

## Chemical & Environmental Engineer

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## **Basic Gas Chromatography - Principles and Applications**

### **Course Introduction:**

The course contents and the manual will serve as a guide for the attendees having insufficient knowledge of Gas Chromatography and for those who feel that a Gas Chromatography refreshing training is essential.

Great attention is given to those subjects where knowledge is critical for chromatography activities in refinery or process laboratories.

### **Course Objectives:**

**This program is designed to give the participants the capability to:**

- Gain the basic theoretical aspects of Gas Chromatography.
- Communicate practical information, capabilities and limitations of Gas Chromatography and gain confidence about the technique available
- To be able to carry out analyses, trouble shooting and evaluate analytical results

**Course Duration:** Four days

### **Course Contents:**

- Course Introduction and Principles
- Theory of Gas Chromatography
- Instrumentation and System Parameters
- Types of Columns and Detectors
- Qualitative Analysis
- Quantitative Analysis
- Trouble Shooting; Methods and Techniques
- Peak Identification
- Results Calculation / Correction
- Practical Applications
- Problem Solving
- Case Studies
- Discussions
- Course Summary
- Course Evaluation

### **Who Should Attend:**

This course is intended for Laboratory operatives, Technicians and Chemists and those who are involved with the Gas Chromatography Processes.

## ***Applying SPC Tools in the Laboratory***

### **Course Objectives:**

**On completion of this course the trainee/s will be competent in:**

- The methods of applying Statistical Processing Tools to maximize on the accuracy Laboratory production and processing.
- The science of effective SPC techniques, the measurement and analysis benefits applied in laboratories. Also the data modeling analysis involved.

**Course Duration:** Five Days

### **Course Daily Contents:**

#### **Day One:**

- Introduction to the benefits of SPC in the laboratory environment and scientific value analysis techniques
- Descriptive tools: Histograms, Frequency Curves, Tables, Normal Curve
- Characteristics of normal curve: Center, Mean, Median, Mode; Width and Range : Standard Deviation, Variance: areas under normal curve, Estimating Percent Meeting Specifications, Other characteristics; Skewness, Kurtosis – Excess-Pareto Charts

#### **Day Two:**

- Process Stability: Mean Square Successive Difference; run Test
- Sampling Distributions: Averages; Variances
- Introduction to Control Charts: Xbar and Range: Xbar and Sigma
- Risks of Control Charts Operating Characteristic, curve, average run length; multiple rules and risks

#### **Day Three:**

- Control Charts for Batch Data: X and Moving Range; Moving Averages; CuSum; Run Sum; Dynamic Histogram
- Rational Subgroups; Size Considerations; Rationality Checks; Concept of 'Level of Control'
- Two Related Variables: Simple Correlation; Measurement of Success; T Square Charts; Analyzing T Square Chart Results

**Day Four:**

- Attributive Data: Defectives and Defects
- Control Charts for Attributive Data: Short Cycle Time Production – p, np, c, u, Demerits Long Cycle Time Production – Time Between Occurrences
- Acceptance Sampling Plans: Attributive Plans: Risks; OC Curve; Power Curve; AOQ: Discovery Sampling, Variable Plans

**Day Five:**

- Sample Size Calculations
- Regression Analysis
- Linear Analysis
- Case Studies in laboratory situations
- Discussions and Exercises
- Course Evaluation and Summary

**Who Should Attend:**

Laboratory Technicians, Laboratory Process Supervisors.

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Great attention is given to those subjects where knowledge is critical for chromatography activities in refinery or process laboratories.

### **Course Objectives:**

**This program is designed to give the participants the capability to:**

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- Quantitative Analysis
- Trouble Shooting; Methods and Techniques
- Peak Identification
- Results Calculation / Correction
- Practical Applications
- Problem Solving
- Case Studies
- Discussions
- Course Summary
- Course Evaluation

### **Who Should Attend:**

This course is intended for Laboratory operatives, Technicians and Chemists and those who are involved with the Gas Chromatography Processes.

## Chemical Laboratory Safety

### Course Background:

Handling and of modern laboratory chemical material and equipment can be hazardous and cause loss of life and limb. The implications of the latest regulations as regards to the Health, Safety and Environmental controls have to been strictly adhered to and every employee or persons involved within a Laboratory environment must understand the risks to themselves and to their colleagues.

They must also understand the actions to be taken to prevent or minimize the risks and what actions to take if they need to take in a situation or emergency. This course is designed to tackle the issues and install the correct practical approach involved and the applicable systems.

### Who Should Attend:

The comprehensive course is designed for persons responsible for the safe operation of chemical laboratories. Such persons, are not only laboratory personnel and laboratory managers but also research directors, company health and safety officers and emergency response managers. It will also benefit administrative personnel related to the laboratories and with some knowledge on basic principles of safety.

### Course objectives:

Participants will be taken through the fundamentals of laboratory operation safety and will gain a thorough understanding of safety procedures, as they are embedded in laboratory management systems.

Participants will gain comprehensive knowledge on the handling of hazardous material and the precautions available as regards facilities, equipment and means personal protection and will be introduced to the technology available for monitoring the conditions in their laboratories.

Hazard identification will be an item for particular attention as it is the point from which management decisions regarding laboratory safety are initiated.

## **Daily Course Contents:**

### **Day One:**

- Introduction. Why is safety important.
- Safety Policy.
- Good Laboratory Design Overview of Laboratory Safety (fume hoods. furniture, floors, ventilation, lighting, drainage, utilities, system, reliability).
- Lab Safety Standards.
- Laboratory Safety Procedures; Safety training for Personnel;
- Implementing Safety in the Laboratory;
- Accident/Incident Reporting; Near misses, The Safety Audits, Safety Organisation.
- Health and Safety Hazard Recognition; System Safety Hazard Analysis, Fault Tree Analysis; Review and Analysis of Procedures.
- Emergency Planning: Establishing Priorities;
- First Aid; Medical Support;
- The Emergency Response Team,
- Developing a Contingency Plan
- Communication, Training; Labelling;
- The Material Safety Data Sheet (MSDS), Warning Clauses.

### **Day Two:**

- Compressed Gases; Handling Compressed Gas Cylinders;
- Pressure Relief Devices.
- Reactive Chemicals, Assessing Reactivity; Compatibility; Reaction Monitoring.
- Toxic Chemicals, Classification
- Health Hazards of Commonly Used Lab Chemicals.
- Air Sampling Methods; Badges, Detector Tubes,
- Instrumentation for Air Sampling; Laboratory Hood Velocity Measurements
- Biological Monitoring.
- Flammable Materials; Hazards; Characteristics; Explosion Potential; Control of Ignition Sources;
- Ventilation Requirements; Containment; Extinguishing Agents; Hazard Checklist;

### Day Three:

- Regulatory Requirements, Compliance with European and Other International Regulations Including ISO 14000.
- Regulations: Complying with International Regulatory Requirements.
- Control of Health and Safety Hazards, Engineering Controls, Ventilation
- Electrical Safety, Administrative Controls; Work Permit System.
- Respiratory Protection, Selection and Use of Respirators; Respirator Protection Programme; Respirator Fit Testing.
- Static Electricity and Other Sources of Ignition in the Laboratory Environment; Personal Protective Equipment.
- Electrical Safety: Hazard Identification; Classification of Electrical Apparatus to be Used in Flammable Areas.
- Procurement, Storage, Distribution, and Disposal of Chemicals

### Day Four:

- Laboratory Safety Programme: Promoting Safety in the Laboratory Environment; Implementing a Safety Programme in a Laboratory.
- Chemical Handling: Storage, Handling and Transportation of Flammable, Reactive and Toxic Chemicals.
- Pressure/Vacuum System: Hazard Identification and Controls; Design,
- Operation and Inspection of Pressure Vacuum Systems (Safety Relief Devices) in the Laboratory.
- Hazard Identification: System Safety-Application of “What If” Analysis
- Job Safety Analysis, and Fault Tree Analysis in Laboratory Operations and PreStart-up Survey.

### Day Five:

- Laboratory Ventilation: Instruments Used in Maintaining Adequate Hood Ventilation;
- Laboratory Hood Design Criteria; Criteria Used in Inspecting and Maintaining a Laboratory Ventilation System;
- Standards on Laboratory Ventilation.
- Emergency Response Planning: Preparing an Emergency Response Plan;
- Spill Control Procedures.
- Handling Lab Wastes.
- Safe disposal of hazardous chemicals.

## Chemical & Hazmat Handling

### Course Introduction:

Care of handling of Chemicals and the Materials / has become a global issue. Companies who are engaged in using chemicals and toxic materials for processing and are responsible for the management, handling and storing of these hazardous items need to be aware of the dangers to their company and to the general public.

