IMME INSTITUTE OF MAINTENANCE MANAGEMENT EDUCATION

Virtual
Training Programme

Root Cause Failure Analysis and Maintenance

Introduction

In many plants, machinery breakdown, repetitive equipment or component failures and suboptimal machinery operating life inevitably result in inferior product quality, erratic production schedules, and reduced profitability. Root Cause Failure Analysis (RCFA) as a maintenance troubleshooting technique that would anticipate and control the systemic causes of maintenance problems occupies the thinking and planning of progressive managements. Root Cause Failure Analysis can be one of the strongest tools your maintenance organization ever puts its hands around since it helps improving reliability of plant equipment significantly.

RCFA is a logical, structured, and deductive technique that can identify the root cause behind the failure. The root cause is the most basic reason for an undesirable condition or problem which, if eliminated or corrected, would prevent it from existing or occurring. Thus, having found the cause, an action plan is formulated that either eliminates the root cause, mitigates the adverse effects of the root cause or provides sufficient early warning that the failure cycle has begun. This process is highly proactive, and can be utilized readily with preventive and predictive maintenance programs in an integrated manner.

Root Cause Failure Analysis is typically used as a reactive method of identifying causes for the failure events, revealing problems and solving them. Analysis is done after an event has occurred. Root Cause Failure Analysis can help transform a reactive culture (one that reacts to problems) into a forward-looking culture (one that solves problems before they occur or escalate). More importantly, it helps reducing the frequency of problems occurring over time within a plant. Root Cause Failure Analysis is a team-based activity. Its success is dependent on having the right people available for the study. Done properly, it often proves a rewarding and illuminating process for the team members as well as for the organizations suffering from the ill effects of plant failures.

The programme is designed for those who look forward to Root Cause Failure Analysis as a way of enhancing Preventive and Predictive Maintenance systems in their plants. The case studies to be discussed in the programme will demonstrate how an RCFA proves useful in uncovering the root causes of failure problems. It will also show how those root causes when addressed properly result in a significant improvement in the reliability of the plant equipment and machinery. For rapid evolution and progress in your operations, help your people develop RCFA skills, and the associated problem-solving techniques, so they have the capability to apply the necessary tools with greater effectiveness.

Methodology

The methodology for conducting the Virtual Training Programme is briefly described as below:

- Focused Presentation
- Interactive Discussions
- Case Studies
- Question - Answer Sessions
- Practical Exercises

Programme Coverage

- Basics of Equipment Failures
- Elements of Failure Analysis Programme
- Approaches to Control Equipment Failures and Downtime
- Techniques to Predict and Investigate Machine Faults & Failures
- Finding Root Causes:
    - Why-Why Analysis
    - Ishikawa Diagrams
    - Logical Questioning Techniques
- Managing Planned Failure Analysis Programme
- Case Studies on RCFA
- Systematic Breakdown Analysis and Case Study
- Practical Exercises

Focal Points of the Training Programme

- **The Basics of Equipment Failures:** Developing matured understanding of several issues regarding equipment failures, e.g. failure phenomenon and impact of failures, fundamental causes, classification of failures & definition of various types, types of failure patterns, P - F Interval, Technical Audit of Failures, objectives of RCFA program, etc.

- **Techniques to Predict & Investigate Failures:** Discussing in detail various techniques and approaches that help in the predictive diagnosis and post occurrence investigation of machine faults and failures.
- **Tools for Finding Root Causes:** Clearly differentiating between treating the symptoms and curing the condition, root cause finding tools identify the origin of a problem using specific steps, with associated tools, and help establishing the root cause of the problem.

- **Planned Failure Analysis Program:** Discerning various steps of Planned Failure Analysis Program starting from the proper reporting and recording of the failure data and finally ending up with the implementation of the remedial actions and follow up.

- **Case Studies:** Exposing participants to real-life failure problems through various case studies involving an up-close, in-depth, and detailed examination.

- **Continuous Improvement:** Learning methodologies for identifying and eliminating problem root causes considered essential to successful continuous improvement activities.

