Applying Reliability Engineering Principles To Process Equipment Maintenance

Introduction:

The course is designed to bridge the gap between the rather theoretical subject of "Reliability Engineering" (RE) and day-to-day equipment maintenance practice by emphasizing the common goals of RE and Maintenance.

It will be shown how various indices allow reliability performance tracking but are of little use when it comes to the identification of reliability improvement strategies. Here is where statistical techniques based on RE principles for analyzing equipment failure data will help. By using practical, real world examples, it will be demonstrated that the application of these techniques will provide a basis for improved equipment management and reduced maintenance costs. Participants are encouraged to bring their failure statistics (motors, pumps, machinery components, etc.) for manual (plotting) or computerized analysis. Similarly, equipment replacement decisions based on RE principles will be examined together with practical operating and maintenance strategies leading to the improvement of plant reliability.

The course explores reliability assessment techniques such as Failure Mode and Effect Analysis (FMEA) and Fault Tree Analysis (FTA) of the equipment presently installed in the participants' plants. It will be shown how the results of these

analyses can provide input into maintenance strategies and operating procedures and thus increase overall equipment availability. Through examples dealing with compression equipment, guidance is given on reliability assurance pertaining to new equipment purchases by means of design audits, reviews and checklists.

Finally, generating and using equipment availability indices will be investigate and discussed.

Who should attend?

This practical course is for maintenance and equipment reliability professionals, supervisors, and technicians involved in machinery reliability and availability management. Personnel from process industries such as refining, petrochemical, chemical, mining, pharmaceutical, fertilizer, pulp and paper manufacturing, food processing, and utilities will profit.

Methodology:

This interactive Training will be highly interactive, with opportunities to advance your opinions and ideas and will include;

- Lectures
- Workshop & Work Presentation
- Case Studies and Practical Exercise
- Videos and General Discussions

Certificate:

BTS attendance certificate will be issued to all attendees completing minimum of 80% of the total course duration.

Course Objectives:

Upon completion of this course, participants will recognize the practical use of Reliability Engineering as it pertains to process plant equipment maintenance. Participants will gain an understanding of the importance of equipment failure and/or repair data collecting. They will learn to apply statistical techniques for the analysis of this data enabling them

to formulate maintenance and operating strategies designed to increase their plant equipment availability. Participants will be able to perform maintenance cost saving Failure Mode and Effect Analyses (FMEA) and understand the principles of Fault Tree Analysis (FTA). Everyone will leave with several techniques that they could apply to improve equipment maintenance, operating, commissioning, installation, and purchase.

Course Outline:

Module 1

- **Session 1**: Theory and Concept of Reliability
    - ❖ Development of Reliability Engineering
    - ❖ Definition and Concept of Reliability
    - ❖ Task Definition of Equipment Maintenance
- **Session 2:** Reliability Theory Applied to the Analysis of Equipment Life Data
    - ❖ Reliability Indices, their Use and Limitation
    - ❖ Statistical Techniques: Trend Analysis
- **Session 3**: Statistical Techniques: Exponential Distribution Analysis
    - ❖ How to Tell Bad Repairs from Bad Designs
- **Session 4:** Statistical Techniques: Weibull Analysis, Manual Plotting Methods vs. Computerized Approaches
    - ❖ Practical Examples

Module 2

- **Session 1**: Risk Assessment Using Weibull Analysis, Predicting Failure Frequency

- ❖ Equipment Replacement Decisions, Preventive vs. Corrective Maintenance Strategies
- ❖ Operating and Maintenance Strategies Leading to Reliability Improvement

- **Session 2**: Maintenance Strategies

  - ❖ Equipment Replacement Decisions, Preventive vs. Corrective Maintenance Strategies
  - ❖ Operating and Maintenance Strategies Leading to Reliability Improvement

- **Session 3:** Equipment Reliability Assessment

  - ❖ Component Reliability and Maintainability (R&M) Analysis Identifies Weak Elements Leading to Appropriate Maintenance Strategies

- **Session 4**: Failure Mode and Effect Analysis

  - ❖ FMEA and its Benefits to the Equipment Maintenance Process

- **Session 5**: Fault Tree Analysis

  - ❖ FTA Detects Machinery System Conditions Which Can Lead to Undesired Events

Module 3

- **Session 1**: Audits and Reviews as Reliability Assurance Tools
- **Session 2**: Building and Use of Reliability Checklists Using Compression Equipment as an Example
- **Session 3**: Generation and Use of Availability Indices