In recent times explosions in companies premises caused by chemicals and toxic waste has meant massive costs in compensations, injuries and loss of life.

This course is deigned to examine which chemicals and toxic materials are the most volatile and the daily care in usage handling and in the general Management involved. It will also discuss the regulations governing their use and the possible penalties involved for non compliance.

Course Duration: Five Days

### Who Should Attend:

Potential and existing Chemical Engineers, Chemical controllers and Handlers, also those responsible for Chemical and Hazmat storage managers and controllers. This course will also benefit chemical and waste disposal engineers and managers.

### Daily Course Contents:

#### Day One

- *Introduction & Definitions: What is a Hazardous Chemical and what is a toxic material, the hazards and characteristics*
- *Classifications: The definition from a legal point of view and its influence on quantities and management strategy*
- *Terminology's and methods*

#### Day Two

- Regulatory Overview
- EU Directives, The Basel Convention, Regulations

- pertaining to storage, transportation, handling and treatment
- Worker right – to – know.
- Recognized safe concentration limits.
- Health effects of hazardous waste
- Biological abnormalities,
- Permanent Vs non-permanent damage, cumulative affects.

### **Day Three**

- Transboundary movement of hazardous materials and their position in international commerce.
- Hazardous Waste Characteristics
- The identification of hazardous materials,
- Analytical methods overview, sampling.
- Company Hazardous Waste Strategy,
- National Hazardous Waste Strategy.
- Components of a hazardous waste system,
- Hazardous waste surveys – establishment of quantities.
- Minimization of hazardous wastes.
- Implementing the Basel Convention.

### **Day Four**

- Siting of Hazardous waste facilities (storage, transfer stations, treatment plants, etc).
- Environmental Impact Assessments, Audits, Risk Assessments.
- Storage site design:
  - Landfill design and construction
  - Linings
  - Environmental Impacts of storage
  - Subterranean injection, mine storage
  - Leaching and leachate treatment
  - Monitoring and sampling of storage sites

### Day Five

- Hazardous waste treatment processes:
  - Recovery Vs neutralization / destruction
  - Unit processes / operations specific to hazardous wastes (Activated carbon, distillation, adsorption, ozonation, advanced oxidation processes, etc, etc.
  - Solidification (Cementation, Vitrification, Incineration and other thermal processes)
- Biological Processes: Composting, Aerobic and anaerobic digestion, Soil remediation
- Special Waste – Case Studies:
  - Waste lubricating oil
  - PCB wastes – transformer oils
  - Dioxins
  - Infectious waste
  - Household Hazardous Wastes
- Final discussion and summary

## Handle Chemicals & Hazardous Materials

### Course Introduction:

Care of the environment has become a global issue. Companies who are engaged in using chemicals and toxic materials for processing and are responsible for the management, handling and storing of these hazardous items need to be aware of the dangers to their company and to the general public.

In recent times explosions in companies premises caused by chemicals and toxic waste has meant massive costs in compensations, injuries and loss of life.

This course is designed to examine which chemicals and toxic materials are the most volatile and the daily care in usage handling and in the general Management involved. It will also discuss the regulations governing their use and the possible penalties involved for non compliance.

### Daily Course Contents:

#### Day One

- *Introduction & Definitions: What is a Hazardous Chemical and what is a toxic material, the hazards and characteristics*
- *Classifications: The definition from a legal point of view and its influence on quantities and management strategy*
- *Terminology's and methods*

#### Day Two

- Regulatory Overview
- EU Directives, The Basel Convention, Regulations pertaining to storage, transportation, handling and treatment
- Worker right – to – know.
- Recognized safe concentration limits.
- Health effects of hazardous waste
- Biological abnormalities,
- Permanent Vs non-permanent damage, cumulative affects.

#### Day Three

- Trans-boundary movement of hazardous materials and their position in international commerce.
- Hazardous Waste Characteristics

- The identification of hazardous materials,
- Analytical methods overview, sampling.
- Company Hazardous Waste Strategy,
- National Hazardous Waste Strategy.
- Components of a hazardous waste system,

#### **Day Four**

- Hazardous waste surveys – establishment of quantities.
- Minimization of hazardous wastes.
- Implementing the Basel Convention Siting of Hazardous waste facilities (storage, transfer stations, treatment plants, etc).
- Environmental Impact Assessments, Audits, Risk Assessments.
- Storage site design:
  - Environmental Impacts of storage
  - Monitoring and sampling of storage sites

#### **Day Five**

- Hazardous waste treatment processes:
  - Recovery Vs neutralization / destruction
  - Unit processes / operations specific to hazardous wastes (Activated carbon, distillation, adsorption, ozonation, advanced oxidation processes, etc, etc.
  - Solidification (Cementation, Vitrification, Incineration and other thermal processes)
- Biological Processes: Composting, Aerobic and anaerobic digestion, Soil remediation
- Special Waste – Case Studies:
  - Waste lubricating oil
  - PCB wastes – transformer oils
  - Dioxins
- Final discussion and Summary

#### **Who Should Attend:**

Potential and existing Chemical Engineers, Chemical controllers and Handlers, also those responsible for chemical and toxic waste storage managers and controllers.

## Chemical Engineering for Non-Chemical Engineers

### Course Objectives:

The course is designed to explain the fundamentals of the role of the chemical engineer and the basics of chemical engineering. General concepts are introduced which enable all participants to have a basic understanding of the needs and requirements of chemical processes with a particular emphasis in the oil & gas industries.

### Who Should Attend:

Potential Chemical Engineers and technicians with some experience and basic understanding of chemical engineering. Also intended for personnel working in the chemical, petrochemical, oil and process industries with a need to understand and discuss issues with the chemical engineering specialists. This course is also designed for those with no prior knowledge of chemical engineering and for those not normally involved with chemical products.

### First Day

- Introduction: What is Chemical Engineering
- History and relationship of Chemical Engineering and other disciplines
- Chemical equilibrium
- Chemical Engineering balances.
- Heat transfer

### Second Day

- Fluids
- Pumps
- Valves
- Compressors
- Basic flow diagrams of Unit Operations

### Third Day

- Safety and loss prevention
- Process simulation
- Process optimization
- Process economics
- Group Exercises
- Course Summary Discussions & Evaluation

## Chemical Engineering for Non-Chemical Engineers

### Course Objectives:

The course is designed to explain the fundamentals of the role of the chemical engineer in the basics of chemical engineering systems for design and production element required in their daily work. It also includes the concepts for construction of chemical products in a safe environment and under construction controls.

The course will also highlight the role involved in basic project work as a team and as an individual.

### Who Should Attend:

Potential chemical engineers and technicians with some experience and the basic understanding of chemical engineering and are involved with basic chemical engineering, efficiency to a safe and competent standard. This course is also designed for those with no prior knowledge of chemical engineering and are not normally involved with chemical products.

### First Day

- Introduction: What is Chemical Engineering.
- Its relation to other engineering and scientific disciplines.
- Brief history of chemical engineering.
- Rapid overview of the profession.
- Where are Chemical engineers employed.
- Chemical Engineering Balances.
- Stoichiometry, Mass Balances, Energy Balances, Chemical reactions, Thermochemistry, Equilibrium principles.

### Second Day

- Equilibrium in systems with chemical reaction,
- Elementary reaction mechanisms and kinetics, catalysis, the concept of yield, rate of reaction.

- Mass Transfer, Diffusion, Diffusion Coefficients, Convective mass transfer, phase equilibria, the driving force concept.
- Heat Transfer, Modes of heat transfer, Simultaneous Heat and Mass Transfer (Evaporation, Condensation, boiling), Elementary heat exchanger design, the log-mean temperature, co-current v.s. counter current staging.

### **Third Day**

- Work safety practices: policy and standards
- The concept of Unit Operations.
- Examples of Unit Operations (Distillation, Adsorption, Drying, Extraction, Evaporation, etc).
- Basic flow diagrams of Unit Operations.

### **Fourth Day**

- Momentum Transfer
- Properties of fluids, fluid flow fundamentals, flow in pipes, pumping, mixing.
- The boundary layer concept
- Analogy between Momentum, Heat and Mass transfer.

### **Fifth Day**

- Process selection
- Process design, flow sheets, batchwise, vs continuous production
- Physical property estimation.
- From laboratory to full scale plant.
- Process simulation, Process optimization, Process economics
- Project and Team work
  
- Case studies based on Scenarios,
- Exercises and Discussions.
  
