COURSE OVERVIEW PE0503
Water Treatment - Advanced

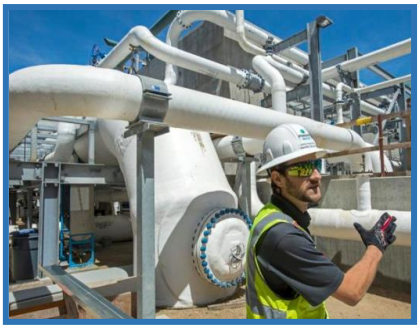
Course Title
Water Treatment - Advanced (E-Learning Module)

Course Reference
PE0503

Course Format & Compatibility
SCORM 1.2. Compatible with IE11, MS-Edge, Google Chrome, Windows, Linux, Unix, Android, IOS, iPadOS, macOS, iPhone, iPad & HarmonyOS (Huawei)

Course Duration
30 online contact hours
(3.0 CEUs/30 PDHs)

Course Description



This E-Learning course is designed to provide participants with a detailed and up-to-date overview of advanced water treatment. It covers the engineering drawing, block diagram, process flow diagram, piping & instrumentation diagram and legends and symbols; the reading of PFD & P&ID; the filtration, media loading sequence, removal of dissolved mater, operating principle and the operation of valves, oil recovery, level gauge and regulator and ICP; the motor driven induced gas flotation system, ion exchange resins, cooling water treatment and cooling system characteristics; and the corrosion control, microbiological control, fouling, boiler water treatment, boiler classification and water quality monitoring.

Further, the course will also discuss the surface handling treatment and identify the types of oil in water mixtures, emulsion and the factors affecting stability; the water clarification processes, parallel plate separation process, reservoir souring, biocide treatment method and wastewater treatment and reuse; the common waste water contaminates including the typical chemical treatment for contaminant removal; the biological treatment, sludge treatment, control valve sizing, pigging operation and evaluation of coagulants; and the analytical methods, corrosion inhibitors selection, corrosion control, stream testing and guidelines for inhibitor selection.

During this interactive course, participants will learn the corrosion monitoring techniques, screening tests and prevention of galvanic corrosion; the hazard identification (HAZID), risk assessment techniques, inspection methods, pipeline integrity management and pipeline inspection and repairs; the corrosion management, modification management, flow assurance, common maintenance strategy, equipment planning and maintenance management; the integrity management, continuous treatment, initial film establishment, corrosion inhibitors selection and corrosion control; the guidelines for inhibitor selection, corrosion failure analysis, the effects of bacteria on drilling fluid properties and the factors affecting the rate of scale formation; managing carbonate scale; selecting scale inhibitors and preventing scale formation and scale removal; and the downhole injection methods, coiled tubing, cleaning pigs, hydrostatic testing, manual handling, hazard identification, process safety management and application of rupture disks.

Course Objectives

At the end of this course, the Trainee will be able to:-

- Apply and gain an advanced knowledge on water treatment
- Explain the main purpose and function of water treatment facilities (sea water treatment process (SWTP), effluent water disposal and injection (EWDP) including water pressure maintenance plant (WPMP), water injection plant (MWIP), central injection pumping facility (CIPF), new water centre (NWC), etc.)
- Describe the operational modes and capacities for each facility and associated systems
- Describe process flow of each facility using PIDs (piping and instrument diagrams)
- Describe the basic control and protection systems applied in water treatment facilities
- Explain basic process parameters and variables (flow, level, pressure and temperature)
- Describe the requirements of water treatment facility operational procedures and standards for normal operations, equipment checks, monitoring, controlling, adjusting, starting, stopping and troubleshooting
- Identify the requirements for equipment and systems to carry out handover (preparation) for maintenance and reinstatement (return to service) after maintenance
- Illustrate engineering drawing, block diagram, process flow diagram, piping & instrumentation diagram and legends and symbols
- Read PFD & P&ID as well as apply filtration, media loading sequence, removal of dissolved mater, operating principle and the operation of valves, oil recovery, level gauge and regulator and ICP
- Recognize motor driven induced gas flotation system, ion exchange resins, cooling water treatment and cooling system characteristics
- Carryout corrosion control, microbiological control, fouling, boiler water treatment, boiler classification and water quality monitoring
- Employ surface handling treatment and identify the types of oil in water mixtures, emulsion and the factors affecting stability

- Apply water clarification processes, parallel plate separation process, reservoir souring, biocide treatment method and wastewater treatment and reuse
- Identify the common waste water contaminates including the typical chemical treatment for contaminant removal
- Carryout biological treatment, sludge treatment, control valve sizing, pigging operation and evaluation of coagulants
- Apply analytical methods, corrosion inhibitors selection, corrosion control, stream testing and guidelines for inhibitor selection
- Employ corrosion monitoring techniques, screening tests and prevention of galvanic corrosion
- Carryout hazard identification (HAZID), risk assessment techniques, inspection methods, pipeline integrity management and pipeline inspection and repairs
- Apply corrosion management, modification management, flow assurance, common maintenance strategy, equipment planning and maintenance management
- Carryout integrity management, continuous treatment, initial film establishment, corrosion inhibitors selection and corrosion control
- Discuss the guidelines for inhibitor selection, corrosion failure analysis, the effects of bacteria on drilling fluid properties and the factors affecting the rate of scale formation
- Manage carbonate scale, select scale inhibitors and prevent scale formation and scale removal
- Perform downhole injection methods, coiled tubing, cleaning pigs, hydrostatic testing, manual handling, hazard identification, process safety management and application of rupture disks
- Discuss operator basics, logsheet readings, valve recognition, lubrication and troubleshooting
- Determine passing relief valves, first failure recognition, insulation, rotating equipment, pumps, centrifugal, cavitation/priming, positive displacement and pump seals
- Identify instruments, air failure, line up instrument air, stroke checking a control valve and putting a control valve on bypass
- Check a pressure gauge and differential pressure (DP) cell as well as apply level measurement, temperature measurement, pressure measurement and flow measurement
- Perform minor maintenance, pressure rating, tightening a leaking gland and flange, opening a flange and re-gasketing a flange
- Clean a pump suction strainer and discuss reservoir souring, water flood function, water flood system and water flood plant major equipment
- Recognize lifting pumps, chlorinator unit, strainers, clarifier, sand filter, clearwall pumps, de-aerator and gas stripping
- Describe vacuum de-aeration, chemical removal of oxygen, discharge pump, injection pump, waterflood plant chemical treatment, waterflood plant injection water quality and key considerations for success

