الديار للإستشارات والتدريب
ALDIYAR
Consultancy & Training

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ROOT CAUSE, PROBLEM SOLVING AND DECISION MAKING

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COURSE OBJECTIVES

- Learn fundamental concepts around failures of machines and equipment, both moving and static
- Understand relationship between failures of machines and equipment and the associated HSE incidents
- Comprehend failure mechanisms of various identified major machines and equipment
- Learn and use Root Cause Failure Analyses (RCA) to arrive at root and generic causes of failures of machines and equipment
- Check effectiveness of the implementation of CAP's and
- PAP's
- Understand and practice skills to draft and generate RCFA
- Report
- Comprehend the importance of RCFA Close-out
- Cascade lessons learnt from the failure Incident and the
- RCFA Report
- Address accurately the various Insurance, Legal and Statutory Implications

WHO SHOULD ATTEND?

- All line functions at all levels – Trainees, interns, and officers
- Managers, senior managers in operation, maintenance, inspection, engineering, other line disciplines
- Exclusively, Inspection, Maintenance and HSE Professionals at all levels
- Middle and Senior management (a bite-sized customized part of this course)
- Non-line functions such as office managers and finance professionals dealing with insurance and statutory compliances

COURSE OUTLINE

Module 1: Fundamental Concepts and Some Failure Analysis Tools

- Reliability Engineering and Predictive Maintenance
- Failure Mode Effects Analysis
- Fault-Tree Analysis
- Cause-and-Effect Analysis
- The Fishbone Graph
- Sequence-of-events diagram
- Bow-Tie method
- Introduction to Root Cause Failure Analysis
- Purpose of RCFA
- Effective use of RCFA
- Personnel Requirement
- Conditions for using the method

Module 2: Root Cause Failure Analysis Methodology

- Reporting a Failure Incident or Problem
- Symptoms and Boundaries/Conditions
- Perceived Causes of Problem
- Event-Reporting Format
- Failure Incident Classification
- Typical Failure Incident-Reporting Form
- Equipment Damage or Failure
- Operating Performance
- Economic Performance
- Safety
- Regulatory Compliance
- Data Gathering: Interviews, Questions to Ask
- Collecting Physical Evidence
- Analyze Sequence of Events
- Design Review: Minimum Design Data
- Objectives of the Design Review
- Application/Maintenance Review: Installation, Operating Envelope, SOPs
- Maintenance History and the associated Procedures and Practices
- Observations & Measurements: Vibration Analysis, Process Parameters, Visual Inspection, Measurement Devices, Failed Machine Components, Wear Particles
- Other testing techniques: NDT (Non-Destructive Testing), metallography, fractography etc

Module 3: Determining the Failure Root Cause(s)

- Misapplication
- Poor Design Practices
- Aging: Depreciation, Remainder Life, Replacement Planning not predictive.
- Procurement Practices: Inadequate Specifications, Substitutions, Low Bid versus Lifecycle Cost, Vendor Evaluations,
- Poor Operating, Inspection & Maintenance Practices and Procedures
- Poor Training
- Inadequate Supervision
- Ineffective Communication
- Faulty Human Engineering
- Work Environment: Physical and Phycological
- Management Systems
- Substandard Qualify Control

Module 4: Evaluating Potential Corrective Actions

- Involvement of SMEs (Subject Matter Experts)
- HSE Risk Assessment Matrix.
- Regulatory Requirements
- Costs Involved: Process, Materials, Labour, Training, other considerations.
- Cost-Benefit Analysis
- Management Decision

Module 5: Report and Recommendations

- Failure Incident Summary
- Initial Plant Condition
- Initiating Event
- Failure Incident Description
- Immediate Corrective Actions
- Causes and Long-Term Corrective Actions
- Internal and External Reports Filed
- Lessons Learned
- References And Attachments
- Failure Investigator or Investigating Team Description
- Review And Approval Team Description
- Distribution List
- Verification of Implementation of Corrective Action and Its Effectiveness

Module 6: HSE-Related Issues

- Fatigue
- Physical Impairment
- Personal Problems
- Repetition/Boredom
- Machine-Human interface not friendly
- Operations Problems/Short-cuts/capacity stretching
- Economic Considerations to avoid HSE best practices
- Inspection and maintenance priorities side-lined

Module 7: Regulatory and Internal Compliance Issues

- Spill Hazards: Recommended Spill Responses
- Worker Education and Communication
- Prevention
- Worker Responsibilities
- Legislation and Reporting Requirements including Pollution Control Board if failures entail it.
- Occupational Health & Safety Management | ISO 45001:2018
- Process Safety Management (PSM)
- Emergency Planning and Community Right-to-Know Act
- Resource Conservation and Recovery Act
- Hazardous Materials Transportation Act

Module 8: Design Evaluation Aspects: Selected Machines & Equipment

- Pumps
- Compressors
- Turbines
- Fans, Blowers, and Fluidizers
- Driving Conveyors and Conveyer Belts
- Mixers And Agitators
- Dust Collectors
- Rollers
- Fasteners
- Ropes and cables
- Gearboxes/ Speed Reducers
- Steam Traps

- Electric Inverters
- Control Valves
- Seals And Packing
- Preventive Trouble Shooting for The Above Machines &
- Equipment to Avoid Failures

Module 9: Live Failure Incidents, Case Studies and Exercises to do RCFA

- Failure Videos and discussions
- Tutor runs the above RCFA methodology with respect to one incident case study to refresh the attendees.
- Tutor presents a few other case studies and asks course participants to work them out with RCA and Investigation Reports
- Tutor observes progress and provides support
- Question and answers