

# Pressure Vessel Inspection, Defect Assessment and Repair



---

4 - 6 May 2015 | Ibis Lagos Airport, Nigeria

---

Partner



**CAPSOURCE**

# CONTENTS

Course Overview	3
About the Course Facilitator	4
Day 1	5
Day 2	7
Day 3	9

## Course Overview

Pressure Vessels has always been an integral part of petroleum, petrochemical and process plants, that operates at a wide range of temperatures and pressures. To ensure its safe operation, its design, operation, and maintenance is strictly regulated through industry codes and standards. The effective maintenance of these pressure vessels is critical not only to ensure uninterrupted plant operation but also to prevent any catastrophic damage to life and property as well.

The areas of Inspection, Defect Assessment and Repair, forms the backbone of pressure vessel maintenance. Hence it requires a high level of execution competency to realize the benefits of minimizing downtime and extending the operating life of this equipment for the plants. This is where experience and expertise needs to be constantly updated, and that is exactly what this master- class aims to deliver.

## Benefits of Attending

- Understand the Codes and Standards for inspection and repairs
- Identify the in-service degradation and damage mechanisms
- Master the inspection process, tools and techniques
- Learn to conduct comprehensive Fitness for Service Assessment
- Grasp the concept of 'Run, Repair or Replace' in decision making

## Why You Should Not Miss This Event

This compact but focused masterclass aims to assist the participants to acquire a sound working knowledge in the areas of pressure vessel inspection, defect assessment and repair techniques. By combining sound engineering principles, applicable code requirements and best practices, a thorough understanding of the concepts and methods presented can be assured. Ultimately the participants will gain practical skills in troubleshooting and improving the pressure vessels to achieve the required level of performance at the lowest life cycle cost. Not to mention, the technical knowledge of participants on pressure vessels will be greatly enhanced, and so does their confidence after attending this workshop.

## Pre-event questionnaire

In order for this workshop to fully benefit you, a pre-course questionnaire will be sent to you in order to test the area where your training needs lies. The results from this questionnaire will ensure that this entire workshop will be delivered at a level that is catering to your needs.

## Workshop Methodology

Highly interactive program with technical discussions, problem-solving exercises and case studies using an experiential learning training approach.

## Partner



General marine and oil Services Ltd (GMO) Rc 228702 is one of the foremost Petroleum and Cargo Inspection Companies in Nigeria. Since inception, GMO has been in the fore front of providing quality services in its core areas of activities which include: Inspection, Laboratory Testing and Quality analysis, Quantity Certification, Calibration Services, EIA, Training and Consultancy Services among others. GMO activities are guided by integrity and professionalism and are executed with the highest professional ethics, by a crop of professional and well trained staff to the satisfaction of our clients and customers. GMO is the one stop vehicle for your business.

Visit GMO at [www.generalmarineoil.com](http://www.generalmarineoil.com).

## About the Course Facilitator

### **Narendra Kumar Roy**

Director

### **Charisma Careers Pvt Ltd**

Narendra is a director on the board of Charisma Careers Pvt. Ltd in Vadodara, India and is also advisor to Charisma Global Networks Ltd. in Auckland, New Zealand. For past 20 years he also served as an advisor to Gramya Research since the inception of the organisation in 1984.

Graduating in Mechanical Engineering at the Bihar Institute of Technology, Sindri, Ranchi University, India in 1966, Narendra completed his Master of Engineering with specialization in Mechanical Machine Design at University of Roorkee; India two years later.

In 1994, he joined Jacobs Engineering (UK/USA) at the Vadodara Regional Office as a Project Engineering Consultant guiding and heading all functions of Project Management and Engineering. Subsequently, he joined Humphreys & Glasgow Consultants Ltd as General Manager. Narendra was the Chief Engineer of Projects & Development India Ltd. under the Project Management Group before joining VXL India Ltd. as the General Manager (Technical). During his stint in VXL, Narendra was responsible for planning and establishing scientific Predictive Maintenance systems and Nondestructive Testing Laboratory. He also helped establish systems for life assessment of pipelines, equipments and boilers including corrosion monitoring.