Who Should Attend

This course provides an advanced overview of water treatment for utility managers, mechanical engineers, civil engineers, water engineers, engineering managers, design consultants, utility managers, superintendents, supervisors and other senior technical staff.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course.

Certificate Accreditations

Certificates are accredited by the following international accreditation organizations: -

- USA International Association for Continuing Education and Training (IACET)

  Haward Technology is an Authorized Training Provider by the International Association for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 1-2013 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 1-2013 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Association for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

Training Methodology

This Trainee-centered course includes the following training methodologies:-

- Talking presentation Slides (ppt with audio)
- Simulation & Animation
- Exercises
- Videos
- Case Studies
- Gamification (learning through games)
- Quizzes, Pre-test & Post-test

Every section/module of the course ends up with a Quiz which must be passed by the trainee in order to move to the next section/module. A Post-test at the end of the course must be passed in order to get the online accredited certificate.

Course Fee

As per proposal

Course Contents

- P&IDs & PFDs
- Introduction to Engineering drawing
- Block Diagram
- Process Flow Diagram
- Piping & Instrumentation Diagram
- Legends and Symbols
- Reading PFD & P&ID
- Engineering drawing
- Filtration
- Dual Flow Filter
- Media Loading
- Acceptance of the System
- Media Loading Sequence
- Typical Dual Media Filter
- Typical Disposable Filter Cartridges
- Diatomaceous Earth Filtration
- Common Types of Filters
- Removal of Dissolved Mater

- Silt Density Index (SDI)
- Statistical Process control
- Operating Principle
- Main Structures
- Vessel
- General Arrangement Diagram
- Control Principle
- Electrical
- Instrumentation
- Operation
- Operation of Pneumatic Ball Valves
- Operation of Oil Recovery channel
- Operation of Level Gauge and Regulator
- Operation of LCP
- Precautions
- Flotation
- Two major types
- Induced Air Flotation (IAF)
- Motor Driven Induced Gas Flotation System
- Induced Air Flotation (IAF)
- Static Induced Gas Flotation System
- Dissolved Air Flotation (DAF)
- Nozzle air TM flotation cell
- Nozzle type four cell gas flotation cell
- Typical Centrifuge
- Hydrocylone principles of operation
- Typical deoiling hydrocyclone
- Operating Principle
- P&ID
- Main Structures
- Vessel
- General Arrangement Diagram
- Control Principle

- Operation
- Operation of Pneumatic Ball Valves
- Operation of Oil Recovery channel
- Operation of Level Gauge and Regulator
- Operation of LCP
- Precautions
- Zeolites
- Classifications of Ion Exchange Resins
- Sodium Zeolite Softening
- Principles of Zeolite Softening
- Softener Operation
- Sodium Zeolite Softener
- Softener Backwash
- Brining
- Slow Rinse
- Fast Rinse
- Cooling Water Treatment
- Cooling System Characteristics
- Evaporating losses
- Windage loss
- Blow down
- Makeup Water
- Cooling water treatment objectives
- Scale Prevention
- Pretreatment of Make up Water
- Corrosion control
- Microbiological control
- Fouling
- Boiler Water Treatment
- Boiler Classification
- Boiler Feed Water Treatment
- Boiler Blow Down
- Condensate Return Systems

- Water Quality
- Economic Perspectives
- water flooding
- Produced water injection
- Ideal water for flooding
- Water Quality Monitoring
- Surface Handling Treatment: Process Investigation And Water Optimization Strategies
- Why De-oil Separated Water?
- Environmental Discharge Limits
- Types of oil in water mixtures
- Reverse Emulsions
- Definition
- Emulsion Types
- Reverse Emulsion
- Factors Affecting Stability
- Ionic Charge
- Droplet size and density
- Stokes' Law
- Droplet Size Distribution
- Droplet Size
- Typical Droplet Sizes
- Droplet / Particle Analysers
- How does it work?
- Droplets v. Particles
- Water pH and ionic strength
- Temperature
- Principles of Water Treatment
- Water Clarification Mechanisms
- Reverse Emulsion Breakers
- Reverse Demulsifiers
- Cationic Polymers
- Coagulation using cationic polymer
- Anionic and Non-ionic polymers

- Inorganic Metal Salts
- Chemical Treatment Range
- Produced Water Treatment Equipment
- Water Clarification Processes
- Skimmer Vessels
- API Separator
- API/ Gravity Separators
- Skim Pile
- 'Subfloat' – Skim Pile with Flotation
- Skim and Vortex Tanks
- Horizontal Skim Vessel
- Parallel Plate Separation Process
- PPI Separator (Parallel Plate Interceptor)
- Corrugated Parallel Plates
- Oil Coalescence in TPS
- Oil Separation in TPS
- Corrugated Plate Interceptor (CPI)
- Downflow Plate Separator
- Cut-away of CPS Unit
- TPI / CPI Separators
- Source Of Water
- Common Source Of Water
- Ground Water
- Surface Water (Rains, Rivers, Sea Water)
- The Nature of water
- Osmotic Equilibrium
- Reverse Osmosis
- Main Difference Between Surface and Underground Water
- The Nature of water
- Reservoir Souring
- Definition
- Why do some reservoirs go sour?
- Is your reservoir really going sour?

