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## Reliability Engineering Training: Introductory Course for Beginners Learning Plan

**Purpose:** Learn the foundational Reliability Engineering analysis methods and techniques, use the basic analysis tools, and implement reliability improvements for operating assets.

No	Element	Unit Performance Criteria (Key Learning Outcomes)	Conditions Prevailing	Training Task	Training Content	Required Standard
1	Module 1 – Plant Reliability Management Reliability Basics	1. Reliability Engineering in Business  2. Causes of Plant and Equipment Failure  3. Reliability Theory of Failure Patterns  4. Data to Business Case Justification	Operating production plant and equipment	1. How business uses Reliability  2. a) Equipment failure concepts b) Causes of equipment failure  3. a) Reliability terms b) Exponential and Weibull distributions c) Failures and Survivors censoring d) Separating failure modes e) Failure density function  4. a) Using reliability to build a business case b) Failure distributions	1. a) Reducing business risk b) Selecting asset strategy c) Reliability improvement  2. a) Infant mortality zone b) Random failure zone c) Wear-out zone d) Choice of maintenance strategies e) Microstructure stress f) Bearing failures g) Lubrication contamination h) Over temperature i) Electric motor failure j) Introduce Failure Mode Effects Analysis  3. a) Failure rate b) Cumulative failure probability c) Reliability probability d) Censored data e) Ranking data  4. a) Using equipment historic records b) Mean Time Between Failure	1. Able to discuss content  2. a) Able to discuss content b) Able to explain sources of equipment failure c) Plot failure density-curve  3. a) Able to discuss content b) Plot cumulative failure distribution c) Plot reliability distribution d) Failure mode distribution  4. a) Able to discuss content b) Failure data analysis c) Plot failure distributions



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		5. Condition Monitoring and Maintenance Excellence  6. Criticality and Risk		5. a) Maintenance Excellence journey b) Condition Monitoring c) Selecting maintenance strategies  6. a) Criticality risk ranking b) Risk triangle c) Risk reduction proposals d) Perform Criticality Analysis of an operating plant	c) Timelines d) Develop and explain business case  5. a) Stable Domain Model b) Maintenance cost reduces with Condition Monitoring c) Condition Monitoring techniques d) Condition Monitoring data collection e) Condition monitoring programme f) Selecting maintenance strategy based on failure distributions  6. a) Risk concepts b) Risk assessment c) Evaluating risk d) Selecting from risk proposal options e) Case study of an operating plant Criticality Analysis	d) Write and explain the business case  5. a) Able to discuss content b) Discuss condition monitoring data collection c) Discuss condition monitoring programme  6. a) Able to discuss content b) Conduct operating plant Critical Analysis and make recommendations



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2	Module 2 – Plant Reliability Management Applying Tools	1. FMECA and RCM  2. Maintenance Strategy Review  3. Cost Effectiveness and Cost-Benefit  4. Key Performance Indicators and Benchmarking  5. System Reliability Modelling	Operating production plant and equipment	1. a) Failure Mode Effect Criticality Analysis  2. a) Reliability Centred Maintenance  3. a) Introduction to Cost-Benefit Analysis b) Criterion Function c) Net Present Value (NPV) d) Benefits of good maintenance  4. a) Hierarchy of Performance Indicators b) Leading and Lagging indicators c) Benchmarking  5. a) Designing for Reliability b) System modelling c) Properties of systems	1. a) Failure Mode Effect Analysis  2. a) Reliability Centred Maintenance methodology b) Case study of RCM application  3. a) Estimating costs b) Cost Benefit determination c) Net Present Value modelling d) Comparing cost-benefit options e) Selling good maintenance f) capital benefits of a capital reliability capital engineer  4. a) KPI dashboard b) Safety indicators c) Production capacity indicators d) Maintenance work process indicators e) Annual and Monthly benchmarking f) Overall Equipment Effectiveness (OEE)  5. a) System modelling basics b) Block diagrams c) System probability calculations	1. a) Able to discuss contents  2. a) Able to discuss RCM b) Conduct an FMECA analysis  3. a) Able to discuss contents b) Able to discuss NPV c) Able to do basic economic spreadsheet modelling  4. a) Able to discuss contents b) Able to develop KPIs c) Able to do benchmarking d) Able to do OEE  5. a) Able to discuss contents b) Develop block diagrams



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				d) Event Tree analysis	d) Properties of series systems c) Properties of parallel systems d) Event Tree modelling c) Probabilistic Safety Analysis	c) Able to discuss Event Tree Analysis  d) Able to discuss Probabilistic Safety Analysis



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3	Module 3 – Plant Reliability Management Implementation	1. Preparing Maintenance Procedures  2. Life Cycle Considerations  3. Root Cause Analysis	Operating production plant and equipment	1. a) Human and Organisational Issues b) Human Errors and Human Factors c) Cultural characteristics d) Mastering Maintenance Processes  2. a) Life Cycle Costing b) Life Cycle Cost control  3. a) Root Cause Failure Analysis process b) RCFA Team facilitation c) Conduct a workplace RCFA d) Implement improvements	1. a) Difficulty of doing maintenance b) High Reliability Organisations c) Human dependent processes d) Human factors e) Human error f) Organisational structures g) Trade skills h) Promoting work quality and accuracy i) Managing change  2. a) Life Cycle Costing analysis b) Life Cycle Costing management c) Project management basics  3. a) Fault Tree Analysis b) Fishbone diagram c) Cause and Effect connections d) Is - Is Not Table e) 5-Why Analysis f) Conducting an RCFA g) Example of an RCFA h) The Facilitator role i) Collecting the evidence j) Running a RCFA meeting	1. a) Able to discuss contents b) Able to interpret human error rate table  2. a) Able to discuss contents  3. a) Able to discuss contents b) Perform a workplace RCFA c) Able to facilitate RCFA meeting d) Write and present RCFA report



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		4. Implementing Improvements		4. a) Update workplace procedures b) Conduct failure post-mortems c) 8-Step Reliability Improvement Process d) W. Edwards Deming - quality system thinking e) The difficulties of changing company practices	k) Investigation and Analysis tools l) Selecting the preferred solution m) Reporting the findings  4. a) Considerations when implementing improvements b) Error proofing maintenance procedures c) Investigate equipment failures d) Tell-tale evidence of component failure e) Roller bearing failure patterns f) Reliability “Improvement Wheel” g) Deming - the importance of understanding systems and processes h) Addressing the barriers to change	4. a) Able to discuss contents
		5. Do a Reliability Improvement Project		5. a) Apply course learning to reliability improvement project	5. a) Apply appropriate course content to conduct improvement project	5. a) Deliver a completed reliability improvement project proposal, including all evidence, analysis, and business case justifications