He has co-authored 3 books on :

- Engineering Manual Of Valves
- Thermal Insulation
- Project Management In Indian Scenario

Additionally, Narendra also has to his credit more than 120 papers published in various national and international technical journals, as well as proceedings of the seminars and conferences with main areas related to pressure vessels, pumps and piping, pipeline designs & Inspection as per ASME and API Code. Narendra is the Honorary Editor of the Journal For Process Equipments & Piping Technology (J-PEP), published by Charisma Careers Pvt. Ltd (Gramya Research Analysis Institute), Vadodara, India.

Up to date, Narendra has conducted numerous trainings on process plant design and inspection for the benefit of engineers and supervisors in Malaysia, India, Oman, Qatar, Indonesia and New Zealand. Under Charisma Global Network Ltd in New Zealand, he frequently conduct trainings and masterclasses on Pressure Vessel Design, Inspection, in-service inspection, defect evaluation, safe life evaluation and related repairs & alterations.

Narendra is a professional member of the American Society of Mechanical Engineers (ASME), American Water Works Association (AWWA), Indian Institute of Metals, Society of Piping Engineers and Designers, USA, Project Management Institute, USA and is listed in Who is Who in the World.

## Module 1

### Introduction to Pressure Vessel Code, Manufacturing Inspections

- Introduction to ASME Boiler & Pressure Vessel Code Sec VIII Div 1
  - Overview of Design
  - Materials
  - Manufacture processes
- Understanding ASME BPVC Inspection requirements:
  - Physical, Dimensional Examination
  - Inspection of Raw materials, Welding Consumables
  - Non-destructive Test of Welds
- Developing Inspection Plans and procedures

## Module 2

### Manufacturing Quality & Defect Assessment

- Quality Assurance /Quality Control Requirements in fabrication and welding
  - Welding Procedure Specification (WPS)
  - Procedure Qualification Record (PQR)
  - Welder Performance Qualification (WPQ)
- Manufacturing & Welding Defects
  - Control of Shell Geometry, Ovality
  - Control of Dished Ends Geometry
  - Identifying Weld Defects:
    - Welding Geometry, Reinforcements
    - Root Penetration
    - Incomplete fusion
    - Cracks
    - Slag Inclusion
    - Porosity

## Module 3

### Main NDT methods and their application

- Liquid Penetrant Testing
  - Process
  - Benefits, Limitations
- Ultrasonic Testing
  - Process
  - Benefits, Limitations
- Radiography
  - Process
  - Benefits, Limitations
- PMI for material Identification
- In-situ Metallography
  - Process
  - Benefits, Limitations

## Module 4

### Pressure Testing

- Hydrostatic testing
  - Code Requirements of Test Pressure
  - Precautions
  - Benefit to Reliability Assessment
- Pneumatic testing
  - Code Requirements of Test Pressure
  - Precautions

## Module 5

### Understanding Pressure Vessel Degradation in Service as per API 571

- Understanding Various Damage Mechanisms Affecting Fixed Equipment in the Process & Refining Industry
  - Caused by process fluids (Chemical reactions) and environmental reasons
  - Caused by elevated temperature
  - Caused by fluctuating loads, Vibrations
  - Caused by due to overloading & improper sizing
  - Caused by low temperature
  - Caused by erosion, abrasion
  - Damages due to Improper material selection

End of Day 1

## Module 6

### Role of Risk Based Inspection (API 580/ 581) to Optimize Inpection

- Discussion on Risks to Vessels in process plants
  - Risks to Vessel due to process environment
  - Risks to vessel components due to service loads
  - Role of material selection to risk mitigation & in limiting failures