- The answers
- A Common Myth
- The UKCS Thistle Field
- Understanding the Problem
- Souring Map
- Mitigation Options
- Microbiological Control – Hypochlorite Treatment
- Residual Free Chlorine
- Chemical Reactions in Hypochlorite Generating Cell
- Effect of pH on the Concentration of Hypochlorous
- Effect of pH on the Concentration of Hypochlorous Acid
- Biocide Application
- Biocide Treatment Method
- Microbiological Control – Types of Biocides
- Microbiological Control – Mode of Action of Biocides
- Wastewater Treatment & Reuse
- Common Waste Water Contaminates
- Typical Chemical Treatment for Contaminant Removal
- Gravity Sedimentation
- Parts of an Up Flow Clarifier
- Settling Modes
- " V "- Notched Weir and Flume "
- Skimmer and Scum Trough
- Clarifier Design
- Laboratory Evaluation of Coagulants
- Stabilizer and Clarifier for Raw Water Treatment
- Radial Flow Clarifier Schematic
- Sources of water
- Distribution of Water on earth
- The Water Cycle
- Physical & Chemical properties
- Physical & Chemical properties of Water
- Water Chemistry & Water Analysis

- Ras Shukeir District
- Water Flood Div.
- Water Flood
- Water Flood Function
- Water Flood system include
- Gulf of Suez Waterflooding Facilities
- Morgan Water Flood Plant Major Equipment
- 1-Lifting Pumps
- 2-Chlorinator unit
- 3-Strainers
- 4-Clarifier
- 5-Sand filter
- Sand filter Media
- 6-Clearwall pumps
- 8-De-aerators
- A-Gas Stripping
- B-Vacuum De-aeration
- Chemical Removal of Oxygen
- 9-Discharge Pump
- 10-Injection pump
- Morgan Waterflood Plant Chemical Treatment
- Morgan Waterflood Plant Injection Water Quality
- Key Considerations for Success
- Nitrite Ed – Souring Technology
- Why Reservoir Souring?
- Consequences Of Reservoir Souring
- Conventional Treatments & Limitations
- Nitrite / Nitrate Technology
- Effect of Nitrite Addition in an Oil Dehydrator
- Effect of Nitrite Treatment in a Gas Well
- Effect of Nitrite Squeeze Treatment in an Oil Well
- Biocide vs. Nitrite
- Conclusions

- Water Treatment
- Raw Water Contaminants
- Common Impurities Found In Water
- Water Treatment Overview
- Water Treatment Processes
- Water Treatment Path
- Process Description
- Waste Water Unit
- Pretreatment
- Schematic of AC.P.I. Showing Flow Pattern
- Secondary De-Oiling
- Full-Stream Pressurization
- Split-Stream Partial Pressurization
- Partial Recycle
- Impeller-Educator System
- Four Stage Dispersed Gas Floatation Cell
- Design Parameters
- Factors Affecting (DAF) Design:
- Biological Treatment
- Nitrification
- Denitrification
- Effect of Temperature
- Toxicity
- Sludge Treatment
- Thickening
- Dewatering
- Equalization
- Neutralization
- Biological Treatment
- Upstream Process Engineering Course
- Ball/Plug Valves
- Gate Valves
- Butterfly Valves

- Globe Valve
- Control Valves
- Control Valve Characteristics
- Control Valve Trims
- Control Valve Design
- Pressure Profile
- Control Valve Sizing - Fisher Method
- Control Valve Sizing - Valtek Method
- Allowable Pressure Drop
- Choke Valves
- Process Control
- Summary of Control Modes
- Measurement and Control
- Level
- Level - Magnetic/Differential Pressure
- Level - Float/Displacer
- Level - Gamma/Density Profiler
- Level -Tuning Frequency/Capacitance-RF Admittance/Radar
- Level - Ultrasonic/Bubbler
- Temperature
- Flow
- Flow - Turbine Meter
- Flow - Orifice Installation
- Flow -Ultrasonics
- Pressure
- Split Range Control
- Three Phase Separator Control
- Separator Level Control
- Separator Pressure Control
- Centrifugal Compressor Control
- Instrument Fittings
- The P&I Diagram
- Control System Architecture

- Pigging
- Pigging History
- Uses & Types of PIG
- Pig Launchers and Receivers
- Pigging Operation
- Water properties/contamination
- Main water problems
- The different water sources for water injection
- Required treatment for water injection
- Chemicals for water injection (raw river water)
- Chemicals for water injection
- Laboratory Training
- Chemical Additives
- Introduction
- Objectives
- Methodology
- Coagulants
- Inorganic Coagulants
- Aluminium Sulphate
- Ferric Chloride
- Ferric Sulphate
- Ferrous Sulphate
- Lime
- Polyelectrolytes
- Evaluation Of Coagulants
- Ensuring Consistent Coagulant Quality
- Analytical Methods: Dosage Tests
- Standard Jar Test
- Cascade Test
- Analytical Methods: Polyelectrolyte Tests
- Ph Of A Polymeric Coagulant Solution
- Measuring The Density Of Polymeric Coagulants
- Viscosity For Polymeric Cationic Coagulants

