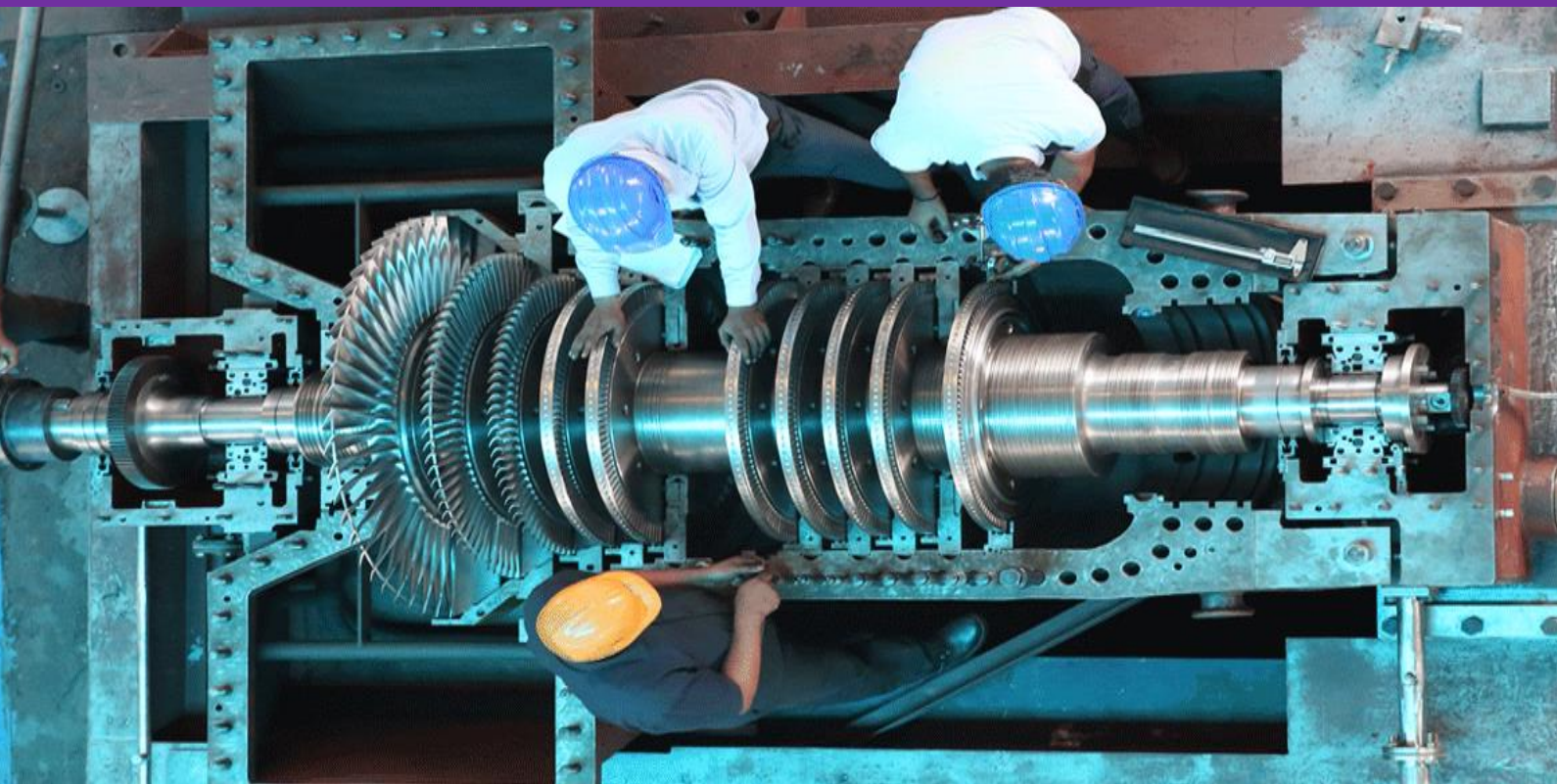


**“A Strategic plan is the blueprint of  
your ultimate achievements ”**

# Equipment Failure Analysis and Prevention



**YOUR PRINCIPAL COURSE LEADER: Mr. Fred Geitner, P.Eng**



- More than 50 years of experience in Oil, Gas and Petrochemical Industry
- EX-Senior machinery Advisor in Exxon Mobile
- Co-Author of Several Machinery Books
- International Training Instructor for Rotating Equipment
- Member of International Society of Tribologists and Lubrication Engineers

**TEHRAN-IRAN**

**17-19 July, 2018**

**Early Birth  
Registration:**

**15 June, 2018**

# Equipment Failure Analysis and Prevention

**MAT Group Ltd.** is proud to present “ **Equipment Failure Analysis and Prevention**” for improving knowledge, scientific and professional level of engineers. This course will be held in **3 days** starting on **Saturday, 17<sup>th</sup> July, 2018** from **8:30 to 17:15** in **Tehran/Iran**.