- Course Evaluation and Summary

## Industrial Corrosion Control

### Course Description:

Corrosion resistance of material is frequently a decisive factor in the development of advanced technology as encountered in power generation, energy conservation, environmental protection techniques, and numerous industrial processes operating under severe corrosive environments. The general aim of this course is to provide a basic understanding of corrosion mechanisms and the methods used in corrosion control and prevention.

There will be discussion of engineering problems, along with corrosion science principles, results in an integrated approach to providing solutions to corrosion engineering problems from a variety of industries.

There will coverage of electrochemical principles of metallic corrosion, discussions of various corrosion mechanisms, methods of corrosion control, high temperature corrosion, degradation of polymers and ceramics, and the selection of metallic, organic and ceramic materials.

### Who Should Attend:

This five - day course is intended for engineers and scientists, from a wide variety of industries, who seek a basic understanding of corrosion phenomena and familiarity with the methods used in corrosion control and prevention. The course should also be of interest to materials engineers and researchers who require familiarity with corrosion science and corrosion engineering.

### Course Contents:

#### ***Fundamental of Corrosion***

- Electrochemical Nature of Corrosion
- Electrode Potentials
- Basic Mechanisms of Corrosion
- Polarization Phenomena
- Corrosion Kinetics
- Passivity

### ***Types of Corrosion***

- Galvanic
- Crevice
- Soil
- Atmospheric
- Microbiological
- Erosion
- Cavitation
- Degradation of Polymers and Ceramics

### ***Corrosion Testing and Corrosion Monitoring***

- Measurement of Corrosion Rates
- Corrosion Detecting Devices
- Evaluation of Corrosion Test Results
- Prediction of Corrosion Rates from Electrochemical Measurements
- In-Plant Corrosion
- Monitoring of Corrosion Rates
- Application of Non-Destructive Evaluation Techniques to Corrosion Problems

### ***Corrosion Control by Improved Design***

- Fluid Flow
- Joining Problems
- Crevices
- Galvanic Coupling
- Stress Concentrations
- Residual Stresses

### ***Inhibitors***

- Theory and Utilization of Filming, Vapour Phase, Environmental Modifying, Anodic and Cathodic Inhibitors

### ***Understanding Corrosion-Resistance Metallic Alloys***

- *Effects of Metallurgical Structure on Corrosion Behavior*
- Application of Stainless Steels and Other Corrosion Resistant Alloys
- Minimization of Corrosion Problems Caused by Welding

## **Organic Barriers**

- *Organic Coatings and Linings*
- Surface Preparation and Application Methods
- Primers and Topcoats
- Lining Systems

## **Inorganic Barriers**

- *Metallic Coatings, Linings and Cladding*
- Chemical Conservation Coatings
- Ceramic Coating and Linings
- Cement and Concrete Linings

## **Electrochemical Protection**

- *Engineering of Cathodic and Anodic Protection Systems*

## **Discussion of Participants' Corrosion Problems**

### ***High Temperature Corrosion***

- Oxidation Resistance
- The Effect of Corrosive Gases, Molten Salts and Molten Metals on Metallic and Ceramic Materials

### ***Corrosion Failure Analysis***

- Approaches to Finding Solutions to Corrosion Problems
- Case Histories
- Discussion of Common Corrosion Problems found in Industry
- Approaches to Economic Solutions of Materials Problems
- Illustrative Examples

### ***Control of Environmental Assisted Cracking***

- Stress Corrosion Cracking
- Corrosion Fatigue

- Hydrogen Embrittlement
- Methods of Minimization
- Introduction to Failure Prevention Using Fracture Mechanics Principles

### ***Control of Microbial Deterioration of Materials***

- Causes and Minimization

### ***Corrosion in Water Systems***

- Corrosive Action on Potable Water, Sea Water, Industrial Waters and Industrial Wastes
- Application of Inhibitors and Related Treatments for Corrosion Minimization
- Chemical Cleaning

### ***Course Summary and Review***

## DEEP VACUUM DISTILLATION

### INTRODUCTION:

Deep-cut crude vacuum technology has become a major focus of refiners in the last ten years. Recognizing this interest, Refining Process Services, in cooperation with Process Consulting Services, is offering this program to the petroleum refining industry. Increasing vacuum gas oil yield and improving gas oil quality reduces vacuum residue production, increases FCC feedstock quality, and reduces crude charge requirements for a given FCC feed rate.

This program focuses on the practical issues associated with accurately determining potential gas oil yield improvement, minimizing capital expenditure, and monitoring deep-cut unit performance. Major equipment design and operational topics will also be discussed.

### PROGRAM:

The major equipment on a vacuum unit consists of the jet ejector system, the fired heater, and the vacuum column and its internals. This program has been designed to provide an understanding of proper design and operation of this equipment since its performance is important if increased gas oil yield is to be achieved and maintained. The fundamental issues of deep-cut vacuum unit design and operation will be emphasized. Ignoring these fundamentals can lead to costly, unscheduled shutdowns.

The program begins with a discussion of the importance of feed characterization and its effect on a project's economics. Ultimately, the amount of recoverable gas oil in the feedstock will establish potential gas oil lift improvements. Further, with few exceptions, deep-cut projects are revamps.

Thus, the speakers will stress the need to determine the existing equipment's limitations in order to ensure the success of a revamp. Presentations will also cover the requirements for reliable deep-cut vacuum column performance, and for improved operating variable monitoring. Program participants will be made aware of the problems that occur in true deep-cut operation.

### The Course Leader

Dr. George Adis has extensive expertise in distillation technology for deep-cut vacuum unit design and operation. The program has been developed for design, process, and operating



personnel involved with an existing deep-cut unit or those who may be considering such a project.

### **Who Should Attend:**

This course is aimed at those Refinery Technologists who are required to be knowledgeable in Deep Vacuum Distillation applications.

### **PROGRAM OUTLINE:**

#### **Day 1**

#### **INTRODUCTION**

- Deep-Cut Vacuum Unit - What Is It?
- Limitations to Gas Oil Recovery
  - Light, Low Metal Paraffinic Oils - North Sea
  - Medium, Moderate Metals - Arab Crude Oils
  - Heavy, High Metals - Venezuelan Crude Oils
- Reliability History

#### **INCREASING VACUUM GAS OIL YIELDS**

- Feed Characterization - How Much Gas Oil is Present?
- Unit Test Run - Establishing Performance
- Future Gas Oil Yield Limitations
  - Gas Oil Quality
  - Feed Vaporization
- Vacuum Unit Designs
  - Dry
  - Steam Injection, Coils and/or Stripper
- Feed Composition - Impact of Atmospheric Column Cutpoint
- Feed Enthalpy
- Major Equipment Overview

#### **Day 2**

#### **PROCESS FLOW SCHEMES**

- Atmospheric Gas Oil Cutpoint - Vacuum Column TBP Distillation
- Heat Integration
- Ejector System Design

## **UNIT EQUIPMENT CONSTRAINTS**

- Balancing Gas Oil Yields - Atmospheric Gas Oil versus Vacuum Gas Oil
- Capacity versus Yields

### **Day 3**

## **MAJOR EQUIPMENT DESIGN**

- Ejector System
- Vacuum Fired Heater
- Transfer Line
- Column and Internals
- Utility Impacts

## **OPERATIONS MONITORING AND TROUBLESHOOTING**

- Cutpoint Monitoring
- Preventing Wash Bed Coking
- Ejector System Troubleshooting
- Group discussions
- Case studies & exercises
- Course Evaluation & Summary

## ENVIRONMENTAL / MANAGEMENT SYSTEMS (EMS)

### **COURSE INTRODUCTION:**

Concern for the environment and a growing awareness of the need to manage resources efficiently are driving many businesses to adopt an environmental management system, (EMS), as a mechanism to respond to the pressure and thereby minimise their impact on the environment. Through this focus on improving the efficiency of all their working practices, businesses are also likely to benefit from a reduction in operating costs.

This course is designed to Identify EMS issues and how they can be handled and the contribution that can be made by all Management and Employees.

### **COURSE METHODS & SUPPORT:**

The course involves full interactive presentation and discussion including case study and utilizes excellent images and pictorials for full impact and benefit to the participants.

### **COURSE DURATION:** Three Days

### **WHO SHOULD ATTEND:**

All Oil & Gas company employees who are required to understand the Environmental Impacts and the necessary requirements to maintain individual and corporate responsibility towards EMS issues.