- **Practical Exercises:** Gaining useful experience of root cause failure analysis by working on various maintenance problems from industry.

Benefits of Attending the Training Programme

Benefits of attending the training programme will include the ability to:

- Understand fundamentals of equipment failures and problem solving processes.
- Identify the origin of a problem, determine what happened, why it happened and figure out what to do to reduce the likelihood, and that it will not happen again.
- Compare common root cause analysis tools and methods such as why-why analysis, cause effect diagrams, logical questioning techniques, fault tree analysis and other techniques.
- Use Failure Modes and Effects Analysis (FMEA) techniques.
- Describe how to prioritize failure events to analyze, preserve failure data, and order a failure analysis.
- Develop and implement effective and efficient Root Cause Failure Analysis programmes.
- Assess how to make RCFA a structured, team based, analytical approach.
- Use data collection, cause charting, root cause identification, corrective action and implementation.
- Gain valuable experience of Root Cause Failure Analysis by way of working on practical problems from industry.

Participation

• Maintenance Engineers & Managers
• Team Leaders
• Technical Executives from reliability, design, trouble-shooting, plant modifications, etc.
• Maintenance Supervisors, etc.

Course Contents

MODULE I: The Basics of Equipment Failures

- The ABC's of Equipment Failures
- Impact of Careless Work Habits and A Classical Case of Negligence
- Fundamental Causes
- Definition & Classification of Failures
- Cause and Effect Relationship

MODULE II: Elements of Failure Analysis

- Bathtub Curve
- Six Types of Failure Patterns
- Approaches to Failure Control
- P - F Curve & P- F Interval
- Technical Audit Report of Breakdowns
- Strategies for Zero Breakdowns

MODULE III: Techniques to Predict & Investigate Failures

- Machine Diagnosis Techniques
- Trouble Shooting Charts
- Fault Finding Logic Diagrams
- Reliability and Maintainability Analysis – MTBF & MTTR Data
- Failure Modes and Effects Analysis (FMEA)
- Fault Tree Analysis

MODULE IV: Finding Root Causes: Why – Why Analysis, Ishikawa Diagrams and Other Techniques

- Why – Why Analysis
- Ishikawa Diagrams
- Logical Questioning Techniques
- Case Studies

MODULE V: Managing Planned Failure Analysis Programme

- Reporting and Recording of Failures
- Codification of Failures
- Analyzing Failure Data
- Suggesting Remedial Measures
- Implementation and Follow Up

MODULE VI: Case Studies on RCFA

- Equipment Failure Case Studies
- Finding Root Causes
- Root Cause Elimination

MODULE VII: Systematic Breakdown Analysis

- Elements of Failure Data for Systematic Breakdown Analysis
- Formats for Data Collection
- Analysis of Data and Corrective Measures
- A Classical Case Study on Breakdown Analysis to reduce Downtime

MODULE VIII: Practical Exercises on Failure Problems and Conclusion

- Practical Exercises on Failure Problems
- Presentation of the Ideas by the Participants and Interaction with Faculty
- Closing Remarks by the Faculty
- Feedback from the Participants
- Appraisal and Conclusion

IMME and Maintenance Reliability Training Programmes

Institute of Maintenance Management Education (www.immeinstitute.org) commenced operations in late 70s as a leading training and consultancy organization to facilitate paving way for excellence in maintenance function in industry. Since then IMME has conducted a large number of top quality maintenance reliability training programmes on different themes and topics. Tens of thousands of candidates from various reputed companies in the corporate sector have participated in different training programmes & courses conducted by IMME in a period of over 30 years.

Maintenance reliability of plant equipment is a key activity in any manufacturing organization. In order to attain top performance in maintaining its assets, a company needs a comprehensive approach that depends on the integration of people, plant and processes. The maintenance reliability organization needs to be efficient, well organized, cost-effective and innovative to realize higher plant availability and smooth operations. Through maintenance reliability training, coaching and mentoring, Institute of Maintenance Management Education (IMME) provides value to the clients by focusing on creation of organic teams who understand asset performance management at strategic reliability level to help improve business profitability.