## COURSE DESCRIPTION:

This course presents a systematic approach to fault diagnosis and failure prevention in a broad range of equipment used in the process, manufacturing, power generation and mining industries. The key routes to preventive maintenance are demonstrated through both overview and the study of examples in component failure analysis and a sequential approach to equipment trouble-shooting and problem solving. First, a systematic approach to generalized problem-solving is introduced and then a highly effective root cause failure analysis (RCFA) method is explained in detail. Following this, equipment failure events will be reviewed and participants are encouraged to bring to the seminar relevant assembly drawings or such components as failed bearings, gears, valves, control loop components and other equipment elements for failure analysis discussion. The course explores a systematic approach to successful failure analysis and troubleshooting programs, including the determination of goals, use of checklists and evaluating failing populations of components. By reference to specific case studies, dealing with mechanical equipment and I&E systems, it will be shown that such a systematic program can lead to significant failure reductions in many types of plant equipment. A matrix approach to equipment and component troubleshooting uses illustrative examples in pumps, centrifugal compressors, blowers and fans, reciprocating compressors, engines and gas turbines and ancillary components. After a thorough definition of reliability terms, generating and using equipment availability indices will be investigated and discussed. It will be shown how various reliability indices allow reliability performance tracking but are of little use when it comes to the identification of failure causes. Here is where statistical techniques based on Reliability Engineering (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, I&E 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 continues by exploring up-front reliability assessment techniques such as Failure Mode and Effect Analysis (FMEA) and Fault Tree Analysis (FTA) of 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.

## LEARNING OBJECTIVES:

Upon completion of this course, participants will gain an understanding of structured, results-oriented hands-on root cause failure analysis methods for all types of equipment components and entire operating systems. Participants will also learn how parts fail, why they fail in a given mode, and how to prevent failures. Participants will recognize the practical use of Reliability Engineering principles as they pertain 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 understand 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 immediately to improve equipment maintenance, operating, commissioning, installation and purchase of their machinery.

## WHO SHOULD ATTEND:

This is a highly practical course for maintenance and technical services engineers, supervisors and technicians involved in equipment operation and troubleshooting. Personnel from all process industries (refining, petrochemical, power generation, chemical, mining, pharmaceutical, fertilizer, and food processing) involved in reliability programs will benefit.

## COURSE OUTLINES:

### DAY 1:

#### Session 1: Root Cause Failure Analysis (RCFA):

Structured Problem Solving Principles:

- The Role of Troubleshooting:
- The Matrix Approach to Equipment Troubleshooting
- Root Cause Failure Analysis (RCFA)
- Priority Setting

#### Session 2: Root Cause Failure Analysis (RCFA)- continued:

Basic Principles of Equipment Failure Analysis:

- Causes of Equipment Failure
- Uniform Record Keeping
- Contributing Factors Often Overlooked

# Equipment Failure Analysis and Prevention

## Session 3: Learning from Metallurgical Failure Analysis

### Methodology:

Examples: Failure Analysis of Bolted Joints:

- Shaft Failures and Their Origins
- Ductile and Brittle Failures of Shafts
- Looking for Redesign Opportunities

## Session 4: Equipment Component Analysis and Reliability Improvement:

Wear Failures:

- Rolling Element Bearing Failures
- Distress in Journal and Tilt Pad Bearings
- Electrical and Control Components

## DAY 2:

### Session 1: Statistical Failure Analysis (What to do with Failure Data):

Reliability Engineering Principles:

- 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 Continued:

Weibull Analysis, Manual Plotting Methods vs. Computerized Approaches

- Practical Examples

## DAY 3:

### Session 1: Statistical Techniques (continued):

Risk Assessment Using Weibull Analysis, Predicting Failure Frequency

### Session 2: Failure Data Based Decisions:

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)

#### Principles:

FMEA and its Benefits to the Equipment Maintenance Process.