### **COURSE OUTLINE:**

#### **BACKGROUND ON MANAGING THE ENVIRONMENT**

- Milestones
- Factors influencing environmental awareness
- Global and regional environmental problems (Climate change, Stratospheric ozone depletion, Major accidents, Waste, Loss of biodiversity, Chemicals, Forest degradation, Marine pollution, etc)
- Responses of industry
- Environmental auditing
  
- Aims of an environmental management system
- International developments
- The roles of ISO 14001 and other ISO series standards

## **BENEFITS**

- Benefits of an effective EMS (Legal, Financial and Business, Image, Management)

## **DEFINITIONS**

- Important terms (interested parties, environment, objectives, targets, etc.)

## **EMS ELEMENTS**

- Organization culture
- Commitment
- Environmental policy statement
- Organization and responsibilities
- Evaluation and register of effects
- Register of regulations
- Objectives and targets
- Environmental management program
- Management manual and documentation
- Operational control
- Records
- Audits
- Management review
- Environmental reporting

## **CASE STUDY & GROUP DISCUSSIONS**

- **ENVIRONMENTAL LEGISLATION**
- **COURSE OVERALL REVIEW & DISCUSSIONS**
- **COURSE EVALUATION**
- **COURSE SUMMARY**

## ENVIRONMENTAL PROTECTION & WASTE MANAGEMENT – FOR JUNIORS

### **COURSE INTRODUCTION:**

The ecosystems are an issue that affects all living things on the planet and there is still industrial pollution from processing plants and manufacturing that is building up to a catastrophic scale which has been addressed by responsible organizations.

Heavy fines and pressures have brought about changes and preventions to ensure controls and monitoring are ongoing but without these aspects the ecosystem would again be under attack and leave a legacy to future generations. This course is designed to bring awareness of the types, effects and prevention of environmental pollution from most areas of industry and the methods employed to reduce the threats and the contribution Junior Employees can make.

### **COURSE OBJECTIVES:**

- To understand the local Environment and how it works
- Identify the types of waste products created from Oil & gas production
- Safe and economical disposal methods for removal / re-generation of waste materials
- The health benefits from good waste disposal
- Managing waste disposal

### **COURSE METHODS & SUPPORT:**

The course involves full interactive presentation and discussion including case study and utilizes excellent images and pictorials for full impact and benefit to the participants.

**COURSE DURATION:** Five Days

### **WHO SHOULD ATTEND:**

All Oil & Gas company employees who are required to understand the Environmental Impacts and the necessary requirements to maintain individual and corporate responsibility towards EMS issues.

### **COURSE OUTLINE:**

- **Atmospheric and Sub Sea Environments**
  - Basis of Eco Systems
  - Pollution: Types, effects, limiting, degradation
  - Global Warming, The atmosphere, Catastrophic theory,

- The Greenhouse effect. Carbon Cycle, Methane, Nitrogen Oxides, Particulates, Aerosols, Ozone (production and distribution), Water Vapor.
- Anthropogenic effect. The enhanced Greenhouse Effect, CFCs, HCFCs, Methane
- Nox, Sox, Particulates, Acid rain.
- Combustion Emissions. Nox, Sox, Particulates.
- Clean Air Combustion Technology (Combating Nox, Sox, Particulates including CO2 sequestration), Clean Technology, and Oil from Coal.
- Effluents and Water Systems
- Factors influencing environmental awareness
- Oil Slicks: Formation of Emulsions, Containment, Dispersal
- **Safer Working Environments**
  - Objectives and targets
  - The Environmental cost's short and long term
  - International and local laws
  - Clean Air and Air Quality Legalities, Acts and Policies
  - Sustainable Development.
- **Volume of Waste production**
  - Waste Types, effects, limiting, degradation
  - Toxic
  - Air borne
  - Handling and Transporting
- **Reduction of Waste**
  - Waste Management Plan
  - Waste Reduction Techniques and Methods
  - Planning, organizational objectives / goals
  - Impact Analysis: Sources, Measurement, Equipment
  - Quantification and Reports
- **Safer Disposal / Regeneration or Recycling of Waste products**
  - Waste Treatment: Methods, natural, burning, burying, break down, recycling, recovery and disposal
  - Projects in Petrochemical Waste Management: Types, success, failures and progression
- **Protection Measures**
  - Individual and General
  - Human effects
  - Personal Protection Equipment (PPE)

- Handling and Barrier creams
- Handling and care
- Spillage Response
  
- **Long - term value of environmental protection**
- Benefits of an effective environmental contribution
  
- **CASE STUDY & GROUP DISCUSSIONS**
- **COURSE OVERALL REVIEW & DISCUSSIONS**
- **COURSE EVALUATION**
- **COURSE SUMMARY**

## Experimental Design

### Course Introduction:

The Design of Experiments is a very important technique in Research, Product and Process Development, Quality Control and Problem Solving. By correctly designing experiments much unnecessary work can be avoided and time and costs saved. The course should be a useful enhancement of the capabilities of chemists, engineers and other personnel related to research and development activities.

### Course Learning Objectives:

**This course enables the participants to:**

- Define objectives for experimental investigation
- Define the parameters to be investigated
- Design the initial experimental set
- Decide the direction of future experiments in relation to the objective
- Optimise the cost of the experiments

**Course Duration:** Five Days

### Who Should Attend:

Chemists, Chemical and other Engineers, Laboratory Managers, R+D Managers, Quality control managers.

### Course Contents:

- Introduction to Experimental Design
- Why design experiments
- Statistics refresher
- Variance and its significance
- Analysis of variance
- Tests of significance
- Simple graphical examples
- The experiment, its objectives and the variables
- Dependent and independent variables
- The design of the experiment
- The execution of the experiment
- The analysis of the results
- The continuation of the experiment
- Case Studies, Examples and Exercises
- Course Summary
- Course Evaluation

### Course Methods

By means of lectures, discussions, examples and workshop to enable the participants to be involved in product

## **FUGITIVE EMISSION**

### **COURSE INTRODUCTION:**

Air borne pollution has risen rapidly and every country on the planet is now responsible for the monitoring and control of Air waste products commonly called Fugitive Emissions, in particular in the Petrochemical and Plant Process Industries.

Awareness of Human and Environmental and Ecological damages are of great concern to identify and take remedial action as soon as Fugitive emissions are apparent. The cost to Industry is huge but the consequences for ignoring are incalculable for our future generations.

### **COURSE METHODS & SUPPORT:**

The course involves full interactive presentation and discussion including case study and utilizes excellent images and pictorials for full impact and benefit to the participants. It discusses what companies and Individuals can contribute.

**COURSE DURATION:** Five Days

### **WHO SHOULD ATTEND?**

All Oil & Gas and Downstream employees who are required to understand the Environmental Impacts and the necessary requirements to maintain individual and corporate responsibility towards Air Pollution issues. This course is also of great interest and benefit to attendees who need awareness of this critical and high profile subject.

### **COURSE OUTLINE:**

#### **DEFINITION & CHARACTERISTICS OF FUGITIVE EMISSIONS:**

- History of air Pollution
- Primary and Secondary Air Pollution
- Smog's and Air particles
- Effect of Poor Air Qualities Human and Ecological & Economical
- Air Qualities Standards
- Types of Fugitive Emissions: Carbon Dioxide, Nox, (Nitrogen Oxides), Sox, (Sulphur Oxides), Fossil Fuels, etc
- Identifying Invisible Air pollutant and emissions
- Factors influencing environmental awareness

- Global and regional environmental problems (Climate change, Stratospheric, Biosphere, Ozone, Loss of biodiversity, Chemicals, Forest degradation, Marine pollution, etc)
- Climate Effects Acid Rain and Water Pollution
- Responses of Industry & Risks
- Costs to Industry

#### **IDENTIFICATION & MEASUREMENT OF EMISSIONS:**

- o Air Sampling
- o Monitoring Equipment
- o Mobile and Static
- o Monitoring agencies government and private
- o Information gathering and analysis
- o Plant & Refinery Laboratory responsibilities
- o Meteorology and Air Monitoring

#### **CONTROL OF EMISSIONS**

- Tools and Techniques, objectives, targets, etc
- Company Plans
- Individual Roles
- National and Global Standards
- Filtering
- Exhausting Methods

#### **AIR POLLUTION PROTECTIVE PROCESSES:**

- Organization culture
- Commitment
- Environmental policy statement
- Organization and responsibilities
- Evaluation and register of effects
- Register of regulations

- Objectives and targets
- Environmental management program
- Management manual and documentation
- Operational control
- Records
- Audits
- Management review
- Environmental reporting
- **ENVIRONMENTAL LEGISLATION**
- **FUTURE DEVELOPMENTS & TECHNOLOGIES**
- **GLOBAL AGREEMENTS**
- **CASE STUDIES & GROUP DISCUSSIONS**
- **COURSE OVERALL REVIEW & DISCUSSIONS**
- **COURSE EVALUATION**
- **COURSE SUMMARY**

## Handling of Hazardous Substances

### Course Background:

Handling and of modern laboratory chemical material and equipment can be hazardous and cause loss of life and limb. The implications of the latest regulations as regards to the Health, Safety and Environmental controls have to been strictly adhered to and every employee or persons involved within a Laboratory environment must understand the risks to themselves and to their colleagues. They must also understand the actions to be taken to prevent or minimize the risks and what actions to take if they need to take in a situation or emergency. This course is designed to tackle the issues and install the correct practical approach involved and the applicable systems.

