. Worked examples and/or case studies are provided where useful. Guided exercises and simulations are included where appropriate. Application of the concepts are practiced by students in the assignments. All assignments noted in the presentations are to be done. Their purpose is to help impart a more complete knowledge and understanding through using the various methods and techniques introduced in the course.

Each student is assigned a Tutor who is also a resource to them to ask questions and get advice on a subject. The Tutor assesses student assignments and provides feedback until the assignment is acceptable to the Tutor.

The Internet is also used as a research tool to self educate and to answer a Student’s own queries.
Workplace Project

To complete the course, and show evidence that learning has occurred in the knowledge and concepts covered in the course, the student undertakes a useful project. The project requires analysis of a failure situation. Appropriate techniques and tools are used to analyse the situation and identify suitable ways to better the circumstances.

The project makes no changes to the workplace; rather it requires the student to propose practical improvements based on their data analysis and to justify their suggestions from the benefits the improvements will bring the operation. Typically the project involves workplace observation, data collection, failure analysis, process flow analysis, root cause analysis and basic costing to arrive at a sound and practical way to improve the situation using the evidence to justify it.

The project could affect a number of people and the student would need to use teamwork. They may need to involve their supervisor and co-workers and to keep those people informed of what the student does and finds-out.

The project must be done by the student and be their own work. They can get help from suitable people within their organisation to assist them as necessary.

Workplace Project Guide

The table below lists the steps to follow in conducting the final project submission.

<table>
<thead>
<tr>
<th>Project Steps</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Define the Project and its Boundary</td>
<td>The Student agrees with the Work Supervisor and their Tutor on the project coverage, including its geographic limits and business process limits</td>
</tr>
<tr>
<td>Specify Project Goals</td>
<td>From the project definition identify what the student’s project will achieve i.e. a problem solved; a defect identified and removed; work quality assurance improved, etc</td>
</tr>
<tr>
<td>Project Plan and Schedule</td>
<td>Develop a bar chart with activities and timetable that when completed will deliver the project goals.</td>
</tr>
<tr>
<td>Develop Data Collection Tools</td>
<td>Create the necessary forms to collect data</td>
</tr>
<tr>
<td>Data Collection</td>
<td>Collect facts and historic information to explain and understand what happens in the workplace by investigating the issue, its history, the losses caused, etc</td>
</tr>
<tr>
<td>Costs Collection</td>
<td>Collect information on the costs and losses of current practices</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>Investigate and interpret the data and costs and extract useful information and facts</td>
</tr>
<tr>
<td>Suggested Improvements</td>
<td>Out of the investigation and analysis develop ideas and suggestions to improve the situation and gauge how much they will enhance the operation</td>
</tr>
<tr>
<td>Write A3 Page Project Report</td>
<td>Justify the reasons behind the suggestions and explain the benefits they will bring in a two to three page report. Include summary data in table form. Use sketches where they help explain the improvements.</td>
</tr>
<tr>
<td>Submit Project for Assessment</td>
<td>Provide the A3 page project report as an email attachment to your Tutor.</td>
</tr>
</tbody>
</table>