- Total Solids Of A Polymeric Coagulant Solution
- Analytical Methods: Inorganic Coagulants
- Density Of Commercial Aluminium Sulphate Solution
- Basicity Or Free Acid Of Commercial Aluminium Sulphate Solution
- Water-Insoluble Matter Of Dry And Liquid Alum
- Coagulant Aids
- Polyacrylamides
- Bulk Denisty Of Polyacrylamide
- Bulk Viscosity Of Polyacrylamide
- Disinfectants
- Analytical Methods
- Chlorine
- Corrosion mechanism
- Atmospheric corrosion
- Form of Corrosion
- Uniform corrosion
- Pitting corrosion
- Galvanized corrosion
- Erosion corrosion
- Cavitation corrosion
- Fretting corrosion
- Inter – Granular corrosion
- Exfoliation corrosion
- De-alloying or selective leaching
- Stress corrosion cracking (SCC)
- Corrosion of the metal
- Corrosion of Alloy
- Corrosion in soil
- Corrosion inspection and monitoring
- Corrosion Control Chemicals
- Theory of Corrosion
- Electromotive Force Series for Metals
- Corrosion Inhibitors

- Amine Fatty Acid
- Definitions
- Anodic Inhibitors
- Non-Oxidizing Inhibitors
- Cathodic Inhibitors
- Organic Inhibitors
- Corrosion Inhibitors Selection
- Corrosion Control
- The Advantages of Side – Stream Testing
- Guidelines for Inhibitor Selection
- Selection of Corrosion Inhibitors
- Inhibitor Application
- Flowing Well Downhole Injection Valve (Courtesy NACE)
- Flowing Well Concentric Kill String
- Measuring and Monitoring Corrosion
- Corrosion Monitoring Techniques
- Desirable Properties of a Corrosion Inhibitor
- Continuous Treatment
- Initial Film Establishment
- The Protective Film Slow the Corrosion Process
- Factors Involved in Inhibitors Selection
- Screening Tests
- Static and Wheel Tests
- How Does Corrosion Effect on our life
- Corrosion Definitions
- What Is Corrosion?
- Corrosion In Petroleum Production
- Theory Of Corrosion
- Electromotive Force Series For Metals
- The Corrosion Cell
- Potential
- Galvanic Series
- Four Parts Of Corrosion Cell

- Corrosion Cell
- Corrosion Battery (Lead Acid Cell)
- Factors Influencing Corrosion
- How Corrosion Occurs
- How To Control Corrosion
- How Fast Will Corrosion Occur?
- The Variation Of Corrosion Rate With Ph
- Velocity Phenomena
- Corrosion Failure Analysis Erosion Corrosion
- Prevention Of Erosion Corrosion
- Types of Corrosion
- General Corrosion
- Galvanic Attack
- Galvanic Series
- Prevention Of Galvanic Corrosion
- Case Study
- Problem Symptom
- Remedial Action
- Material Comparison
- Pitting Corrosion
- Crevice Corrosion
- Localised Attack
- Inter granular Corrosion
- Intergranular Attack Weld decay
- Intergranular Attack
- Corrosion Failure Analysis Hydrogen Sulfide Corrosion
- SSCC Mechanism
- Sulfide Stress Corr. Cracking (SSCC)
- SSCC Decision Criteria
- Stress Corrosion Cracking
- Corrosion Failure Analysis Oxygen Corrosion
- Prevention of Oxygen Corrosion
- Corrosion Failure Analysis Carbon Dioxide Corrosion

- Refinery Corrosion
- What We Are Trying to Prevent – Failures!
- Low Temperature Corrosion - CUI Emphasis
- Stress Corrosion Cracking
- High Temperature Corrosion – Sulfidic, Naphthenic, etc.
- Weld Overlay Disbonding – Shutdown Concern
- Process Control & Corrosion
- CUI Corrosion at Whiting Refinery
- Corrosion Under Insulation
- The Role of Insulation
- An Oxygen Concentration Cell on a Wet Surface
- Examples of CUI & Underground Corrosion
- Icicle Safety Hazard
- Vessel Pitted Through from OD and Air Was
- Sucked as The Vacuum Tower Operated
- Soil-Air Interface Corrosion
- VRU 100/200 Underground Corrosion
- Underground Corrosion
- Aspects of Underground Corrosion
- CUI Checklist for Identifying CUI
- CUI Checklist
- General Procedure to Determine Corrosivity of Oil Wells
- Management & Monitoring
- Corrosion Monitoring
- Inspection, Survey, and Monitoring
- Corrosion Surveillance
- Corrosion Monitoring Philosophy
- Corrosion Monitoring Techniques
- Corrosion Monitoring
- Generic Riser Repair Procedure
- Integrity Management
- Course overview
- Definition

- Longford pre-course study
- BP Integrity Management Standard
- 3-year PSIM Rolling Action Plans
- IM Objectives in E & P
- North Sea pig launcher HIPO
- Root Causes of Integrity Incidents
- E&P IM Performance
- Hazard Evaluation
- Disasters and regulations
- Ship and rig collision hazards
- Unsafe spacing of storage tanks
- BP storage tank fire video
- Tank farm fire
- Hazards of lightning
- Hurricane damage
- Hazard Evaluation: key concepts
- Hazard barrier diagram
- Recognizing hazards
- What are we trying to avoid?
- Hazard barrier diagram
- Major accident consequences
- Hazard identification (HAZID)
- Risk assessment techniques
- Major Hazard Risk Matrix
- BP Trinidad MAHA matrix
- Typical 30-year old platform design
- October major hazard risk matrix
- ALARP
- Quantitative risk assessment
- Individual Fatality Statistics (Egypt)
- Which is safer?
- Modern vehicle safety features
- Which is inherently safer?