### Who Should Attend:

The comprehensive course is designed for personnel responsible for the safe operation and handling of chemical, toxic and hazardous materials & waste. It will also benefit administrative personnel related to the laboratories and with some knowledge on basic principles of safety.

### Course Objectives:

Participants will be taken through the fundamentals of operation safety and will gain a thorough understanding of safety procedures.

Participants will gain comprehensive knowledge on the handling of hazardous material and the precautions available as regards facilities, equipment and means personal protection and will be introduced to the technology available for monitoring the conditions in their laboratories.

Hazard identification will be an item for particular attention as it is the point from which management decisions regarding laboratory safety are initiated.

Course Duration: Five Days

### Daily Course Contents:

#### **Day One**

- Introduction - Why is safety important
- Safety Policy
- Safety Standards

- Safety Procedures
- Accident/Incident Reporting; Near misses, The Safety Audits.
- Health and Safety Hazard Recognition.
- First Aid; Medical Support and Available Equipment

## Day Two

- The Emergency Response Team
- Communication, Training; Labelling
- The Material Safety Data Sheet (MSDS), Warning Clauses.
- Work permit system
- Alarm system, Fire alarm system
- Personal Protective Equipment PPE, Gloves etc
- Electrical Safety
- Static Electricity and Other Sources of Ignition in the Laboratory Environment

## Day Three

- Handling of sample containers
- Flame arrestors
- Reactive and Toxic Chemicals.
- Health Hazards of Commonly Used Lab Chemicals.
- Storage, Distribution, and Disposal of Chemicals
- Air Sampling Methods; Badges, Detector Tubes
- Instrumentation for Air Sampling
- Biological Monitoring.
- Flammable Materials; Hazards; Characteristics; Explosion Potential; Control of Ignition Sources

## Day Four

- Ventilation Requirements; Extinguishing Agents
- Laboratory Ventilation: Hood Ventilation
- Spill control procedures
- Hazard identification

## Day Four

- Implementing the safety programme in operations
- Case study and exercises
- **Course Evaluation**
- Course summary and discussion

## Hazardous Spill Response

### Course Introduction:

The handling of Hazardous Materials is a necessity of every day life. The possibility of accidents involving such materials must be minimized and many measures are being taken in this direction. One of these measures however is preparedness for immediate and appropriate response in case an incident does take place. The course is an introduction into the various measures and actions for which a responsible organization must prepare itself.

### Course Objectives:

This course is designed to give the participants:

- Full awareness of all the implications of handling hazardous materials
- The organizational requirements for Hazardous Spill Response
- The resource requirements for handling spill incidents
- Elements of human behaviour under crisis situations

### Who Should Attend:

Managers and technicians from all departments handling materials, chiefs and personnel of emergency response teams, risk minimization managers, fire department chiefs and staff.

### Daily Course Contents:

#### Day One

- Introduction, Definitions
- Accidents, Incidents, near-misses
- Large and small spills
- Causes of spills
- Properties of hazardous materials
- Elements of event tree analysis, domino effects
- Spills in stationary applications
- Spills in moving applications (transport)

### **Day Two**

- Preventive measures
- Precautionary measures
- Alert mechanisms, response time
- Organization of the response team
- Actions for personnel and equipment protection
- Actions for community protection
- Spill containment measures
- Environmental effects of spills (soil contamination, vapour plume)

### **Day Three**

- Clean-up operations
- Protective equipment
- Clean-up chemicals
- Absorbents
- Decontamination of equipment tools and site
- Handling of clean-up waste
- Case Studies
- Group Exercises and Discussions
- Course Evaluation
- Course Summary

## Hazardous Chemical Spillage

### Course Introduction:

The handling of Chemicals and Hazardous Materials is a necessity of every day life. The possibility of accidents involving such materials must be minimized and many measures are being taken in this direction. One of these measures however is preparedness for immediate and appropriate response in case an incident does take place. The course is an introduction into the various measures and actions for which a responsible organization must prepare itself.

### Course Objectives:

This course is designed to give the participants:

- Full awareness of all the implications of handling hazardous materials
- The organizational requirements for Hazardous Spill Response
- The resource requirements for handling spill incidents
- Elements of human behaviour under crisis situations

### Who Should Attend:

Managers and technicians from all departments handling materials, chiefs and personnel of emergency response teams, risk minimization managers, fire department chiefs and staff.

### Daily Course Contents:

#### Day One

- Introduction, Definitions
- Accidents, Incidents, near-misses
- Large and small spills
- Causes of spills
- Properties of hazardous materials
- Elements of event tree analysis, domino effects
- Spills in stationary applications
- Spills in moving applications (transport)
- Health and Safety

- Environmental Concerns
- Economic and Social Impacts

### **Day Two**

- Prevention training requirements
- Response training requirements
- Preventive measures
- Precautionary measures
- Response emergency organization
- Command and control
- Public information
- Spill response operations
- Planning
- Logistics
- Administration and Finance
- Alert mechanisms, response time
- Organization of the response team
- Actions for personnel and equipment protection
- Actions for community protection
- Spill containment measures
- Environmental effects of spills (soil contamination, vapour plume)

### **Day Three**

- Emergency planning
- Assess spill and response operations
- Assess the effects of spill movement and weathering on response operations
- Determine and implement safety procedures
- Select and operate means of transport
- Establish and maintain communications
- Clean-up operations
- Contain spill
- Operate recovery equipment
- Protective equipment
- Clean-up chemicals- Chemical dispersion system

- Absorbents
- Decontamination of equipment tools and site
- Handling of clean-up waste
- Perform post-spill activities

#### **Day Four**

- Hazardous waste management
- Developing a hazardous waste policy and strategy
- Typical hazardous wastes from industry
- Waste transport control system
- Hazchem codes
- UN Hazard classification and labels
- Hazardous materials response guide
- Risk evaluation

#### **Day Five**

- Risk assessment and risk communication in the context of chemical accident prevention, preparedness and response
- Case Studies
- Group Exercises and Discussions
- Course Evaluation
- Course Summary

## Industrial Corrosion Control

### Course Description:

Corrosion resistance of material is frequently a decisive factor in the development of advanced technology as encountered in power generation, energy conservation, environmental protection techniques, and numerous industrial processes operating under severe corrosive environments. The general aim of this course is to provide a basic understanding of corrosion mechanisms and the methods used in corrosion control and prevention.

There will be discussion of engineering problems, along with corrosion science principles, results in an integrated approach to providing solutions to corrosion engineering problems from a variety of industries.

There will coverage of electrochemical principles of metallic corrosion, discussions of various corrosion mechanisms, methods of corrosion control, high temperature corrosion, degradation of polymers and ceramics, and the selection of metallic, organic and ceramic materials.

### Who Should Attend:

This five - day course is intended for engineers and scientists, from a wide variety of industries, who seek a basic understanding of corrosion phenomena and familiarity with the methods used in corrosion control and prevention. The course should also be of interest to materials engineers and those who require familiarity with corrosion science and corrosion engineering.