## About Your Course Leader:



**Mr. Fred K. Geitner P.Eng. M.S.M.E.** is the Principal Engineer of PMES (Process Machinery Engineering Services). He has **over 50 years experience** in rotating/process machinery engineering for the petrochemical and related process industries. He is presently working as an

expert witness for rotating machinery and is advising on subjects related to process machinery (e.g. air compressors, steam turbines, etc.), reliability improvement and maintenance such as machinery failure analysis, specifications, technical bid analysis and machinery design audits. From 1993 to 2000, Mr. Fred K. Geitner worked for a major natural gas transmission company in Germany where he was in charge of machinery technology liaison between the German firm and pipeline companies in the newly independent states of the former Soviet Union. Before retiring from Exxon in 1992, after twenty years of service, Mr. Geitner's professional career included positions as Engineering Associate with Esso Chemical Canada and a three-year assignment as a lead machinery specialist with Exxon Chemical France. Prior to joining Exxon, Mr. Geitner worked for ten years for Cooper Industries, a major manufacturer of process machinery. There he held positions in field service engineering, design and manufacturing at various locations in Canada and the U.S. Mr. Geitner graduated from the Technical University of Berlin/Germany with an M.S. (Dipl. Eng.) degree in Engineering and did post-graduate studies at the University of Cincinnati, USA. Mr. Geitner has presented courses and seminars on design, operation and maintenance of process machinery and related equipment in Canada, the US, Europe, South America and the Middle East.

He is also a present member of the Society of Tribologists and Lubrication Engineers and has, together with Heinz Bloch co-authored a series of books on process machinery management and reliability engineering. The current list of his books includes:

- (1) Machinery Failure Analysis and Troubleshooting (Third Edition), by Heinz P. Bloch and Fred K. Geitner (Houston, Texas: Gulf Publishing Company).
- (2) Practical Machinery Management for Process Plants, Volume 1, 3rd Edition.
- (3) Practical Machinery Management for Process Plants, Volume 2, 3rd Edition
- (4) Practical Machinery Management for Process Plants, Volume 3, 2nd Edition:
- (5) Practical Machinery Management for Process Plants, Volume 4, 2nd Edition.
- (6) Machinery Component Maintenance and Repair
- (7) Process Equipment Maintenance and Repair
- (8) Process Plant Machinery
- (9) Process Plant Reliability

# REGISTRATION:

## TERMS FOR ATTENDING THE COURSE:

- University Engineering Degree (e.g. Mechanical, Chemical &..) is highly recommended.
- Sending the completed "Course Registration Form" by **15 June, 2018**
- Knowledge or background in the field of "**Process Machinery and Maintenance**" is highly recommended.
- Formal language of the course is English.

## COURSE FEE:

- Payment of Rials **50,000,000.00** to MAT Persian Group, **Account Number 810-652-6, Code 1080, Parsian Bank, Iran, Tehran 15 June, 2018.**
- The above price does not include 9%VAT.

## IMPORTANT NOTICE:

- Payments are required with registration and must be received prior to the course to guarantee your place.
- The regular registration period ends on **15 June, 2018.** Afterward, late "Registration Fee" of **Rials 3,000,000.00** will be charged.
- A certificate of successful completion of the course will be awarded to participants who attend and complete all course sessions and successfully pass the final exam of the course.
- The registration payment includes: **Course Materials, Coffee Break & Lunch.**

## PAYMENT, CANCELATION & REFUND POLICIES:

All payments must be received prior to course commencement. Payments are accepted in the form of bank cheque or bank transfer. Cancellation requests by applicants should be in writing and received 30 days before the commencement of course, for the course fee to be refunded minus registration/administration cost of **Rials 3,000,000.**

Cancellations must be made in writing. No refunds will be made for cancellations received less than 30 days before the start of the course. Enrollment is not automatically cancelled if participant does not show up. A substitute participant may be nominated upon approval of MAT Group.

MAT Group reserves the right to withdraw or postpone a course if the number of participants is not sufficient, up to three weeks prior to the course starting date. If a course is cancelled by MAT Group, you will receive notice by email or fax. A full refund of paid registration fees will be given or can be transferred to another MAT Group public course within 12 months (date of registration) of equal cost. Please keep our registration and cancellation policies in mind when arranging your travel as MAT Group does not accept liability for any costs incurred for cancellation or change of travel or hotel reservations.



## CONTACT US:

Unit#3, No.26, 3<sup>rd</sup> Alley, Vozara Ave, Tehran  
1513634114 Iran  
Tel/Fax: +9821-88552734  
Tel.: +9821-88553230  
E-mail: [training@matgroup.org](mailto:training@matgroup.org)  
[www.matgroup.org](http://www.matgroup.org)

## 3 Easy Ways to register:

Online: [www.matgroup.org](http://www.matgroup.org)  
Email: [training@matgroup.org](mailto:training@matgroup.org)  
Fax: +9821-88552734