IMME helps companies reach their maintenance reliability goals by way of building capacity and competency – knowledge, skill, motivation, initiative, team work, etc. of maintenance managers, plant engineers, maintenance supervisors, technicians, etc. through training on various themes related to maintenance reliability function. Identifying and embracing the best practices in maintenance reliability management enables an organization to avoid failures, breakdown maintenance work and other barriers to success while maintaining safe, reliable operations and minimizing costs.

EXCELLENCE IN TRAINING FOR OVER 30 YEARS

Some of our Clients

☐ **Tens of thousand of maintenance engineers, managers, plant executives and other engineering personnel from various reputed companies in the corporate sector have participated in different in-house / virtual training programmes, distance courses, outbound programmes, workshops, seminars, etc. conducted by IMME in a period of over 30 years.**

☐ Some of the companies who have participated in various short-term training programmes conducted by IMME in the past are shown below:

ABB India Ltd.
Addverb Technologies Pvt. Ltd.
Ador Welding Ltd.
Alfa Laval (India) Ltd.
Amaraja Batteries Ltd.
Ambuja Cements Ltd.
Anshupati Textiles
(A Divn. of Vardhman Polytex Ltd.)
Antifriction Bearings Corporation Ltd., The
Ashok Leyland Ltd.
Asian Cables & Industries Ltd.
Asian Paints (India) Ltd.
Atul Limited
Bajaj Auto Ltd.
Balkrishna Industries Limited
Balmer Lawrie & Co. Ltd.
Bata India Limited
Bellary Steels & Alloys Ltd.
Bharat Dynamics Ltd.
Bharat Electronics Ltd.
Bharat Heavy Electricals Ltd.
Bharat Petroleum Corporation Ltd.
Bharat Refractories Ltd.
Bhuruka Gases Limited
Birla Cement Works
Blue Star Limited
Bombay Dyeing & Mfg. Co. Ltd., The
Borosil Glass Works Ltd.
Brakes India Limited
Bridge and Roof Co. (India) Ltd.
Britannia Industries Ltd.
Cable Corporation of India Ltd.
Carborundum Universal Ltd.
Castrol India Limited
Ceat Limited
Central Electronics Limited
Cetex Petrochemicals Limited
Chennai Petroleum Corpn. Ltd.
Chittaranjan Locomotive Works
Cipla Limited
Coal India Limited
Colgate-Palmolive (India) Ltd.
Continental Device India Ltd.
Coromandel Fertilizers Ltd.
Cosmo Ferrites Limited
Cosmo Films Limited
Crompton Greaves Limited
Cutfast Abrasive Tools Ltd.
Dabur India Limited
Daurala Sugar Works
Deepak Fertilisers and Petrochemicals Corporation Ltd.
Deepak Nitrite Limited
Denso India Ltd.
Dhampur Sugar Mills Ltd., The
Dharamsi Morarji Chemical Co. Ltd., The
E.I.D. Parry (India) Ltd.
Eicher Tractors
Emco Transformers Ltd.
Enercon (India) Limited
Esab India Limited
Escorts Limited
Ester Industries Limited
Eveready Industries India Ltd.
Fertilizers and Chemicals Travancore Ltd., The
Finolex Industries Ltd.
Gharda Chemicals Ltd.
Godrej & Boyce Mfg. Co. Ltd.
Goodyear India Limited
Graphite India Limited
Grasim Industries Limited
Greaves Cotton Limited
Gujarat Mineral Development Corporation Ltd.
Gujarat State Fertilizers Co. Ltd.
Hawkins Cookers Limited
Heavy Vehicles Factory