- Inherent safety design concepts
- Inherent safety concepts offshore
- Inherently safer design: Tangguh
- Corrosion resistant well flowlines
- Tangguh platform individual risks
- Gupco rehabilitation project
- Stages of safety
- Hierarchy of Risk Reduction
- Hazard Identification – Application
- Why Analyze Risk?
- Analyzing Risk
- Reducing Risk
- Document
- What's the purpose?
- Risk Tools Pyramid
- Major Accident Hazards
- Process Tools
- Selecting a Tool vs. Project Stage
- Risk Summary
- Safety Critical Equipment
- The Longford Plant Fire
- Lessons from Longford
- PSIM "Minimum Requirements" Hazard Evaluation
- Mechanical Integrity
- Mechanical Integrity-Definition
- Brittle fracture on hydrostatic test
- Mechanical damage to BP pipeline
- Longford exchanger: brittle fracture
- Rig collision damage on BP Platform
- Cracking at K-node of platform jacket
- BP heat exchanger, brittle fracture
- TransCanada gas line rupture
- BP Harding Gas Lift Manifold

- Corrosion at piping support, BP site
- Collapse of LPG storage sphere
- Structural collapse of water tank
- Well blow-out
- Management of mechanical integrity
- Integrity management process
- Assurance in Design
- Assurance in Contractors
- Assurance in Materials
- Assurance in Operations
- Assurance in Maintenance
- Assurance in Decommissioning
- Inspection Methods – General
- Why Inspect?
- Inspection Methods
- Destructive vs. Nondestructive
- Mandatory Inspections/Tests
- Inspection Selection
- Team exercise: inspection plans
- Causes of leaks
- Never happened in history?
- Pipeline Integrity Management
- Operations & Safety Systems
- Pipeline Inspection and Repairs
- Corrosion Management
- Modification Management
- Flow Assurance
- Common Maintenance Strategy
- Equipment Planning
- Reliability Objectives
- Components
- CMS Process
- Maintenance Management

- Plan Content
- Failure Analysis
- Failure Analysis Results
- Performance Measures
- Tool Box
- Lessons from Longford
- Protective Systems
- Layers of protective barriers
- Protective Systems - key concepts
- Safety-Related Devices (pressure)
- Upkeep & Readiness
- Performance Indicators
- Process alarms / trips: the first barriers
- Example safety instrumented function
- Safety Integrity Levels (SIL)
- PSVs: the last overpressure barriers
- Lock-open / lock-close valves: SCE
- Pipeline ESDV on 30 yr old BP platform
- Storage tank overpressure
- Vacuum collapse of storage tank
- Roof vent blocked by plastic sheet
- “EX” boxes to avoid ignition source (!!)
- Forties Alpha and EX fittings
- WJ Junction Box Inspections
- Control of hot work..a “protective system”
- Cold work to avoid ignition source
- Wellhead bay deluge testing
- Evacuation / survival equipment is SCE
- Types of protective devices
- Hierarchy of Protective Systems
- Protective systems
- Toilet explosion!! (Feb 2004)
- “Layers of protection” on a storage tank

- Ashland tank disaster, 1988
- Tank containment: team exercise
- Avoiding an “Ashland”
- PSIM “Minimum Requirements” Protective Systems
- Management of Change
- MOC – Scope
- Typical MOC procedure
- Management Of Change Considerations
- Temporary Changes
- Emergency Change
- Technical Authority (TA)
- Technical Authority
- Change Creep
- Summary
- Flixborough Case Study
- Overview of the Incident
- Process Description
- Reactor Connections
- Events Leading to the Explosion
- The Explosion
- One Theory
- Investigation Inquiry
- Lessons from Longford
- The IM Incident and Learning Pyramid
- Lessons from Longford
- Emergency Response
- Hierarchy of Risk Reduction
- Minimum Requirements
- Lessons from Longford
- PSIM Performance Metrics
- IM Scorecard
- Integrity Management
- The new IM Standard

- Competent Personnel
- Engineering Authorities: key roles
- Element 6: Incident Investigation
- High reliability organisations
- Element 8: Performance Mgt and Assurance
- The IM Matrix
- The Integrity Management “Journey’’ to become the Great Operator
- Self-verification
- BUL and PUL support for IM
- Gupco IM risk matrix
- IM Competency Development
- Competency-on-Line for IM
- COMAH accidents, Apr 2000-Mar 2001
- COMAH accidents, Apr 2001-Mar 2002
- Major IM Legislation in UK & US
- Link Between GHSER and PSIM
- Ship collision
- Earthquake
- Tangguh Platform Inherent Safety Goals
- Distribution of hazards – offshore
- BP Grangemouth 1987
- Gas Injection Pipework (170 bar)
- Corrosion Control System
- Management of Corrosion Under Insulation
- Individual risk summary – Cassia
- Cassia: process accident risks
- Cassia: riser accident risks
- Causes of pipeline / riser failures
- Pipeline / riser adjustment factors
- Inherent safety of risers
- bpTT: major accident scenarios
- Can you see anything wrong?
- Canada Gas BU