Training Objectives and Minimum Standards

The training objectives and the standard for each of the Course performance criteria are shown in the following Table.
<table>
<thead>
<tr>
<th>No</th>
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<th>Learning Task</th>
<th>Training Content</th>
<th>Required Standard</th>
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</table>
| 1  | Science of Failure       | 1. a) Structure of Engineering Materials, and the behaviour of metals  
 2. a) Effects of loads and stress on Materials of Construction  
 3. b) Metal Degradation  
 4. a) Effects of cyclic loading  
 5. a) Degradation Curve explained  
 6. a) Evidence from a failure event  
 6. b) Signs of Equipment Failure  
 6. c) Failure Causes and Failure Modes | 1. Construction and behaviour of metals  
 2. Effect of applying forces on Materials of Construction  
 3. Fatigue failure explained  
 4. Explain the degradation curve  
 5. Introduction to the use of Physics of Failure analysis  
 6. a) Information contained in machinery failure evidence  
 6. b) Do a Failure Mode Effects Analysis (FMEA) | 1. Explain the limitation of metals used to make industrial equipment  
 2. Explain what forces do to machine parts  
 3. Explain how metals fatigue  
 4. Explain how the degradation curve develops and how it is used to conduct condition monitoring  
 5. Describe the phases of the Physics of Failure methodology  
 6. Complete a FMEA Table |
| 2  | Life Cycle Asset Management | 1. a) Life cycle explained  
 2. b) Implications of Life Cycle for Operations  
 2. c) Life Cycle Costs  
 3. a) Ensuring reliability across the life cycle  
 3. b) Design and Operating Costs Total Optimised Risk | 1. Overview of Life Cycle Physical Asset Management  
 2. Identify all the business-wide cost impacts of a failure  
 3. Concepts used in maximising Operating Profits | 1. Describe the Life Cycle and its business implications  
 2. Compile a Defect and Failure Total Cost Table  
 3. Explain what can be done to maximise operating profit |
| 3  | Operational Risk Reduction | 1. a) Risk explained  
 2. b) Risk equation  
 2. a) Risk Management process  
 2. b) The Risk Matrix  
 2. c) Implications of risk management and control for Operations | 1. Introduce Risk and its components  
 2. Overview risk management per ISO 31000  
 3. Introduce Equipment Criticality analysis  
 4. Run-to-fail, Preventive, Predictive, Proactive Maintenance | 1. Describe the parts of the risk equation  
 2. Present the key risk management concepts  
 3. Interpret an Equipment Criticality Matrix  
 4. Explain the standard |
## Applied Reliability Improvement for Operating Plant Reliability Improvement Team Training Plan

