Lifetime Reliability • Solutions

Phone +61 8 9457 6297
Mobile/Cell: +61 (0) 402 731 563
Email: info@lifetime-reliability.com
Website: www.lifetime-reliability.com

Applied Reliability Improvement Course Syllabus and Training Plan

Operating Plant Applied Reliability Engineering for Reliability Improvement 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

Contact Type	Coverage	Hours
Learning and Assignments	Explanation of concepts and answer assignment questions	32 – 34
Workplace Project	Apply concepts to improve workplace	14 – 16
Workplace Assessment	Report and explanation of workplace project improvements	4 – 5
	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.

Lifetime Reliability • Solutions

Phone +61 8 9457 6297
Mobile/Cell: +61 (0) 402 731 563
Email: info@lifetime-reliability.com
Website: www.lifetime-reliability.com

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 analyse 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.

Project Steps	Description
Define the Project and its Boundary	The Student agrees with the Work Supervisor and their Tutor on the project coverage, including its geographic limits and business process limits
Specify Project Goals	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
Project Plan and Schedule	Develop a bar chart with activities and timetable that when completed will deliver the project goals.
Develop Data Collection Tools	Create the necessary forms to collect data
Data Collection	Collect facts and historic information to explain and understand what happens in the workplace by investigating the issue, its history, the losses caused, etc
Costs Collection	Collect information on the costs and losses of current practices
Data Analysis	Investigate and interpret the data and costs and extract useful information and facts
Suggested Improvements	Out of the investigation and analysis develop ideas and suggestions to improve the situation and gauge how much they will enhance the operation
Write A3 Page Project Report	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.
Submit Project for Assessment	Provide the A3 page project report as an email attachment to your Tutor.

Training Objectives and Minimum Standards

The training objectives and the standard for each of the Course performance criteria are shown in the following Table.

Lifetime Reliability • Solutions

Phone +61 8 9457 6297
Mobile/Cell: +61 (0) 402 731 563
Email: info@lifetime-reliability.com
Website: www.lifetime-reliability.com

Applied Reliability Improvement for Operating Plant Reliability Improvement Team Training Plan

No	Element	Element Competency	Unit Performance Criteria (Key Learning Outcomes)	Conditions Prevailing	Learning Task	Training Content	Required Standard
1	Science of Failure	Understand how components, and machines fail and what situations cause equipment failure.	1. Limits of Materials of Construction 2. Load and Stress on Parts 3. Fatigue of Metal Parts 4. Understand the Degradation Curve 5. Physics of Failure 6. Equipment Failure Events	Given the current production process and workplace	1. a) Structure of Engineering Materials 2. a) Effects of loads and stress on Materials of Construction b) Metal Degradation 3. a) Effects of cyclic loading 4. a) Degradation Curve explained b) Implications of Degradation Curve c) Condition Monitoring explained 5. a) Physics of Failure explained b) Implications of Physics of Failure 6. a) Evidence from a failure event b) Signs of Equipment Failure 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 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	Recognise lifecycle management implications and learn to make sensible and profitable life cycle asset choices.	1. Asset Life Cycle Concept 2. Cost of Failure 3. Operating Profit Optimisation	Given the current production process and workplace	1. a) Life Cycle explained b) Implications of Life Cycle for Operations c) Life Cycle Costs 2. a) Business-wide impact of failure b) Defect and Failure Total Cost 3. a) Ensuring reliability across the life cycle 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	Identify operational risk and apply effective risk mitigations.	1. Operating Risk 2. Risk Control and Management 3. Operating Risk and Equipment Criticality 4. Purpose of Maintenance		1. a) Risk explained b) Risk equation 2. a) Risk Management process b) The Risk Matrix 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

Phone +61 8 9457 6297
Mobile/Cell: +61 (0) 402 731 563
Email: info@lifetime-reliability.com
Website: www.lifetime-reliability.com

Applied Reliability Improvement for Operating Plant Reliability Improvement Team Training Plan

No	Element	Element Competency	Unit Performance Criteria (Key Learning Outcomes)	Conditions Prevailing	Learning Task	Training Content	Required Standard
			5. Selecting Maintenance Strategy		d) Confirm Risk is substantially reduced e) Select Risk Reduction activities 3. a) Equipment Criticality explained 4. a) Role of maintenance strategy in reliability 5. a) Risk and maintenance strategy implications b) Selecting Maintenance Strategy	5. a) Apply Reliability Centered Maintenance (RCM) b) Appreciation of Maintenance Optimisation	maintenance strategies 5. a) Contribute to a RCM analysis team b) Confirm the effectiveness of maintenance activity selection
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 b) Implications of Series arrangement for machinery 4. a) Explain Parallel arrangements b) Implications of Parallel arrangement for machinery 5. a) Identify how parts can be failed 6. a) Explain mechanical system reliability b) Develop a simple Reliability Block Diagram 7. a) Identify Failure Curve Types and Zones 8. a) Variation and distribution curves b) Gather equipment history data c) Analyse history data 9. a) Introduction to uses of reliability mathematics b) Introduction to Weibull Analysis	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