- TNK-BP: long term delivery risk matrix
- TNK-BP: typical pipeline manifold leak
- Training
- Competence Components
- Competence Levels
- Competence Management
- Key IM Competence
- Java PU Risk Matrix, 2004
- West Java Mechanical Integrity Plans
- IM Matrix
- Corrosion Control Chemicals
- Amine Fatty Acid
- Continuous Treatment
- Initial Film Establishment
- Corrosion Inhibition
- Corrosion Inhibitors Types
- Anodic Inhibitors
- Non-Oxidizing Inhibitors
- Cathodic Inhibitors
- Organic Inhibitors
- Corrosion Inhibitors Selection
- Corrosion Control
- The Advantages of Side – Stream Testing
- Guidelines for Inhibitor Selection
- Selection of Corrosion Inhibitors
- Flowing Well Downhole Injection Valve (Courtesy NACE)
- Flowing Well Concentric Kill String
- Measuring and Monitoring Corrosion
- Corrosion Monitoring is used to Determine the Effects of Corrosion
- Corrosion Monitoring Techniques
- Desirable Properties of A Corrosion Inhibitor
- Factors Involved in Inhibitors Selection
- Screening Tests

- Static and Wheel Tests
- Kingdom of Microorganisms
- Classification of Bacteria
- Simplified organic degradation
- Sulfate Reduction
- Microbial Induced Souring
- Bacterial Populations in Oilfield Systems
- Recognition of MIC (Direct)
- Sulfate Reducing Bacteria
- Problems Types of SRB
- Salinity
- Redox
- Temperature
- pH
- Pressure
- Water
- Oxygen Relationship
- Morphology of Bacteria
- Microorganisms
- Classes of Biocides
- Prevention Of MIC
- Media Bottles
- Corrosion Failure Analysis - Sulfate Reducing Bacteria Corrosion
- Prevention Of SRB Corrosion
- Corrosion Failure Analysis - Acid Producing Bacteria (APB) Corr.
- Prevention Of Acid Producing Bacteria Corrosion
- Corrosion Failure Analysis Underdeposit Corrosion
- Prevention Of Underdeposit Corrosion
- Bacteria Related Oilfield Problems
- Key Elements of Corrosion
- MIC
- Microbially Induced Corrosion
- Bacteria In Oilfield Systems

- Simplified Organic Degradation
- Acid Producing Bacteria (APB)
- Anodic Reaction
- Cathodic Reaction
- Recognition of MIC (Direct)
- Microbially Influenced Corrosion Physical Appearance
- System Souring
- MIC Failure mean
- Plugging by solids or biofilm
- Microbial Problems in Drilling and Fracturing Fluids
- When polymer performance is lost it costs money
- Effects of Bacteria on Drilling Fluid Properties
- Indicators of Bacterial Problems
- Biocides in oilfield systems
- Mechanical and Operational Controls
- Mineral Scale in Oilfield Production Systems
- Scale Deposition in Oilfield Production Systems
- Mineral Scale and Deposition Factors
- Common Mineral Scales
- Low Specific Activity (LSA) Scale
- Mineral Scale and Deposition Factors
- Reasons for Scale Formation
- Calcium Carbonate Scale Mechanism
- Calcium Carbonate Deposition
- Calcium Sulphate Scale Mechanism
- Calcium Sulphate Deposition
- Barium Sulphate Scale Mechanism
- Barium Sulphate Deposition
- Strontium Sulphate Scale Mechanism
- Mineral Scale and Deposition Factors
- System Factors
- Factors Affecting the Rate of Scale Formation
- Degree of Supersaturation

- Rate of Nucleation
- Rate of Crystal Growth
- Adherence of Scale
- Possible Locations of Scale: Water Injection System
- Three Phase Separator
- Scale Control
- Chemical Treatment
- Mechanical Treatment
- Scale Inhibitors
- Inorganic Phosphates
- Phosphate esters
- Polymers
- Phosphono - methylated amines (Phosphonates)
- PMPA (phosphono - methylated polyamine)
- Mixed formulations
- Mechanisms of Scale Inhibition
- Scale Inhibitor Selection Criteria
- Scale Deposition in Oilfield Production Systems
- Scale Composition Determination
- Selection of Scale Inhibitor
- Compatibility
- Scale Deposition in Oilfield Production Systems
- Water Injection System – Application
- Scale Inhibitor Injection Points
- Production System – Application
- Downhole Injection Methods
- Via Lift Gas
- Downhole Capillary
- Coiled Tubing
- Squeeze Treatment
- Successful Squeeze
- Long Reach Horizontal
- Horizontal Well: Squeeze

- Scale Inhibitor Squeeze Treatment
- Typical Squeeze Treatment
- Typical Spearhead
- Scale Inhibitor Selection
- Scale Inhibitor Concentration
- Overflush, Shut in and Re-flow
- Successful Squeeze
- Unsuccessful Squeeze
- Squeeze Volume Calculations
- Overflush Volume
- What is Scale?
- Types of Scale
- Where does scale Form?
- Where Does Scale form?
- The Cost of Downhole Scale
- Health and Safety Issues
- Why Does Scale Form?
- Effect of Pressure on Carbonate Chemistry
- Scale: Interpretation of results
- Ionic Composition of some Formation Brines
- Changing Water Chemistry Introduces Different Scale Risks.
- Overview of Scale Potential for a Field with Active Water Injection
- Scale Deposition
- Down hole Scale
- How do we Manage Carbonate Scale?
- Case Study - Effect of CaCo3 Scale on well productivity
- Key Points - Case study final result
- How do we Manage Sulphate Scale?
- How Do Inhibitors Work?
- Selection of Scale Inhibitors
- What is MIC?
- Where do we deploy scale inhibitors?
- Scale Inhibitor Squeeze Treatments