Hindalco Industries Ltd.
(Renusagar Power)
Hindustan Aeronautics Limited
Hindustan Everest Tools Limited
Hindustan Fertilizer Corporation Limited
Hindustan Unilever Limited
Hindustan Newsprint Limited
Hindustan Organic Chemicals Ltd.
Hindustan Petroleum Corporation Ltd.
Hindustan Wires Limited
ITC Limited
ITI Limited
India Glycols Ltd.
India Pistons Limited
Indian Farmers Fertilizer Co-operative Ltd.
Indian Oil Corporation Ltd.
Indian Ordnance Factories
Integral Coach Factory
JSW Ispat Special Products Ltd. *(Formerly Monnet Ispat & Energy Limited)*
Kalyani Steels Ltd.
Karnataka Antibiotics & Pharmaceuticals Ltd.
Kirloskar Brothers Limited
Kirloskar Copeland Limited
Kirloskar Electric Company Ltd.
Kirloskar Oil Engines Ltd.
Kirloskar Pneumatic Co. Ltd.
Lakshmi Electrical Control Systems Ltd.
Larsen & Toubro Limited
Lubrizol India Pvt. Ltd.
Lupin Limited
MRF Limited
Maharashtra Seamless Limited
Mahindra & Mahindra Ltd.
Malayala Manorama Co. Ltd.
Malwa Cotton Mills Ltd.
Manali Petrochemical Ltd.
Mark Auto Industries Ltd.
Mineral Exploration Corporation Ltd.
Mother Dairy
Mysore Paper Mills Ltd., The
NTPC Limited
Nagarjuna Fertilizers and Chemicals Ltd.
National Aluminium Company Ltd.
National Engineering Industries Ltd.
National Fertilizers Limited
National Steel Industries Ltd.
Neyveli Lignite Corporation Ltd.
Nuclear Fuel Complex
Nuclear Power Corporation of India Ltd.
Orient Cement
Orient Paper Mills
Oriental Carbon & Chemicals Ltd.
Panchmahal Steel Limited
Panyam Cements & Mineral Industries Ltd.
Pasupati Acrylon Ltd.
Philips India Ltd.
Poona Shims Pvt. Ltd.
Prakash Industries Ltd.
Pyrites, Phosphates & Chemicals Ltd.
Radico Khaitan Ltd.
(Unit: Rampur Distillery)
Rajasthan State Co-operative Spg. & Gng. Mills Federation Ltd.
Ranbaxy Laboratories Ltd.
Rane Brake Linings Ltd.
Rashtriya Chemicals & Fertilizers Ltd.
Raymond Limited
RCCPL Pvt. Ltd.
(Formerly Reliance Cement Co. Pvt. Ltd.)
Reckitt Benckiser (India) Ltd.
Reliance Industries Ltd.
SRF Limited
Samcor Glass Limited
Samtel Color Limited
Saraswati Sugar Mills, The
Shiram Pistons and Rings Ltd.
Siemens Ltd.
Simbhaoli Sugar Mills Ltd., The
Sona Steering Systems Ltd.
Steel Authority of India Ltd.
Stumpp, Shuele & Somappa Springs Pvt. Ltd.
Sud-Chemie India Pvt. Ltd.
Sudarshan Chemical Industries Ltd.
Sunflag Iron & Steel Co. Ltd.
TAFE Motors and Tractors Limited
(Formerly Tractors and Farm Equipment Ltd.)
TVS Motor Company Ltd.
Tamilnadu Petroproducts Ltd.
Tata Chemicals Limited
Tata Coffee Ltd.
Tata Power Company Ltd.
Tata Motors Ltd.
Tata Steel Ltd.
Technova Imaging Systems (P) Ltd.
Tega Industries Ltd.
Thermax Limited
Traco Cable Company Limited
Travancore Titanium Products Limited
U.P. Twiga Fibreglass Ltd.
USV Pvt. Limited
United Phosphorous Ltd.
Usha Martin Ltd.
V.I.P. Industries Ltd.
Vadilal Industries Ltd.
Videocon Appliances Ltd.
Vikram Cement
(A Unit of Grasim Industries Ltd.)
Vindhya Telelinks Ltd.
Voltas Limited
Walchandnagar Industries Limited
WIL Car Wheels Ltd.
(Formerly Wheels India Ltd.)
Wipro Limited
Wires and Fabriks (S.A.) Ltd.
Wockhardt Limited