### Course Contents:

#### ***Fundamental of Corrosion***

- Electrochemical Nature of Corrosion
- Electrode Potentials
- Basic Mechanisms of Corrosion
- Polarization Phenomena
- Corrosion Kinetics
- Passivity

### ***Types of Corrosion***

- Galvanic
- Crevice
- Soil
- Atmospheric
- Microbiological
- Erosion
- Cavitation
- Degradation of Polymers and Ceramics

### ***Corrosion Testing and Corrosion Monitoring***

- Measurement of Corrosion Rates
- Corrosion Detecting Devices
- Evaluation of Corrosion Test Results
- Prediction of Corrosion Rates from Electrochemical Measurements
- In-Plant Corrosion
- Monitoring of Corrosion Rates
- Application of Non-Destructive Evaluation Techniques to Corrosion Problems

### ***Corrosion Control by Improved Design***

- Fluid Flow
- Joining Problems
- Crevices
- Galvanic Coupling
- Stress Concentrations
- Residual Stresses

### **Inhibitors**

- Theory and Utilization of Filming, Vapour Phase, Environmental Modifying, Anodic and Cathodic Inhibitors

Understanding Corrosion-Resistance Metallic Alloys

- *Effects of Metallurgical Structure on Corrosion Behavior*
- Application of Stainless Steels and Other Corrosion Resistant Alloys
- Minimization of Corrosion Problems Caused by Welding

### **Organic Barriers**

- *Organic Coatings and Linings*
- Surface Preparation and Application Methods
- Primers and Topcoats
- Lining Systems

### **Inorganic Barriers**

- *Metallic Coatings, Linings and Cladding*
- Chemical Conservation Coatings
- Ceramic Coating and Linings
- Cement and Concrete Linings

### **Electrochemical Protection**

- *Engineering of Cathodic and Anodic Protection Systems*

### **Discussion of Participants' Corrosion Problems**

#### ***High Temperature Corrosion***

- Oxidation Resistance
- The Effect of Corrosive Gases, Molten Salts and Molten Metals on Metallic and Ceramic Materials

#### ***Corrosion Failure Analysis***

- Approaches to Finding Solutions to Corrosion Problems

- Case Histories
- Discussion of Common Corrosion Problems found in Industry
- Approaches to Economic Solutions of Materials Problems
- Illustrative Examples

### ***Control of Environmental Assisted Cracking***

- Stress Corrosion Cracking
- Corrosion Fatigue
- Hydrogen Embrittlement
- Methods of Minimization
- Introduction to Failure Prevention Using Fracture Mechanics Principles

### ***Control of Microbial Deterioration of Materials***

- Causes and Minimization

### ***Corrosion in Water Systems***

- Corrosive Action on Potable Water, Sea Water, Industrial Waters and Industrial Wastes
- Application of Inhibitors and Related Treatments for Corrosion Minimization
- Chemical Cleaning

### ***Course Evaluation, Summary and Review***

## Industrial Waste Water Treatment Systems & Recycling

### Course Description:

Water is increasingly becoming a scarce resource. Large and small scale users need to take action to conserve it not only because it is prudent practice to do so for their own benefit, but also because it is an active demonstration of their concern about the global pollution and environmental problems.

The course will go through the basic principles of water conservation and reuse and establish a common way of approach to water use issues. It will examine the various techniques and technologies, which can be used to achieve what can sometimes be enormous savings through the implementation of solutions. The course covers industry in general but will be customized to the chemical, petrochemical and oil industries.

### Who Should Attend:

This course is designed suit a number of disciplines within the water Environment & Pollution controls including Environmental Engineers, Chemical Engineers, Mechanical Engineers, Technicians and Utilities Engineers who are responsible for monitoring pollution levels and water purification.

### Daily Course Contents:

#### Day One:

- *Introduction: Waste water characteristics, domestic versus industrial wastewater*
- *Types of industries and their wastewater*
- *Sampling of wastewater Analysis of industrial wastewater*
- *Examples of wastewater from petrochemical and related operations, BOD, COD, Toxicity, Heavy metals, Dissolved, VOC, suspended solids*
- *Uses of water in industry. Cooling, conveying, process, boilers, water heaters, etc.*
- *Pretreatment of water for industrial use*
- *Water pretreatment processes as sources of wastewater (R.O., softening, desalination, etc).*
- *The “correct” water quality.*

### **Day Two:**

- *Pretreatment of waste waters: Segregation of flows, equalization, settling, coagulation, filtration, pH adjustment, neutralization, flocculation, grit removal*
- Statutory water quality objectives
- European Union Urban Wastewater Directive, treatment for sewer discharges Treatment for reuse
- Agricultural reuse options
- Community reuse options
- Industrial reuse options
- Sharing the water resource

### **Day Three:**

- Chemical wastewater treatment: Coagulation, flocculation, precipitation, heavy metals removal
- Oxidation, electrochlorination, other processes.
- Physical waste water treatment: R.O. Activated charcoal, distillation / evaporation

### **Day Four:**

- Biological wastewater treatment
- Elementary Microbiology
- Growing microorganisms on wastes
- Nutrient Removal from Wastewater
- Biological wastewater treatment processes: Aerobic, Anaerobic.

### **Day Five:**

- Sludge treatment: Characteristics of Sludge
- Oily Sludges, Inorganic Sludges, Biological Sludges
- Sludge Use
- Incineration,
- Composting,
- Hazardous sludge.
- Water Reuse: Recycling vs. reuse
- Water use audits, Water use reduction.
- The cost of using water
- Total cost concept
- Discussion and case studies based on scenarios

## ***Industrial Waste Water Treatment***

### **Course Objectives:**

**On completion of this course the trainee/s will be competent in:**

- Understanding of the methods and techniques involved in industrial water and wastewater treatment.
- Safety Systems involved with handling during Identification and Treatment.

**Course Duration:** Five Days

### **Daily Course Contents:**

#### **Process Selection and Source Testing & Control**

- At source controls
- End of Pipe Controls
- Guidelines for Selection and Systems Analysis
- Review of Testing Techniques and Procedures

#### **Principles of Biological Treatment**

- Suspended Growth Systems
- Fixed Film Systems
- Volatile Emissions from
- Biological Treatment Systems
- Sludge Handling Aspects

#### **Control of Bio – Floc Quality**

- Problem Definitions and Causes
- Control of Building
- Aerobic / Anoxic Selectors
- Chemical Control

#### **Aerobic Biological Removal**

- Biodegradation of Toxic Organics
- Kinetic Expression
- Design Basis
- Process Performance

## **GAC and PACT**

- Process Description
- Design Basis and Equation
- Performance of GAC and PACT
- Biological Nutrient Control

## **VOC and Odour Control in Active Sludge**

- Mathematical Modeling to Predict VOC Removals and Degradation

## **Anaerobic Treatment Processes for COD Removal**

- Fundamentals and Performance
- Applications
- Mineralization of Specific Organics

## **Membrane Processes**

- Micro – and Nano-filtration
- Reverse Osmosis

## **Toxicity Identification and Reduction**

- Testing Procedures
- TIEs and TREs
- Case Studies

## **Chemical Oxidization**

- Peroxide, Ozone, UV Catalysis
- Complete and Particle Oxidization

## **Metals Removal – Precipitation and Ion Exchange**

- Description and Performance of Methods
- Case Studies, Discussions
- Exercises

## **Who Should Attend:**

Engineers, chemists and supervisors involved in water treatment systems; especially those involved in the design, operation and control of industrial and power plants.

## Catalysis and Kinetics

### Course Objectives:

The course is designed to give the basic foundation for an understanding of the subject and it will help chemical engineers, chemists, and managers acquire confidence in understanding this branch of physical chemistry which concerns itself with the study of the rates of chemical reactions and with the elucidation of the mechanisms and pathways, by which they proceed.

An understanding of the phenomenon of catalysis requires some familiarity with all three classical branches of chemistry. Catalysts are often inorganic materials and a knowledge of inorganic chemistry is needed for their preparation.

The reactions themselves are studied by the techniques of physical chemistry. The large scale practice of catalysis necessitates the application of chemical engineering principles and a deep insight into materials.

Course Duration: Five Days

### Who Should Attend:

The course is directed to scientists and engineers concerned with heterogeneous catalysis in academic teaching and research as well as in industrial research and development. It can also help chemical engineers and technicians with some experience, in the basic understanding of catalysis and kinetics. This course will also benefit those with no prior knowledge of chemical engineering and are not normally involved with chemical products.

### First Day

- Introduction
- Brief history of surface catalysis
- Concepts and definitions
- Kinetics of elementary steps
- Surface phenomena and catalysis
- Rates of order of reactions

### ***Second Day***

- Arrhenius and activation energy
- Collision theory:
- Bimolecular reactions
- Unimolecular reactions
- Termolecular reactions
- Transition state theory

### **Third Day**

- Effect of temperature on reaction velocity
- Kinetics of elementary steps:
  - Adsorption,
  - Desorption
  - Chemisorption
  - Surface reactions
- Mass transport limitations

### ***Fourth Day***

- The importance of active catalytic centers at the catalyst surfaces
- Structure sensitive / insensitive reactions
- Reactions on acidic solids
- Bifunctional catalysts
- Bimetallic catalysts
- Catalyst poisons

### ***Fifth Day***

- Industrial processes based on solid catalysts
- Experimental Apparatus and Techniques
- Case Histories and Practical Examples of Key Reactions
- Course Summary and Evaluation

## Laboratory Safety Management

### Course Background:

Handling and of modern laboratory chemical material and equipment can be hazardous and cause loss of life and limb. The implications of the latest regulations as regards to the Health, Safety and Environmental controls have to been strictly adhered to and every employee or persons involved within a Laboratory environment must understand the risks to themselves and to their colleagues. They must also understand the actions to be taken to prevent or minimize the risks and what actions to take if they need to take in a situation or emergency. This course is designed to tackle the issues and install the correct practical approach involved and the applicable systems.

