

## **MR22 - Tanks & Tank Farms - Design, Operation and Maintenance**

### **Course Overview**

Storage tanks play an important role in the hydrocarbon processing industry whether they are part of a refinery, a chemical plant or a marketing depot. They constitute a huge investment and failure to maintain them could result in major losses due to loss of income and penalties due to environmental regulations.

### **Scope**

The scope of the course is to covers all aspects of the lifecycle of storage tanks and tank farms from design, construction, inspection and maintenance.

### **Course objectives**

The course will provide participants with both the theoretical and practical knowledge to:

- Distinguish function of structural parts and fittings of storage tanks
- Explain design and operational aspects of storage tanks
- Set up inspection and maintenance schedules
- Get acquainted with erection methods
- Get familiar with modern maintenance methods
- Learn the basics of tank farm design and operation

### **Who should attend:**

The course is suitable for Storage Tank Operators, Inspectors, Engineers, HSE Officers,

Supervisors and Technicians involved with storage tank operation, maintenance and inspection.

### **Training Methodology:**

The course material will be covered with lectures, presentations, videos, instructor led discussions, exercises and real-life case studies.

### **Course instructor:** Mr. George Loizou

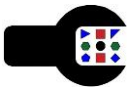
George is a Mechanical Engineer with more than 35 years of experience mainly in the Oil and Gas Industry. George holds an MSc Degree from The Pennsylvania State University. He is a member of SMRP and a Certified Maintenance and Reliability Professional (CMRP), Certified trainer by the Human Resources Development Authority of Cyprus (EU), member of the Cyprus Scientific and Technical Chamber and Associated member of the Institution of Mechanical Engineers of UK.

George worked as Head of Mechanical Maintenance at the Cyprus Petroleum Refinery Ltd, Engineering Manager and Terminal Manager at Cyprus Petroleum Storage Company Ltd.

He has a wide experience as a trainer, as since 2005 he has been delivering courses and seminars internationally.

**Duration:** 5 Days

**Course Venue:** TBA



**Day 1**

**Pre-Test**

**1 Introduction**

Storage tank standards, Liquid Classification, Tank Types, Tank Selection

**2 Storage Tank Components**

Free Vents, Pressure Vacuum Valves / Breather Valves, Flame arresters, Dip hatch, Dip Plate, Floating suctions, Stairways, handrails, Shell nozzles for inlet and outlet, Drainage arrangements (centre drains or side drains), Firefighting facilities, Earthing bosses, Instrumentation, Heating coils, Suction heaters, Side-entry mixers, Special fittings and accessories for floating roof tanks, Supporting legs, Gauge Hatch, Roof drains, Access Hatch, Access ladder to the roof, Earthing, Automatic bleeder vents, Rim vents for metallic shoe type seals, Guide and level gauge pole, Wind girder, Staircases - elevated gauger's platform, Overflow Roof Drain, Internal Floating Roof Tank seals

**3 Operational Considerations**

Facts related to capacity, Tank Gauging, Tank Gauging Systems, Stock Accounting, Leak Control and reconciliation, Custody Transfer, Oil Movements and Operations, Basic Terms, Gauges – Instrumentation, Quality Assessment in Tank Gauging, Future Trends in Tank Gauging, Level Alarms

**4 Materials of Construction**

Plates, Structural Shapes, Pipes and couplings, Flanges, Bolts

**5 Welding**

Responsibilities for manufacturer, Electrodes, Recommendations for welding, Welding Procedure Specification, Procedure Qualification Record, Welder's Performance Qualification, Welding Positions per ASME, Storage Tank Welding Details, Welding Defects

**6 Non-Destructive Testing (NDT)**

Visual inspection, Magnetic testing, Penetrant testing, Radiography, Ultrasonic testing, Vacuum box testing, Coating/lining inspection, Hydrotest, New Developments in NDT

