

Course No. 1845

Root Cause Failure Analysis (RCFA) for Mechanical Equipment Training Course

**MECHANICAL MAINTENANCE, RELIABILITY & TURNAROUND
OIL & GAS**

DURATION

5 Days

DELIVERY

Classroom



Course Overview

The Root Cause Failure Analysis (RCFA) for Mechanical Equipment Training Course provides a comprehensive professional program focused on systematically investigating equipment failures, identifying their underlying causes, and developing effective corrective and preventive actions. The course is designed for industrial environments where equipment reliability, operational continuity, safety, and maintenance effectiveness are critical business priorities.

Participants will learn how to distinguish between immediate failure symptoms, contributing factors, and true root causes. The program introduces structured failure investigation methodologies that combine technical evidence, equipment history, operating data, maintenance records, inspection findings, and human and organizational factors to establish defensible conclusions.

The course covers the investigation of failures affecting pumps, compressors, turbines, rotating equipment, pressure equipment, piping systems, valves, heat exchangers, gearboxes, bearings, seals, and other mechanical assets. Particular attention is given to common failure mechanisms including fatigue, fracture, corrosion, erosion, wear, overheating, vibration, lubrication failures, misalignment, overload, and material degradation.

A strong practical focus is placed on developing corrective actions that address the root cause rather than simply treating the failure symptom. Participants will learn how to prioritize recommendations, verify their effectiveness, communicate technical findings, and integrate RCFA results into reliability engineering, maintenance strategies, asset integrity programs, and continuous improvement initiatives.

Objectives

- By the end of the course, participants will be able to:
- Analyze the principles, objectives, and benefits of root cause failure analysis.
- Distinguish between failure symptoms, direct causes, contributing causes, and root causes.
- Apply structured methodologies for investigating mechanical equipment failures.
- Collect, validate, and analyze technical evidence from failed equipment.
- Evaluate equipment history, operating conditions, maintenance records, and inspection findings.

- Identify mechanical, material, operational, maintenance, and human factors contributing to failures.
- Apply appropriate analytical tools to determine causal relationships.
- Evaluate common mechanical failure mechanisms and their characteristics.
- Develop effective corrective and preventive actions based on identified root causes.
- Prioritize recommendations according to risk, reliability impact, and business consequences.
- Verify the effectiveness and sustainability of implemented corrective actions.
- Improve failure reporting, documentation, communication, and organizational learning.
- Integrate RCFA into reliability, maintenance, asset integrity, and continuous improvement programs.

Who Should Attend

This course is designed for reliability engineers, mechanical engineers, maintenance engineers, equipment engineers, inspection engineers, rotating equipment specialists, asset integrity professionals, and technical personnel responsible for investigating equipment failures.

It is also suitable for maintenance supervisors, reliability managers, operations engineers, condition-monitoring specialists, vibration analysts, maintenance planners, quality professionals, and engineering personnel involved in troubleshooting and failure prevention.

The program is particularly valuable for managers, technical leaders, and decision-makers responsible for equipment reliability, maintenance performance, asset availability, production continuity, operational safety, and reducing recurring equipment failures.

Learning Outcomes

- Upon completion of the course, participants will be able to:
- Explain the purpose and methodology of root cause failure analysis.
- Define the difference between symptoms, failure modes, causes, and root causes.
- Establish a structured investigation team and failure-analysis process.
- Collect and evaluate evidence from failed mechanical equipment.
- Analyze equipment history, operating conditions, maintenance activities, and inspection records.

- Identify mechanical and material failure mechanisms.
- Evaluate failures associated with bearings, seals, shafts, gears, pumps, compressors, and other equipment.
- Apply cause-and-effect analysis and other structured analytical techniques.
- Develop evidence-based root cause conclusions.
- Identify corrective actions that eliminate or control root causes.
- Prioritize corrective actions according to risk and business impact.
- Establish effectiveness checks for implemented recommendations.
- Prepare professional RCFA reports and communicate findings to management.
- Integrate lessons learned into maintenance and reliability strategies.
- Develop preventive measures to reduce repeat and systemic failures.

Course Outline

DAY 01

Fundamentals of Failure Analysis & RCFA

- Failure analysis principles, objectives, terminology, and investigation process.
- Failure modes, failure mechanisms, symptoms, direct causes, and root causes.
- Failure investigation planning, team formation, evidence preservation, and data collection.
- Equipment history, operating conditions, maintenance records, and failure chronology.

PRACTICAL APPLICATION

Develop a failure investigation plan for a mechanical equipment failure.

DAY 02

Mechanical Failure Mechanisms & Evidence Analysis

- Fatigue, fracture, wear, corrosion, erosion, overheating, and material degradation.
- Bearing, seal, shaft, gear, coupling, pump, and compressor failure mechanisms.
- Lubrication failures, misalignment, imbalance, vibration, overload, and installation-related problems.
- Inspection findings, material evidence, operating data, and equipment-condition assessment.

DAY 02 — CONTINUED

PRACTICAL APPLICATION

Analyze a failed mechanical component and identify probable failure mechanisms using available evidence.

DAY 03

Root Cause Investigation & Analytical Techniques

- Structured failure investigation methodologies and evidence-based reasoning.
- Cause-and-effect analysis and systematic causal mapping.
- Five-whys analysis, fault-tree concepts, barrier analysis, and causal-factor identification.
- Evaluation of technical, maintenance, operational, human, and organizational contributors.

PRACTICAL APPLICATION

Conduct a complete RCFA for a simulated mechanical equipment failure and develop a root cause map.

DAY 04

Corrective Actions, Reliability Improvement & Risk Reduction

- Developing corrective and preventive actions that address root causes.
- Risk-based prioritization of recommendations and action ownership.
- Equipment design, maintenance strategy, operating practice, and process improvements.
- Verification of corrective-action effectiveness and prevention of recurrence.

PRACTICAL APPLICATION

Develop an action plan to eliminate the root causes of a recurring equipment failure.

DAY 05**RCFA Reporting, Implementation & Continuous Improvement**

- Preparing professional failure investigation and RCFA reports.
- Communicating technical findings, conclusions, recommendations, and business impacts.
- Integrating RCFA findings into maintenance, reliability, asset integrity, and risk-management systems.
- Organizational learning, knowledge management, performance monitoring, and continuous improvement.
- Final Application: Complete an integrated RCFA case study covering failure definition, evidence collection, failure mechanism, causal analysis, root cause identification, corrective actions, effectiveness verification, reporting, and long-term reliability improvement.

Register or Request More Information

Course page: <https://quest-training.com/courses/root-cause-failure-analysis-rcfa-for-mechanical-equipment-training-course>

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