- Scale Inhibitor Squeeze Return
- Scale Inhibitor Squeeze Treatments
- Scale Inhibitor Squeeze Treatments Issues
- Scale Inhibitor Squeeze Deployment Issues
- Monitoring
- Pumps – How good are yours?
- Example of Single Zone Completion and $BaSO_4$ Scale Management
- Scale
- Reactive Scale Control-Scale Removal
- Water Chemistry
- Water Formed Scales
- Preventing Scale Formation
- Scale Removal
- Chemical Cleaning for Heater Tubes @ Process Plant
- Production Damages
- Scale
- NORM Scales
- Why in scale?
- Scale Location
- Scale Prediction
- Paraffin Composition
- Deposits
- Deposition Location
- Wax
- Asphaltenes
- Asphaltenic Oil Stability
- Asphaltene Sources
- World Wide Crude Oil Chemical Compositions (SARA)
- Asphaltene Stability
- What are Asphaltenes?
- Observations
- Microscopic photos of asphaltene aggregation
- Typical Oil Component Ranges

- Asphaltic Sludges
- Emulsions
- Emulsion Parts
- Energy Sources
- Stabilizers
- Coalescence
- Fluid/Fluid Reactions
- Hydrates
- Hydrate Phase Behavior
- Retrogade Condensate Problem
- Hydrate Control Techniques and Common Practices
- Injection Rules
- Scale inhibitor common types
- Selection and evaluation
- Scale Inhibitor Application
- Scale Monitoring
- Non- chemical scale control devices
- Scale removal chemicals Hydrocarbons
- SMC Scale & Microbiological control Course
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- Mineral Scale and Deposition Factors
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- Adherence of Scale
- Cost of Lost Production due to Scale
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- Possible Locations of Scale: Production System
- Three Phase Separator
- Scale Control
- Chemical Treatment
- Mechanical Treatment
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- Scale Inhibitor Selection Criteria
- Scale Composition Determination
- Selection of Scale Inhibitor
- Compatibility
- Coreflooding
- Coreflood Test Rig
- Coreflood Test Procedure
- Scale Inhibitor Selection Tests
- Phosphonate Return Curve
- Comparison of Inhibitor Return Curves

- Computer Modelling - Squeeze V
- Squeeze Predictions via Squeeze V
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- Scale Inhibitor Injection Points
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- Successful Squeeze
- Unsuccessful Squeeze
- Squeeze Volume Calculations
- Overflush Volume
- The Art of Pigging
- What is a pig?
- Cleaning-pig (PI-DI with brush)
- Caliper – Pig (Dimensioning)
- Smart Pig (Inspecting)
- Why pig a pipeline?
- Why we pig the lines?
- Types of pigs
- Geometry Pig for inspection
- Cleaning pigs
- Sealing pig (BI-DI Pig)

- Smart Pig (Inspecting)
- Foam pigs “Polly – pigs”
- Advantages of Polly pigs
- Disadvantages of Polly pigs
- Polly pigs are used for:
- Cleaning pigs
- Utility Pig (Pin wheel pig)
- Mandrel (steel shaft) pig
- Advantages of mandrel pigs
- Disadvantages of mandrel pigs
- Specialty pigs
- Gel Pig
- Utility Pig (Pin wheel pig)
- Batching pigs
- Displacement pigs
- Gauging pigs
- Gauging pigs
- (Profile pig)
- Geometry Pig
- Profile pig
- Dual diameter pigs
- Transmitter pigs
- Solid cast pigs
- Spheres pigs
- Pig speed
- Brush pigs
- Pig detection equipment
- Pipeline Plugs
- Batching-Gauging Pigs
- Scale removal
- Scale removal - Line scrapers (pigs)
- Smart Pigging
- Smart Pigging Limitations

- Hydrostatic testing versus smart pigging hydrostatic testing
- Negative aspects to hydrostatic testing
- Smart Pigging Instruments
- Kaliper Pigs (Geometry pig)
- Magnetic flux pigs
- Ultrasonic (U.T.) inspection pigs
- Above ground maker system - Maker location
- Operating instructions
- What is a Hazard?
- What is Risk?
- Identify the Hazard and Risk?
- Accident Ratio Pyramid
- Risk Assessment Steps
- Types of Hazard
- Slips, trips and falls
- Reducing the Risk of Slips
- Preventing Injuries
- Classes of Fires
- Causes of Electrical Hazards
- Hazardous Substances
- Material Safety Data Sheet
- NFPA Hazard Identification System
- Noise Hazards
- Manual Handling
- Mechanical Equipment
- Result of Released Hazard
- Hazard Identification
- Hazard Identification Posters
- What is a Process?
- Process Safety & Personal Safety Overlap
- Process Safety Incident
- Requirement for Process Safety
- Process Safety

