Course ID
RCFA
Course Duration
5 days

Course Title
Root Cause Analysis of Systems Failure: A Comprehensive Five Day Workshop

Related Courses

- Root Cause Analysis of Systems Failure (RCFA2D, 2 days)
- Root Cause Analysis of Systems Failure: A Comprehensive Course (RCFA4D, 4 days)
- Root Cause Analysis of Component Failure: Understanding Human and Engineering Factors for Improved Product Performance (RCFA-ME, 2-4 days)
- Systems Engineering: An Intermediate Tutorial and Workshop (SYSENG, 2 days)
- Succeeding at Technical Management: Do's and Don'ts for the Technical Manager (DOS&DONTS, 1 day)

Aimed At

This course is aimed at manufacturing engineers, quality engineers, project engineers, design engineers, MRB engineers, procurement specialists, manufacturing managers, program managers and others responsible for preventing or determining the cause of a systems failure.

Group Size

5-25

Prerequisites

While there are no formal prerequisites, the course does assume experience in an industrial, manufacturing, or engineering development/maintenance setting.

Course in a Nutshell

This five-day course brings together in a problem-solving workshop setting important concepts from engineering, quality assurance, problem solving, procurement, and other disciplines to identify and eliminate the root causes of failures occurring in complex systems, subsystems, and components.

We will show you how to utilize fault tree analysis for identifying potential failure causes. We will also arm you with procedures and technologies for working through various types of systems failure. We will learn how hardware analysis, statistical analysis, design of experiments, technical data package evaluation, and other pertinent tools and techniques can be brought together to define root causes of a failure and to develop a plan of corrective actions. The course will utilize real-life case studies to help you apply this toolkit effectively to your job. The workshop day at the end of the course will engage you in the hands-on solution of a problem

specific to your organization. At the end of the course, you will have learned how to identify dominant failure modes through quantity and cost-based Pareto analyses, identify the root causes of systems failures, select and implement effective corrective actions, and work as an inter-organizational, multi-disciplinary failure analysis team.

Customize It!

Whatever the nature of your system and objective, whether failure prevention or cause determination, we will customize the course to meet your specific needs and concerns. Here are some of the ways in which we can tailor the course to help you get more out of it:

- Add a more in-depth discussion of the design-of-experiments and Taguchi training.
- Schedule post-class follow-up consultation for continuing in-house product and process failure analyses.

Learn How To

- Work together in an effective multi-disciplinary team environment to resolve complex system failures.
- Objectively identify all potential failure causes using fault tree analysis, design of experiments, and other technologies.
- Objectively evaluate the likelihood of each potential failure cause.
- Identify the most likely failure causes.
- Proactively eliminate additional potential failure causes before they occur.

Course Outline

- Day 1: Introduction to Systems Failure Analysis
  - The need for efficient systems failure analysis
  - Systems failure analysis philosophy
  - The four-step problem solving approach
  - Systems and component failure analyses
  - The inherent value of failed hardware
  - Failure analysis definitions and basic failure analysis concepts
  - Continuous improvement concepts and the systems failure analysis contribution
  - A framework for systems failure analysis
  - Quality measurement and reporting concepts
  - Nonconformance data base approaches
  - Pareto analysis
  - Integrating the cost of quality of program
  - Understanding systems interactions and how systems operate
  - The value of a priori failure cause identification
  - Case study
- Day 2: Fault Tree Analysis
  - Fault tree analysis history, applications, and capabilities

- Defining the problem and developing fault tree analysis top undesired events
- Relationships between logic operators and events
- Fault tree gate usage and interpretation
- Using inhibit functions to model probability distributions
- Navigating from the failure site
- Quantifying top undesired events
- Failure rate sources
- Using fault trees to identify redundancy-defeating failure modes
- Using Failure Mode Assessment and Assignment (FMA&A) matrices for managing the systems failure analysis effort
- "What's Different" analysis
- Use of test and inspection data, material certifications, and statistical process control data
- Use of flow charts for product performance and process evaluations
- Interviewing techniques for use with assembly, test, and inspection personnel. Failed hardware analysis
- Case study

- Day 3: Design of Experiments and Systems Failure Analysis
  - Basic experimental design concepts
  - Deterministic versus statistical thinking
  - Hypothesis testing
  - The normal distribution and other basic statistical concepts
  - Analysis of variance
  - Z-tests, t-tests, and f-tests
  - Identifying potentially critical design and process parameters
  - Identifying test objectives
  - Test readiness reviews
  - Inducing failures to confirm causes
  - Introduction to Taguchi philosophies and Taguchi design of experiment technologies
  - Designing a Taguchi experiment
  - Selecting test parameters
  - Two and three level orthogonal arrays
  - Selecting output parameters and data collection approaches
  - Strategies for minimizing test risk
  - Signal-to-noise ratios
  - Defining test specimen configurations
  - ANOVA applied to Taguchi experiments
  - Typical test strategies
  - Multiple level experiments
  - Case study
- Day 4: Specialty Analyses, Corrective Action, and Course Wrap Up
  - Evaluating failed hardware compliance
  - Assessing technical data package adequacy
  - Common technical data package shortfalls
  - Tolerance analysis

- Quality Assurance compliance assessment tools
- Optical microscopy, SEM, FTIR, EDAX, X-ray, N-ray, SIMS, and Auger analysis
- Monte Carlo simulations
- Evaluating leaks
- Basic metallurgical and electronic component evaluations.
- Customer/supplier interface issues
- Commercial failure analysis laboratories
- The advantages of eliminating repair, rework, and use as is dispositions
- Corrective action order of precedence
- Design modifications, process modifications, requirements relaxation, screening, and other corrective actions
- Use of statistical process control as a corrective action
- Using the FMA&A matrix for corrective action identification and tracking

- Day 5 (Workshop Day): Participants will work together to analyze a failure specific to your organization. The workshop day can be scheduled a few weeks after the first four days of this course to allow time for "home work".

- Course Wrap-up
  - A suggested failure analysis procedure
  - Creating a product-oriented Lessons Learned document
  - Recap, Q/A, and evaluations

How You Will Learn

- A seasoned consulting engineer-instructor will present this course in interactive lecture/workshop format.
- Along with lecture, we use exercises, puzzles, case studies, and interesting group activities to enrich the instruction and drive home the essential points.
- If you already know something about this subject, we will build on that. We'll compare and contrast what's familiar with what's new, making the new ideas easier to learn as well as more relevant.
- If your background is less technical, we will use meaningful and ingenious examples and analogies to simplify the complex subject matter.
- You will receive a printed Participant Handbook which will help you remember and retain what you learned in class and apply it on your job.
- You will learn the key concepts of root cause failure analysis from a theoretical, practical, and organizational perspective.
- The workshop day at the end of the course will engage you in the hands-on solution of a problem specific to your organization.

Revised *09 Sept 29f*