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</table>
| 4  | Introduction to Reliability Engineering | Identify the factors impacting reliability and apply means to monitor and trend reliability. | 1. Reliability Terms and Definitions  
2. Chance of Event Occurrence  
3. Series Arrangements  
4. Parallel Arrangements  
5. Reliability of Parts  
6. Reliability of Machines  
7. Parts Failure Curves  
8. Failure Distribution Curves  
9. Basic Reliability Maths | Given the current production process and workplace | 1. a) Key reliability terms defined  
2. a) Conceptualise the Likelihood or Probability of events happening  
3. a) Explain Series arrangements  
4. a) Explain Parallel arrangements  
5. a) Identify how parts can be failed  
6. a) Explain mechanical system reliability  
7. a) Identify Failure Curve Types and Zones  
8. a) Variation and distribution curves  
9. a) Introduction to uses of reliability mathematics | 1. Introduce the key Reliability Engineering terms  
2. Introduce the determination of probability  
3. Introduce series configuration and explain series properties 1, 2, 3  
4. Introduce parallel configuration and explain properties of parallel arrangements  
5. Introduce machine component reliability  
6. Introduce machine system reliability  
7. Introduce development of component failure curves  
8. Develop distribution curves of failure history  
9. Overview common reliability maths and analysis methods | 1. Able to explain important reliability definitions  
2. Calculate simple event probability  
3. Explain series arrangements  
4. Explain parallel arrangements  
5. Describe how high component reliability is achieved  
6. Describe how high machine reliability is achieved  
7. Discuss the various zones of failure curves  
8. Develop a distribution curve from failure data  
9. Interpret a Weibull Analysis graph |
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| 5  | Human Error and its Management | Identify risk of human error in work process activities and implement suitable protection. | 1. Human Factors  
2. Human Error Tables  
3. Impact of Human Error  
4. Job Procedure Quality Assurance | 1. a) Dirty Dozen Human Factors  
b) Implications and control of Human Factors  
2. a) How Human Error occurs  
b) Get meaning from Human Error Tables  
3. a) Weaknesses in work processes  
b) Work Process Failure  
4. a) Error Proofing  
b) Write Error Proof Procedures | 1. Introduce the Dirty Dozen causes of most Human Errors  
2. Examine the content in a Human Error Table  
3. Analyse risks in work processes  
4. Introduction to Error Proof methods | 1. Describe the twelve factors of the Dirty Dozen  
2. Describe what causes human error  
3. Identify high risk tasks and develop controls  
4. Write error proofing into job procedures |
| 6  | Quality Control and Assurance | Identify quality standards and put measures in place to monitor quality assurance. | 1. Defining Quality  
2. Business Process Design  
3. Quality Assurance  
4. Processes in Control | 1. a) Identify Equipment Quality Parameters  
2. a) Develop process flow diagrams  
3. a) Including quality controls into work processes  
4. a) Explain basic statistical process control concepts | 1. a) Understand the quality concept  
b) Identifying when measurement of quality condition is vital  
2. a) Explain process mapping  
3. a) Designing work processes for failure prevention  
b) Proof testing for compliance to standards  
4. a) Monitoring and measuring process capability | 1. Set quality parameters and measurement for job tasks  
2. Flow chart a process  
3. Incorporate quality standards into work activities  
4. Develop ways to track and trend the performance of a process  
5. Interpret a process control chart correctly |
| 7  | Equipment Reliability Improvement | Make changes and introduce methods that improve plant and equipment reliability. | 1. Reliability Improvement Model  
2. Hierarchy of Reliability Controls  
3. Precision Maintenance  
4. Operator Maintenance  
5. Reliability Audit | 1. a) Creating Reliability Improvement  
b) Making Reliability 'Business-as-Usual’  
2. a) Reliability improvement strategies  
3. a) Precision Maintenance explained  
b) Establish Precision Maintenance Requirements  
4. a) Identify Operator Driven Reliability Activities  
5. a) Using Reliability Audit Checklists | 1. a) Establishing a Reliability Improvement process  
2. a) Compare reliability vs. safety hierarchy of controls  
3. a) Cover the 14 points of a Precision Maintenance program  
4. a) Effective use and value-add of plant and process operators  
5. a) Do Reliability Audit of designated area | 1. Explain the reliability improvement process  
2. Describe the options available to improve reliability outcomes  
3. Differentiate precision maintenance from the other maintenance strategies  
4. Develop Operator Checklist |
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<tr>
<td>10</td>
<td>Change to a Reliability Workplace Culture</td>
<td>Develop strategy and plans to help work teams implement reliability improvement change and habits.</td>
<td>1. Leadership for Reliability  2. Project Management  3. Team Management  4. Management of Change  5. Establish Site Reliability Improvement Strategy</td>
<td>1. a) Reliability is to be ‘Business-as-Usual’ in future  b) Leadership process at all Levels (Manager / Engineer / Shopfloor)  c) Reliability roles/responsibilities in the organisation  2. a) Project Control and Management  3. a) Reliability Improvement Team and Their Purpose</td>
<td>1. a) Leadership and its role  b) Develop the organisation’s Reliability Improvement Processes  c) Specifically what Operations / Maintenance / Stores / Engineering will focus on for ‘reliability is business-as-usual’  2. a) Basics of Managing Projects  b) Planning for successful projects</td>
<td>1. Explain the role of a leader  2. Manage a small improvement project  3. Run and coordinate a small reliability improvement team  4. Explain how to work through a change process for introducing</td>
<td></td>
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| 4  | 3.  a) Use of Reliability Teams   b) Make-up of Reliability Teams   c) Roles of Reliability Team members   d) Work with Team Members to find Affordable Improvements
| 5  | 4.  a) The importance of Role Models in leading reliability improvement   b) Business system and process requirements that need to be established to sustain change   c) Barriers to sustained reliability improvement in the business, workplace and self   d) How can barriers be addressed?
| 5  | 5.  a) Develop reliability improvement sustaining plans and actions to undertake and instigate as standard practice   b) Business system and process requirements that need to be established to sustain change

<table>
<thead>
<tr>
<th>11</th>
<th>Final Project Assessment</th>
<th>Perform a Reliability Improvement Project Analysis and Justification</th>
<th>1. Complete an A3 Page Analysis that explains and justifies the recommendations</th>
<th>Conditions Prevailing</th>
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</table>
| 1  | 1. Conduct a reliability improvement project | 1. Explain use of A3 Page report format   b) Gather equipment failure event history   c) Perform Analysis of Event Cause   d) Select Effective Mitigation
| 5  | 5. Develop a Change strategy from start to application in the workplace |