- Process Safety Management
- Stages of Process Safety
- Fire and Gas detectors
- Smoke Detectors
- Heat Detectors
- Flame Detectors
- Ultra-Violet Flame Detector
- Infra-Red Flame Detector
- IR/UV Flame Detector
- Fusible plug detector and sprinklers
- Manual alarm call points
- Gas detectors
- Pellistor Catalytic Gas Detector
- Infrared absorption gas detector
- H2S gas detectors
- Portable gas detector
- Fire and gas Detection system
- Alarms, Executive Actions, Annunciation
- Pressure Terminology
- Types of Pressure Relief Devices
- Conventional Pressure Relief Valves
- Pilot - Operated Pressure Relief Valve
- Piston - Type Pilot - Operated Pressure Relief Valve
- Diaphragm - Type Pilot - Operated Pressure Relief Valve
- Balanced Bellows Pressure Relief Valve
- Balanced Bellows with Auxiliary Balancing Piston
- Power - Actuated Pressure Relief Valves
- Temperature - Actuated Pressure Relief Valves
- Pressure Vacuum Vent Valves
- Rupture Disk
- Application of Rupture Disks
- Types of Rupture Disks
- Conventional Rupture Disks

- Scored Tension - Loaded Rupture Disks
- Composite Rupture Disks
- Composite Rupture Disks
- Reverse - Acting Rupture Disks
- Graphite Rupture Disks
- Rupture Pin Relief Valves
- Buckling Pin Relief Valves
- Blowdown Valve
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- Rupture Pin Relief Valves
- Buckling Pin Relief Valves
- Blowdown Valve
- Atmospheric pressure
- Pressure exerted by liquids
- Pressure Units
- Pressure Measurements

- Bourdon Tube Pressure Gauges
- Diaphragm Pressure Gauges
- Pressure Transmitter
- Standard Transmitter Set Up Diagram
- Control Loop – Case Study
- Differential Pressure Transmitter
- Pressure Switches
- Level
- Dip Tapes And Dip Sticks
- Gauge Glasses
- Magnetic float indicators
- Differential Pressure Cells (DP Cells)
- Displacer
- Back Pressure Method
- Ultrasonic Sound Waves Method
- Nucleonic Level Measurement System
- Level Switches
- Flow Measurement
- Volumetric And Mass Flow Rate Flow
- Flow Patterns
- Flow Measurement Devices
- Orifice Plate Flow Meter
- Venturi Tube Flow Meters
- Pitot Tube Flow Meters
- Turbine Flow Meters
- Paddle Wheel Flow Meters
- Ultrasonic Flow Meters
- Positive Displacement [PD] Flow Meters
- Variable Area Flow Meters
- Temperature measurement
- Temperature Units
- Measurement Devices
- Glass Capillary Thermometers

- Bimetallic Thermometers
- Bimetallic Thermometers
- Gas And Liquid Filled Thermometers
- Vapour Tension Thermometers
- Thermocouple
- Resistance Temperature Devices (Rtds)
- Radiation Temperature Detectors
- Temperature Switches
- Process Control Valves
- Linear Rising Stem
- Rotary Action Control Valves
- Pneumatic Diaphragm Actuators
- Piston Hydraulic Actuators
- Piston Pneumatic Actuators
- Electrical Actuators
- Solenoid Valves
- Valve Positioner
- I/P Converter
- Process control system
- Process Control Elements
- Pressure Control System
- Level Control System
- Flow Control System
- Temperature Control System
- Types of Signals
- Pneumatic Signal Transmission
- Electronic Signal Transmission
- Open Loop Control
- Closed Loop Control
- Cascade Control
- Flowlines & Manifolds
- Wellhead & Choke
- Choke

- Flowlines
- Remote Gathering Manifold Station (RGMS)
- Trunkline
- Inlet Manifold
- Process Chemistry Process Chemistry
- Emulsion Treatment
- Dehydration
- Sludge
- Deoiling
- Organic Deposits
- Gas Hydrates
- Waxy Crude
- Asphaltenes
- Drag Reducers
- Inorganic Scales
- Oil Field Water Scales
- Bacteria and Biocides
- Corrosion
- HSE Aspects
- Introduction to the Training & Development Guides
- Process Topics
- Operator Basics
- Observation
- Housekeeping
- Communication
- Taking Logsheet Readings
- Valve Recognition
- Check Valve Recognition (NRV)
- Lubrication
- Trouble Shooting
- Passing Relief Valves
- First Failure Recognition
- Insulation

- Rotating Equipment
- Pumps
- Centrifugal
- Cavitation/Priming
- Positive Displacement
- Pump Seals
- Instruments
- Air Failure
- Line up Instrument Air
- Stroke Checking a Control Valve
- Putting a Control Valve on Bypass
- Checking a Pressure Gauge
- Checking a Differential Pressure (DP) Cell
- Level Measurement
- Temperature Measurement
- Pressure Measurement
- Flow Measurement
- Minor Maintenance
- Pressure Rating
- Tightening a Leaking Gland
- Tightening a Leaking Flange
- Opening a Flange
- Re-gasketing a Flange
- Cleaning a Pump Suction Strainer
- Reservoir Souring
- Definition
- Why do some Reservoirs Go Sour?
- Is your Reservoir Really Going Sour?
- The Answers
- A Common Myth
- The UKCS Thistle Field
- Understanding the Problem
- Souring Map

- Mitigation Options
- Sea Water Injection (“Secondary Recovery”)
- Water Flood Function
- Water Flood System
- Water Flood Plant Major Equipment
- Lifting Pumps
- Chlorinator Unit
- Strainers
- Clarifier
- Sand Filter
- Sand Filter Media
- Clearwall Pumps
- De-aerator
- Gas Stripping
- Vacuum De-aeration
- Chemical Removal of Oxygen
- Discharge Pump
- Injection Pump
- Waterflood Plant Chemical Treatment
- Waterflood Plant Injection Water Quality
- Key Considerations for Success