Lifetime Reliability • Solutions

Phone +61 8 9457 6297
Mobile/Cell: +61 (0) 402 731 563
Email: info@lifetime-reliability.com
Website: www.lifetime-reliability.com

Applied Reliability Improvement for Operating Plant Reliability Improvement Team Training Plan

No	Element	Element Competency	Unit Performance Criteria (Key Learning Outcomes)	Conditions Prevailing	Learning Task	Training Content	Required Standard
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

Lifetime Reliability • Solutions

Phone +61 8 9457 6297
Mobile/Cell: +61 (0) 402 731 563
Email: info@lifetime-reliability.com
Website: www.lifetime-reliability.com

Applied Reliability Improvement for Operating Plant Reliability Improvement Team Training Plan

No	Element	Element Competency	Unit Performance Criteria (Key Learning Outcomes)	Conditions Prevailing	Learning Task	Training Content	Required Standard
8	Defect Elimination and Failure Prevention	Prevent failure causing defects and errors from occurring throughout the asset life cycle.	1. Failure Prevention 2. Maintenance and Operating Quality Standards 3. Reliability Growth Cause Analysis		1. a) Defect Creation Model b) Eliminating failure causes 2. a) Defect Removal b) Setting Quality Specifications for use and maintenance of equipment c) Measuring Achievement of the Standards 3. a) Identify risks to reliability	1. a) Introduce defect generation across the Life Cycle 2. a) Methods of Defect Prevention b) Examples of quality standards that prevent defects 3. a) Introduce the causes of reliability growth b) Defect elimination and failure prevention	1. Recognise situations and circumstances that can introduce defects 2. Describe what can be done to eliminate defects 3. Do a Reliability Growth Cause Analysis
9	Root Cause Failure Removal	Investigate and remove defects and failure causes from plant and equipment.	1. Root Cause Failure Removal Process 2. Root Cause Analysis 3. FRACAS 4. Failure Analysis Tools 5. Remove the Root Cause	Given the current production process and workplace	1. a) Explain Root Cause b) Root Cause Failure Creation 2. a) Basic Root Cause Analysis process b) Event Trees d) Latency Causes 3. a) Explain FRACAS 4. a) Use basic problem solving tools 5. a) Implementing Reliability Improvements	1. a)Introduce root cause failure concept b) Develop the root cause removal processes 2. a) Describe the root cause analysis process 3. a) Introduce use of FRACAS 4. a) How to complete a Fishbone Diagram b) Do a Cause and Effect Tree c) Perform a 5-Why Analysis 5. a) Completing the actions that will prevent more failures	1. Explain what is a failure root cause 2. Describe the root cause analysis process 3. Develop Reliability Register to track reliability and its improvement 4. a) Do a fishbone b) Do a cause and effect tree c) Do a 5-Why table 5. Develop a defect removal implementation plan
10	Change to a Reliability Workplace Culture	Develop strategy and plans to help work teams implement reliability improvement change and habits.	1. Leadership for Reliability 2. Project Management 3. Team Management 4. Management of Change 5. Establish Site Reliability Improvement Strategy		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	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	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

Phone +61 8 9457 6297
Mobile/Cell: +61 (0) 402 731 563
Email: info@lifetime-reliability.com
Website: www.lifetime-reliability.com

Applied Reliability Improvement for Operating Plant Reliability Improvement Team Training Plan

No	Element	Element Competency	Unit Performance Criteria (Key Learning Outcomes)	Conditions Prevailing	Learning Task	Training Content	Required Standard
					4. a) What is known about Changing Culture b) Sustaining the necessary Changes c) Barriers to Change 5. a) Produce Plans, Actions and Responsibilities for Reliability Improvement	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 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. a) Develop reliability improvement sustaining plans and actions to undertake and instigate as standard practice	new team practices 5. Develop a Change strategy from start to application in the workplace
11	Final Project Assessment	Perform a Reliability Improvement Project Analysis and Justification	1. Complete an A3 Page Analysis that explains and justifies the recommendations	Given the current production process and workplace	1. Conduct a reliability improvement project 2. Layout A3 Page summary report	1. a)Explain use of A3 Page report format b) Gather equipment failure event history c) Perform Analysis of Event Cause d) Select Effective Mitigation 2. a) Draft final A3 Page Report	1. Do a reliability improvement project 2. Submit a completed A3 Page failure analysis and prevention plan