## Module 7

### In-Service Inspection as per API 510

- Overview of Inspection as per API 510
- Non- Intrusive Inspections of vessels in service
  - External Visual Inspection
  - Evaluation of maintenance records
  - Thickness survey of vessel components
  - Inspection for Corrosion under Insulation
- Shutdown inspections, Internal Inspection
  - Visual Internal Inspection
  - Thickness survey
  - Inspection for local corrosion and damages
- Wide area corrosion, Erosion
- Corrosion pits
- Cracks
- Stress Corrosion cracks
- Fatigue cracks
- Creep cracks
- Metallurgical deterioration



## Module 8

### Assessment of Corrosion for Safe Remaining Life of Vessels

- Hydrostatic testing
  - Code Requirements of Test Pressure
  - Precautions
  - Benefit to Reliability Assessment
- Pneumatic testing
  - Code Requirements of Test Pressure
  - Precautions
- Reliable assessment of damages due to Corrosion (as per API 510)
  - Remaining Thickness of Components
  - Area of Corrosion
  - Depth of Corrosion Pits
  - Crack size
- Corrosion Rate calculations
  - In-service actual corrosion rate
  - Comparison with design rate
- Remaining Life Calculations for General Corrosion services
  - Calculation for available thickness for corrosion
  - Calculate safe required thickness of vessel till end of service life
  - Estimation for Safe Remaining life of vessel
  - Identifying area and components of vessel which will be at risk to fail first

## Module 9

### Fitness for Service Assessment

- Fitness-for-service (FFS) assessment (API 579)
  - Assess all components of vessel for safe remaining life
- Shell, Head, Nozzles under general corrosion
- Corrosion pits and affected area of vessel components to be analysed if safe
- Cracks in a component of vessel to be assessed if safe against fracture or rupture
- Compile good & safe operating industry practices & guidelines
- Evaluation for Low Temperature Conditions Brittle Fracture Risk
- Evaluation for Fatigue & Creep Conditions
  - Compile or establish fatigue crack growth rate value for the material of vessel
  - Compile or establish creep crack growth rate value for the material of vessel
  - Establish safe remaining life of vessel using fracture mechanics criteria

## Module 10

### Re-rating of Vessel after long operating service

- Assessing Need for Re-rating
- Minimum Required Thickness Determination
- Maximum Allowed Working Pressure Determination
- Recommendation for Re-rating the vessel

## Module 11

### Repairs of Damaged Vessels in service

- Identify Types of Repairs to be recommended
  - Temporary Repairs
  - Permanent Repairs
- Welded Repairs
  - Weld overlay repairs (recommended for smaller areas)
  - Welded Inserts (panel shell inserts, full shell section insert)
  - Reinforcement repair, local strengthening
  - Nozzle Replacement
- Mechanical Repairs
  - Band or strap repair
  - Leak Repairs

## Module 12

### Case Studies

- Discussion on Case Histories on Failures, Inspection & Probable Repairs
  - Caustic Solution Storage Vessel ( Stress Corrosion Cracking, Inspection, Recommended Repairs)
  - Down-comer pipe support bracket attached to vessel failed due to fatigue cracking (Inspection, failure analysis, redesign of bracket support, recommended repairs)
  - Case histories of participants will be invited; scheme for inspection, design evaluation & recommended repairs will be discussed.

## End of Day 3

### Other Relevant Programs by CapSource

- Onshore Pipeline Engineering
- Advanced Contract Negotiation for Oil and Gas
- Above Ground Atmospheric Storage Tanks
- Project Auditing for Oil and Gas
- Practical Pigging Operations
- Pipeline Repair Methods, Hot Tapping, & In-Service Welding

# Delegate Registration Form

<b>PRESSURE VESSEL INSPECTION, DEFECT ASSESSMENT AND REPAIR (LG-TR-ME1511)</b> Lagos, Nigeria 4 May - 6 May, 2015	USD 3,995	REGISTRATION 5 or more USD 3,195 each

Return this signed form to:

**DAUD**  
 Fax : +603 4131 6700  
 Tel : +603 2630 6100  
 Email : daud@capsource.com.my

**1st DELEGATE**

Name: Dr/Mr/Ms \_\_\_\_\_  
 Department & Job Title: \_\_\_\_\_  
 E-mail: \_\_\_\_\_  
 Company: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 \_\_\_\_\_  
 Mobile No: \_\_\_\_\_ Tel: \_\_\_\_\_

