

SGD 2400 for
2
Participants
or More

ROOT CAUSE ANALYSIS FOR **BOILER & STEAM** **CYCLE FAILURES**

12 – 13 MARCH 2018, MANILA, PHILIPPINES

TOPICS COVERED

Review of Steam Cycle
Damage Mechanisms

Steam Cycle Components
and Failure Modes

Collecting Evidence and
Identifying the Failure
Mechanism

Root Cause Analysis
Methods

Sample Case Histories and
Discussion

Expert Course Faculty Leader

James W. Malloy



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About This Training Course

This training course is primarily intended for experienced O&M staff working in thermal power and process plants as well engineering and management staff at the corporate level. The objective is to give attendees all the essentials for effective determination of the root cause of failures that can occur in the boiler or associated steam balance-of-plant. The principal failure modes are reviewed, with focus on those occurring in the boiler, critical piping and other key components such as pressure vessels and condensers.

Major emphasis is placed on analyzing how upstream events in the steam cycle process can lead to failures in downstream components. Several actual failure case histories treated by Tetra Engineering staff at plants around the world are presented, providing attendees with practical application of the presented concepts.

Course Learning Outcome

- Gain an overview of the most common damage mechanisms, either on the waterside or fire/gas/air-side, that can affect components in the steam cycle
- Understand how to define the problem, collect the evidence and then identify the component failure mechanism, which is not the same as the failure root cause.
- Acquire insight into the various root cause analysis methods, their respective merits and how several were applied in some actual case studies

Who Should Attend

Engineers of all disciplines, managers, technicians, design, maintenance and operations personnel, and other technical individuals who need a comprehensive introduction to practical optimization, operation and design considerations of a major combined cycle power plant.

Unique Features with **powerEDGE** Training

- Pre-Course Questionnaire to help us focus on your learning objectives
- Detailed Course & Reference Manual for Continuous Learning and Sharing
- Practical Exercises & Case Examples to better understand the principles
- Limited class size to ensure One-to-One Interactivity
- Assessment at the end of the course to help you develop a Personal Action Plan



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2 Day Course Outline

Review of Steam Cycle Damage Mechanisms

Gain an overview of the most common damage mechanisms, either on the waterside or fire/gas/air-side, that can affect components in the steam cycle

- General Surface Corrosion
- Pitting Corrosion
- Flow Accelerated Corrosion, Cavitation and Fluid Erosion
- Underdeposit Attack
- Fatigue and Corrosion Fatigue
- Creep, Creep Fatigue and other Heat Damage
- Fire or Gas Side Erosion or Attack
- Gas and Waterside Fouling
- Hydrogen Embrittlement
- Stress-Corrosion Cracking

Steam Cycle Components and Failure Modes

A summary of failure modes and mechanisms most frequently observed in various steam cycle components

- Boiler Tubes and Internal Pressure Parts
- Boiler Gas Path and Exterior
- Power Piping (Condensate, Feedwater and Steam)
- Valves and Pumps a (Summary with Focus on Major Items)
- Condensers and Other Heat Exchangers
- Pressure Vessels

Collecting Evidence and Identifying the Failure Mechanism

The key first step is to define the problem, collect the evidence and then identify the component failure mechanism. It's important to remember that this is usually not the same as the failure root cause.

- Defining the Investigation Scope
- Collecting the Field Evidence: Visual, NDE and Destructive Samples
- Process Data Collection
- Overview of Laboratory Analytical Techniques
- Getting the Most Out of Metallurgy
- Effective Reporting

Root Cause Analysis Methods

There are several methods or approaches to determining the root cause, these are presented in summary fashion here as background. Despite their differences, all follow a similar overall strategy and aim to achieve the same goal. Whatever the method chosen, it is important to remember that the ultimate objective is to find a solution that prevents further failures.

- Defining the Investigation Scope
- Collecting the Field Evidence: Visual, NDE and Destructive Samples
- Process Data Collection
- Overview of Laboratory Analytical Techniques
- Getting the Most Out of Metallurgy
- Effective Reporting

Sample Case Histories and Discussion

Examples from recent projects performed by Tetra staff are presented, covering failure analyses on a variety of steam cycle pressure part components

- Steam Turbine Corrosion
- HRSG Casing Vibration
- Superheater Tube Cracking Failure 1
- Superheater Tube Burst Failure
- HRSG LP Evaporator Tube Burst Failure
- Boiler Tube Fouling
- Others.....

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Your Expert Faculty – **James W. Malloy**

James is Principal Engineer and Partner at Tetra Engineering, a leading engineering and inspection consultancy in the thermal power generation sector. Their services assist clients in assuring the performance and integrity of their steam cycle. His areas of specialization are thermal process modeling and analyzing degradation and failure modes in pressure part components. He originally trained and worked as a nuclear engineer and in the machine control sector before joining Tetra in 1991.

CRE S.A., Sophia Antipolis, France

1987-1991

Lead Engineer, worked on the design and development of real-time systems for controlling diesel generators and turbines.

Raytheon Company, Development Laboratory, Sudbury, MA. USA

1983-1987

Performed engineering and analyses to improve the resistance of defense electronic systems to spatial environments and effects of nuclear radiation.

Combustion Engineering Inc., Nuclear Division, Windsor CT. USA

1980-1982

Worked in the reactor physics group designing nuclear fuel reloads for US commercial power reactors



S O U R C E



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	PER PARTICIPANT	2 PARTICIPANTS OR MORE	IN-HOUSE TRAINING
2 Day Programme	SGD 2,600 Per Participant	SGD 2,400 Per Participant	Guaranteed Minimum 40% Off Normal Price

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Name Job title

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Name Job title

Tel Department Email

Name Job title

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