### Who Should Attend:

The comprehensive course is designed for laboratory personnel responsible for the safe operation of chemical laboratories. It will also benefit administrative personnel related to the laboratories and with some knowledge on basic principles of safety.

### Course objectives:

Participants will be taken through the fundamentals of laboratory operation safety and will gain a thorough understanding of safety procedures.

Participants will gain comprehensive knowledge on the handling of hazardous material and the precautions available as regards facilities, equipment and means personal protection and will be introduced to the technology available for monitoring the conditions in their laboratories.

Hazard identification will be an item for particular attention as it is the point from which management decisions regarding laboratory safety are initiated.

## Daily Course Contents:

### Day 1

- Introduction. Why is safety important.
- Safety Policy.
- Lab Safety Standards.
- Laboratory Safety Procedures.
- Accident/Incident Reporting; Near misses, The Safety Audits.
- Health and Safety Hazard Recognition.
- First Aid; Medical Support;
- The Emergency Response Team,
- Communication, Training; Labelling;
- The Material Safety Data Sheet (MSDS), Warning Clauses.
- Work permit system
- Alarm system, Fire alarm system.
- Personal protective equipment
- Electrical Safety
- Static Electricity and Other Sources of Ignition in the Laboratory Environment;

### Day 2

- Compressed Gases; Handling Compressed Gas Cylinders;
- Handling of sample containers, sampling bombs;
- Pressure Relief Devices. Flame arrestors
- Reactive and Toxic Chemicals.
- Health Hazards of Commonly Used Lab Chemicals.
- Storage, Distribution, and Disposal of Chemicals
- Air Sampling Methods; Badges, Detector Tubes,
- Instrumentation for Air Sampling.
- Biological Monitoring.
- Flammable Materials; Hazards; Characteristics; Explosion Potential; Control of Ignition Sources;
- Ventilation Requirements; Extinguishing Agents;
- Laboratory Ventilation: Hood Ventilation;
- Spill control procedures;
- Hazard identification;
- Implementing the safety programme in the Laboratory;
- Case study
  
- **Course summary and discussion**
  
- **Course Evaluation**

## Laboratory Equipment

### Course Background:

The need for ensuring consistent and high quality products requires continuous measurements and control of processes. Much of this measurement takes place in laboratories through the use of standardized tests and methods. Similarly the development of new products and processes often requires the use of laboratories and of course laboratory equipment. Understanding the principles of operation and the field of application of such equipment is very important for the laboratory operator and the researcher. But even the most sophisticated equipment is no guarantee for reliable results. The equipment operator must understand and employ the correct procedures for calibration, validation of methods and statistical treatment of measurement uncertainty. Of course laboratories must also be safe places to work in as they often handle materials which are hazardous and toxic to the environment and to humans.

This course brings all these diverse elements close together and presents a complete picture of laboratory equipment selection, installation and operation.

### Who Should Attend:

Research Directors Laboratory managers, Laboratory operators, quality managers, laboratory staff, chemists, chemical engineers,

Course Duration: Five Days

### Course Objectives:

- To give the principles of operation of key laboratory equipment
- To give the principles of reliable laboratory measurements
- To outline key laboratory safety issues and safety measures

### Daily Course Contents:

#### **Day 1**

- Introduction.
- The laboratory and its purpose.

- The laboratory environment.
- Types of equipment: an overview.
- Laboratory layout and construction.
- Out-of-laboratory services, Electricity, ventilation, water, drains etc.
- Benches, hoods, sinks.
- Glassware.
- Plasticware.

## Day 2

- Wet chemistry.
- Instrumental Chemistry.
- Principles of instrumental chemistry.
- Balances.
- Titration.
- Colorimetry.
- Polarography.
- Light absorption.
- Atomic absorption.
- Chromatography.
- Petroleum Laboratory equipment.

## Day 3

- Calibration.
- Correlations.
- Reference materials.
- Correct laboratory techniques.
- Statistical principles for Laboratory measurements.
- Reporting of analytical results.

## Day 4

- Why is safety important.
- Safety Policy.
  - Laboratory Safety.
  - Handling of toxic and hazardous materials.
  - Spills and spill control.
  - Good laboratory practice.
  - Material safety data sheets.
  - Emergency preparedness.
  - Emergency planning.
  - Handling of Compressed Gases (Cylinders).
  - Destruction of hazardous chemicals in the laboratory.

## Day 5

- Examples of calculations
- Exercises.
- Course Evaluation.
- Course Summary.

## Oil Spillage Emergency for Operations

### Course Introduction:

Oil Companies recognize the need to have in place an effective and tested crisis management capability. Oil spill response planning is one facet of that activity. The handling of oil materials is a necessity in our every day life. The possibility of accidents involving oil must be minimized and many measures are being taken in this direction. One of these measures however is preparedness for immediate and appropriate response in case an incident does take place. The course is an introduction into the various measures and actions for which a responsible organization must prepare itself.

### Course Objectives:

The Oil Spillage Emergency for Operations is a 5-day programme designed to teach participants emergency operations for managing major oil spill responses. The course focuses on management aspects of spill response activities and includes training in spill containment and recovery.

**The course is a hands-on programme** in which the participants learn to identify potential spill sources, to properly use response equipment and to determine the appropriate cleanup techniques for the various types of oil that may be spilled. This course provides detailed instruction in oil spill prevention and response techniques. The first phase is classroom instruction and includes the following major topics:

- Prevention of Spills
- Oil movement on Water
- Use of Containment Booms
- Mechanical Recovery
- Use of Dispersants
- Oil Spills on Land
- Temporary Storage and Disposal
- Boat Operation
- Training and Drills

The second phase provides field application. First, surveys are conducted, both within the facility and along the waterfront, to emphasize ways to prevent spills from occurring and to identify cleanup equipment needs. The course then shifts emphasis to spill response and provides one and one half days of hands-on training in the deployment of containment booms, the operators skimmers and the application of dispersants.

Participants learn about the types of cleanup equipment, deployment techniques and the planning required for rapid response. Both safety and handling are also covered.

In particular, this course is designed to give the participants:

- Full awareness of all the implications of handling oil
- The organizational requirements for Oil Spill Response (prevention and control)
- The resource requirements for handling oil spill incidents
- Elements of human behaviour under crisis situations

### **Who Should Attend:**

Managers and technicians from all departments handling oil, chiefs and personnel of emergency response teams, risk minimization managers, fire department chiefs and staff.

### **Daily Course Contents:**

#### **Day One**

- Introduction, Definitions
- Oil Spill Issues
- Prevention – Causes of Spills
- Workshop #1 – Spill Causes/Prevention Examples & Actions
- Contingency Planning
- Oil Spill Response Equipment – Discussion and Demonstrations (At the Warehouse)
- Boat Operations Training (At the Wharf)

#### **Day Two**

- Fate and Effects of Oil Spills
- Workshop #2 – Environmental Considerations for Oil Spill Response Strategies
- Containment and Control – Operational Considerations
- Disposal and Temporary Storage
- Field Exercise #1 – Wharf Spill Scenario

#### **Day Three**

- Field Exercise #1 Review
- Communications for Oil Spills
- Workshop #3 – The Communications Plan

- Industrial Hygiene and Safety
- Workshop #4 – Oil in the shore in front of the Oman Refinery
- Field Exercise #2 – Beach Scenario

### **Day Four**

- Field Exercise #2 Review
- Land Spills
- Public Affairs Issues
- Workshop #5 - The Initial Press Release
- Oman Refinery Response Management Team
- Field Exercise 33 – Practical Exercise (Team Response to an unannounced scenario)

### **Day Five**

- Field Exercise #3 Review - Lessons Learned
- Alternative Technologies
- Oil Spill Response Organization & Capabilities
- Case Studies (Exxon Valdez, etc)
- Course Review and Open Discussion
- Closing Remarks and Presentation of Diplomas

### **Video films**

#### **Part One-INITIAL RESPONSE (25 min.)**

It provides training to personnel who are called upon to control and clean up oil spills. Topics covered in “Initial Response” include:

- How spills occur
- Sizing up the situation
- Size control
- Responder safety
- Incident management
- Different types of oil
- Hazards during different phases of the spill
- Factors that control how a spill behaves
- Agencies to notify about a spill

#### **Part Two-COUNTERMEASURES ON LAND (28 min.)**

It provides training to personnel who are called upon to control and clean up oil spills. Control activities discussed in “Countermeasures on Land” include:

- Low and high pressure washing
- Sand blasting
- Soil washing

- Mechanical removal
- Sorbents
- Steam cleaning
- Physical removal Vacuum pumping
- Bioremediation
- Other topics covered include spill behavior, safety precautions for responders, preparing for an approaching spill, and the special problems of shoreline clean-up.