**2nd DELEGATE**

Name: Dr/Mr/Ms \_\_\_\_\_  
 Department & Job Title: \_\_\_\_\_  
 E-mail: \_\_\_\_\_  
 Company: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 \_\_\_\_\_  
 Mobile No: \_\_\_\_\_ Tel: \_\_\_\_\_

**3rd DELEGATE**

Name: Dr/Mr/Ms \_\_\_\_\_  
 Department & Job Title: \_\_\_\_\_  
 E-mail: \_\_\_\_\_  
 Company: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 \_\_\_\_\_  
 Mobile No: \_\_\_\_\_ Tel: \_\_\_\_\_

**4th DELEGATE**

Name: Dr/Mr/Ms \_\_\_\_\_  
 Department & Job Title: \_\_\_\_\_  
 E-mail: \_\_\_\_\_  
 Company: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 \_\_\_\_\_  
 Mobile No: \_\_\_\_\_ Tel: \_\_\_\_\_

## AUTHORISATION

I understand and agree to CapSource terms and conditions (Signatory must be authorised to sign on behalf of contracting Organisation)

\_\_\_\_\_  
 Name:  
 Job Title:  
 Date:  
 Direct Line:

**Company Stamp**

## INVOICE DETAILS

Name: \_\_\_\_\_  
 Department & Job Title: \_\_\_\_\_  
 E-mail: \_\_\_\_\_  
 Company: \_\_\_\_\_  
 Direct Line: \_\_\_\_\_

## FINANCE CONTACT DETAILS

Name: \_\_\_\_\_  
 Department & Job Title: \_\_\_\_\_  
 E-mail: \_\_\_\_\_  
 Company: \_\_\_\_\_  
 Direct Line: \_\_\_\_\_

### Terms and Condition

**COPYRIGHT** - All intellectual property rights in all materials produced or distributed by CapSource in connection with this event is expressly reserved and any unauthorised duplication, publication or distribution is prohibited. **DISCLAIMER** - Please note that speakers and topics were confirmed at the time of publishing; however, CapSource may necessitate substitutions, alterations or cancellations of the speakers or topics. As such, CapSource reserves the right to change or cancel any part of its published programme without penalty due to unforeseen circumstances. Any substitutions or alterations will be updated on the website as soon as possible. **DATA POLICY** - The information the Client provides will be safeguarded by CapSource which may be used to keep the Client informed of relevant products and services through letter, phone, fax, email or other electronic means. CapSource will not share this information with other parties unless expressly stated. **TAX NOTE** - The investment fee does not include any taxes (withholding or otherwise). In case of any applicable taxes, the client has to ensure that the taxes are paid on top of the investment fee paid for the course. Compliance with the local tax laws is the responsibility of the client. **CANCELLATION & SUBSTITUTIONS POLICY**

- A replacement participant is always welcomed at no additional charge.
- For cancellations received in writing more than seven (7) days prior to the conference, the participant is entitled to pay full amount (100%) stated on the invoice and it will receive Credit Voucher that can be used in any of upcoming trainings by Capsoure within one year form the date of issuance.
- For cancellations received in writing seven (7) days or less prior to an event (including day 7), participant is entitled to pay full amount (100%) stated on the invoice with no Credit Voucher issued, however the delegate will still be entitled to a complete set of course documentation.

In the event that CapSource cancels or postpones an event due to circumstances beyond its control, participants' payments at the date of cancellation or postponement will be credited to a future-scheduled CapSource event within one year from the date of issuance. Should the event be cancelled due to an act of terrorism, fortuitous events, extreme weather conditions, industrial action, or any reasons beyond management control, CapSource shall endeavour to reschedule, but the client hereby indemnifies and holds CapSource harmless from and against any and all costs including airfare, hotel and other costs, damages and expenses, including attorney fees.