**Day 2 7 Mechanical Design**

Storage Tank Loads, Bottom Plates, Water Drawoff Sumps, Shell Plates, Shell thickness calculation according to the 1-foot method, Shell thickness calculation according to the Variable Design Point method, Shell Openings, Venting, Top and Intermediate stiffening rings, Intermediate stiffening rings, Roofs, Frangible Roof, Design of tanks for small internal pressures (Annex F of API 650), Wind Load on Tanks

**8 Tank erection**

Bottom Plates, Shell erection, Roofs

**9 Inspection and Testing**

Visual Inspection, Radiographic inspection, Tank bottom inspection, Tank shell inspection, Hydrostatic testing procedure, Fixed roofs, Floating roofs, Dimensional Tolerances

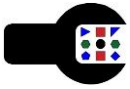
**Day 3 10 Venting Atmospheric and Low-Pressure Storage Tanks**

Basic Terms, Liquid Movement Into or Out of a Tank, Weather Changes, Fire Exposure, Causes of Overpressure or Vacuum, Determination of Venting Requirements, Alternative calculation of normal venting requirements (old method), Types of Vents, Installation of vents, Vent inspection and maintenance, Materials of Construction, Marking of Venting Devices

**11 Tank Foundations**

Codes and Standards, Soil Investigations, Environmental baseline survey, Important Elements to Consider in Foundation Design, Tank Foundation Types, Leak detection systems

**12 Aluminium Dome Roofs**



- 13 Fire Protection of Tanks**  
The fire water distribution system, Storage Tank Protection
- 14 Planning Bulk Depots**  
Design and construction, Secondary Containment (Bunding), Minimum Safety Distances, Other Considerations
- Day 4 15 Tank Emissions**  
Emission calculations, Floating Roof Tank Improvements, Roof Drain system improvements.
- 16 Corrosion**  
Definition, Corrosion in storage tanks, Corrosion control and prevention, Specific Storage tank corrosion service problems, Basic Types of lining, Maintenance painting, Surface Preparation, Economic considerations, Cathodic Protection, Sacrificial system, Impressed Current Anodes, Monitoring and Maintenance of CP Systems, Electrical Isolation, Prevention of water ingress underneath bottom
- 17 Tank Inspection, Repair, Alteration and Reconstruction**  
Inspection Standards, Safe working practices, Suitability for Service, Tank roof evaluation, Minimum Thickness Calculation for Welded Tank Shell, Distortions, Flaws, Wind Girders and Shell Stiffeners, Shell Welds, Shell Penetrations, Tank bottom evaluation, Tank foundation evaluation, Foundation Repair or Replacement, Inspection Records, Recommended Inspection frequencies per EEMUA 159
- 18 Tank Preparation for Inspection**  
Trends towards inspection, Considerations at design stage, Inspection planning, Tank Cleaning and Gas freeing, Safety considerations
- Day 5 19 Tank Repairs**  
Bottom repairs, Shell repairs, Fixed roof repairs, Floating roof repairs, Drain replacement, Seal replacement, Rolling ladder repair/replacement
- 20 Foundation Repairs**  
Even (uniform) settlement, Tank Shell Settlement into the Foundation, Difference in soil settlement between centre and periphery of the tank, Uneven soil settlement, Edge settlement, Tank pad shoulder with insufficient width or poor construction quality, Planar tilt, Maximum tolerances and limits for settlement and out-of-verticality of tank shell
- 21 Floating roof designs**  
Single deck, pontoon, Top decks of double-deck roofs
- 22 Roof seals**  
Allowable Gap Dimensions between Seal and Tank Shell, Rim Seal Materials, Seal Replacement
- 23 Guidelines for the operation of floating roofs**  
Before the Roof is taken into Service, During the First Month of Operation, During Operation, Before Landing the Roof, Roof Standing on its Supports, Recommended Filling Rates for Floating, Roof Tanks, Ballooning of Single-Deck Floating Roof
- 24 Case studies**  
Buncefield and CAPECO accidents
- Final Test**