



# TUV / IICS 2.7 API 691 PRACTITIONER (RISK BASED MACHINERY MANAGEMENT)

**COURSE DURATION: 5 DAYS** (4 DAYS TRAINING + 1 DAY EXAM)

## COURSE DESCRIPTION

This course covers the Risk Based Machinery Management and is long-awaited systematic extension of the RBI approach applied on pressure vessels in the machinery area. The course provides the basic RBM framework and goes into details into the methods and tools – methodology toolbox for its implementation.

Further, the course discusses the various maintenance management approaches and provides guides for optimizing decision making considering safety and economic aspects and constraints.

## COURSE OBJECTIVE

The course objective is to enable the participants to master the risk based machinery management process and its implementation toolbox – methods and tools for its implementation.

It will help the participants in the process of decision making under the 4R principle (run, repair, replace, retire) optimizing the safety and economic benefits.

## COURSE OUTLINE

### DAY 1

#### 1) Module 1: RBMM Introduction

- Scope
- Machinery Risk Management
- Limitations
- Work Process Overview
- Normative References
- Terms and Definitions
- Acronyms and Abbreviations
- API Risk Assessment Methodology (Annex A)

#### 2) Module 2: Feasibility and Concept Selection

- Feasibility and Concept Selection
- Introduction
- Technical Risk Categorization
- Technology Readiness Level
- Product Qualification
- API 691 Feasibility and Concept Selection Facility Audit
- Guideline of API 691 Facility Audits (Annex G)

### DAY 2

#### 3) Module 3: Front-end Engineering Design

- Front-end Engineering Design
- Introduction
- Preliminary Machinery Risk Assessment
- Reliability, Availability, and Maintainability Analysis
- Machinery Design and Selection
- Process and Instrument Diagram (P&ID) Reviews
- Long Lead Machinery
- Vendor Qualifications
- Operations, Maintenance, and Facilities Strategies
- Optional Field Testing



#### WHO SHOULD ATTEND?

Refining and Petrochemical Engineers; Maintenance Engineers, Plant Engineers, Maintenance personnel, operations supervisors, and process specialists who are expected to make decisions regarding the suitability of equipment for continued service; Engineers and inspection personnel from the pulp and paper, oil and natural gas, and chemical industries may also find the course beneficial.

A working knowledge of basic equipment and machine is recommended.



#### 4) Module 4: Detailed Design

- Detailed Design
- Introduction
- Detailed Machinery Risk Assessment
- Design Failure Mode and Effects Analysis
- Risk Mitigation-Task Selection Process
- RAM-2 Analysis
- Safe Operating Limits and Integrity Operating Windows
- Qualification of Manufacturing and Design
- Start-up and Commissioning Plans
- Machinery Standard Operating Procedures
- Facilities Completion Planning and Execution
- Implementation of Risk Mitigation Tasks and Strategies

#### 5) Module 5: Installation and Commissioning

- Introduction
- Installation
- Commissioning, Decommissioning, and Decontamination
- Pre-start-up Safety Review
- Optional Tests

#### 6) Module 6: Background toolbox skills (1)

- Risk-based Machinery Validation Checklists (Annex B)
- Machinery Failure Modes, Mechanisms, and Causes (Annex C)

### DAY 3

#### 7) Module 7: Operations and Maintenance

- Field Risk Assessments
- Risk Mitigation
- Operating Company Implementation

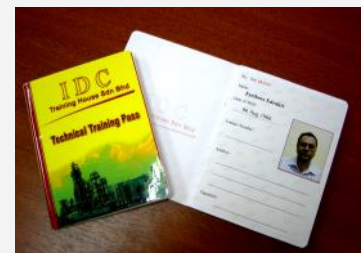
#### 8) Module 8: Documentation and Recordkeeping

- General
- Documentation During Feasibility and Concept Selection
- Documentation During FEED
- Documentation During Detailed Design
- Documentation During Installation and Commissioning
- Documentation During Operations and Maintenance



**BONUS !!!**

**Technical Training Passes will be provided**



**9) Module 9: Training and Qualification**

- Operation and Maintenance Training
- Proof of Qualification

**10) Module 10: Background toolbox skills (2)**

- Guideline on Risk Mitigation Task Selection (Annex D)

**DAY 4**

**11) Module 11: Background toolbox skills (3)**

- Guideline on Condition Monitoring and Diagnostic Systems (Annex E)
- Guideline on Machinery Prognostics (Annex F)
- API 691 Datasheets (Annex H)
- API 691 FMEA Worksheet (Annex I)

**12) Module 12: Repetitorium**

**13) Exam**



**COURSE DURATION**

- 4 days Training + 1 day exam

**DAILY SCHEDULE**

- 8:30am - 5:30pm

**Stationeries such as pen and highlighter will be provided.**





## TRAINER'S PROFILE

# DANIEL BALOS

**MSc in Mechanical Engineering with the specialization in applicative IT and industrial management, PhD in application of data mining techniques on material behaviour modelling for high temperature components.**

Almost 20 years of work in research and industrial projects, as well as training activities especially in risk-based inspections for power plants and refining industry. Participated or led more than 20 EU funded projects, and participated in a number of national projects in the area of material research and education abroad.

In these projects, a vast understanding and knowledge about materials, material degradation mechanisms, inspection methods, risks has been accumulated. Project and risk management skills are proven in numerous projects in last 10 years. Sub-project leader and part of the management team for iNTeg-Risk project (2008-2013).

In the area of RBI, he is active last 15 years, starting with participation in the key EU project in the area – RIMAP (Risk based inspection and maintenance procedures for European industry) – work in development and implementation of RBI approach for power plants, work in CEN CWA 15740 (standardization initiative for RBI in Europe), developed and implemented tools for RBI assessment of refining equipment in various projects.

Participation in the implementation project of RBI for NIS Serbia, EnBW Germany, as well as MOL, Hungary, ESKOM in South Africa, QP in Qatar and SINOPEC in China. Teaching RBI techniques and holding courses in RBI for petrochemical and power industry since 2005, with successful courses delivered in Germany, the Netherlands, Serbia, Romania and China.