### **Part Three-COUNTERMEASURES ON WATER (28 min.)**

It provides training to personnel who are called upon to control and clean up oil spills. Control activities discussed in “Countermeasures on water” include:

- Booms and barriers
- Skimming
- Dispersants
- In situ burning
- Herding
- Sorbents
- Chemical treatment
- Other topics include how weather, wind, sea conditions and currents affect water spills, tracking spills in order to predict ecological impact, safety precautions for responders, and dealing with contaminated wildlife.

### **Part Four-WASTE MANAGEMENT (22 min.)**

It provides training to personnel who are called upon to control and clean up oil spills. “Waste Management” discusses the very important issues of handling recovered oil and debris resulting from the clean-up effort and outlines waste management priorities:

- Eliminating the waste
- Reducing the waste
- Recycling the waste
- Treating the waste
- Disposing the waste
- Other topics studied include standards waste oil must meet for recycling, temporary storage options for bulk oil, oil water separation. Use of vacuum trucks, extracting emulsions, separating waste streams, and disposal and reclamation.

CP/  
Oil Spillage Emergency for Operations-5days

## Quality Assurance of Chemical Measurements

### COURSE INTRODUCTION:

Very often there are quality issues in the laboratory, which affect the standards that are intended and mean that quality can be in doubt for our clients. During various stages of processing we need to use quality tools to maintain confidence in the products. The analysis of each stage means that total confidence can also be achieved.

This course is designed specifically for Laboratory technicians and those involved with quality control during the chemical process utilizing the most accurate tools and terms of measure for control. It contains full explanations in an easy to understand format and regular discussions to reinforce learning throughout.

### COURSE LEARNING OBJECTIVES:

- Introduction to Quality Assurance in the Laboratory and how Principles of Measurement are understood and utilized.
- Principles of Chemical Measurement and the Principles of Quality Assurance involved and used to their maximum.
- Accurate Measurement and Recording of Analysis and Results of Sampling of each step of chemical processes using Quality Tools.

### WHO SHOULD ATTEND:

Laboratory Supervisors, Technicians and those involved with Laboratory quality systems and controls.

### COURSE OUTLINE:

#### DAY ONE

- Introduction to Quality Assurance in the Laboratory
- Principles of Measurement
- Principles of Chemical Measurement
- Principles of Quality Assurance
- Good Laboratory and Good Measurements Practices
- Distinction Between GLPs, GMPs, and SOPs
- The Quality Control System
- Chemical Analysis as a System
- Principles of Sampling
- Quality Assurance of Sampling

## **DAY TWO**

- Precision, Bias, and Accuracy
- Sources of Error
- Errors of Rounding
- Influence of Uncertainty on Decision
- Statistical Control
- Statistical Techniques
- Distributions
- Statistics of Measurements
- Estimation of Standard Deviation
- Pooling Estimates of Standards Deviations
- Confidence Limits for an Estimate of a Standard Deviation

## **DAY THREE**

- Confidence Interval for a Mean
- Statistical Tolerance Intervals
- Pooling Means to obtain a Grand Average
- Outliers
- Statistics of Control Charts
- Control Limits
- Use of Random Number Tables

## **DAY FOUR**

- Precision
- Sensitivity
- Limit of Detection
- Selectivity
- Importance of an SOP
- Standardization of Methods
- Principles of Calibration
- Linear Relationships
- Test for Linearity

## **DAY FIVE**

- Blank Correction
- Statistical Treatment of the Blank
- Control Charts

- Control Samples
- Evaluation Samples
- Reference Materials
- Traceability
- Quality Audits
- Validation
- Reporting Analytical Data
- Case Studies
- Discussions
- Course Evaluation and Summary

## Reaction Kinetics and Catalysis

### Course Objectives:

The course is designed to give the basic foundation for an understanding of the subject and it will help chemical engineers, chemists, and managers acquire confidence in understanding this branch of physical chemistry which concerns itself with the study of the rates of chemical reactions and with the elucidation of the mechanisms and pathways, by which they proceed.

An understanding of the phenomenon of catalysis requires some familiarity with all three classical branches of chemistry. Catalysts are often inorganic materials and knowledge of inorganic chemistry is needed for their preparation.

The reactions themselves are studied by the techniques of physical chemistry. The large scale practice of catalysis necessitates the application of chemical engineering principles and a deep insight into materials.

**Course Duration:** Five Days

### Who Should Attend:

The course is directed to scientists and engineers concerned with heterogeneous catalysis in academic teaching and research as well as in industrial research and development. It can also help chemical engineers and technicians with some experience, in the basic understanding of catalysis and kinetics. This course will also benefit those with no prior knowledge of chemical engineering and are not normally involved with chemical products.

### First Day

- Introduction
- Brief history of surface catalysis
- Concepts and definitions
- Surface phenomena and catalysis
- Rates of order of reactions
- Case Study – Polypropylene Production

### Second Day

- Kinetics of elementary steps
- Arrhenius and activation energy
- Effect of temperature on reaction velocity
- Collision theory:
- Bimolecular reactions
- Unimolecular reactions
- Termolecular reactions
- Transition state theory
- Case Study – Steam Reforming
- 

### Third Day

- Adsorption,
  - **Physical and Chemical Adsorption**
  - **Desorption**
- Chemical Adsorption and Catalysis
- - A Classification of solid Catalysts
  - **Metals**
  - **Metal Oxides**
  - **Acids**
- Mass transport limitations
  - **Surface reactions**
- Case Study – Ammonia Production

### Fourth Day

- The importance of active catalytic centers at the catalyst surfaces
- Structure sensitive / insensitive reactions
- Reactions on acidic solids
- Bifunctional catalysts
- Bimetallic catalysts
- Catalyst poisons
- Kinetics of Solid Catalyzed Reactions
- Case Study – Iron and Steel Production

**Fifth Day**

- Industrial processes based on solid catalysts
- Case Histories and Practical Examples of Key Reactions
- Course Summary and Evaluation

**Course Background:**

The ecosystems are an issue that affects all living things on the planet and there is still industrial pollution from processing plants and manufacturing that is building up to a catastrophic scale which has been addressed by responsible organizations.

Heavy fines and share holders pressures have brought about changes and preventions to ensure controls and monitoring are ongoing but without these aspects the ecosystem would again be under attack and leave a legacy to future generations. This course is designed to bring awareness of the types, effects and prevention of environmental pollution from most areas of industry and the methods employed to reduce the threats.

**Course Objectives:**

- The Eco Systems and environmental damages awareness and actions in force
- The penalties from protection bodies, The International and EU Regulations, Health & Safety Laws and compliance with the laws regarding pollution.
- Good Housekeeping in conjunction with environmental management / ecosystems systems.
- The organizational benefits in costs and profitability.

**Course Duration:** Four Days

**Course Contents:**

- Introduction to environmental damage caused by poor waste management technology: the effects and the potential remedies
- The Environmental cost's short and long term
- International and EU laws
- Clean Air and Air Quality Legalities, Acts and Policies
- Sustainable Development.
- The Debate and Politics.
- International Legislation.
- Health and Safety Regulations: The requirements and the penalties
- Effluents and Water Systems Natural and Man-made Pollution
- Basics of Atmospheric chemistry.
- Global Warming, The atmosphere, Catastrophic theory,
- The Greenhouse effect. Carbon Cycle, Methane, Nitrogen Oxides, Particulates, Aerosols, Ozone (production and distribution), Water Vapor.
- Anthropogenic effect. The enhanced Greenhouse Effect, CFCs, HCFCs, Methane
- Nox, Sox, Particulates, Acid rain.
- Combustion Emissions. Nox, Sox, Particulates.
- Clean Air Combustion Technology (Combating Nox, Sox, Particulates including CO<sub>2</sub> sequestration), Clean Coal Technology, and Oil from Coal.

- Pollution: Types, effects, limiting, degradation
  - Waste Management Treatment: Methods, natural, burning, burying, break down, recycling, recovery and disposal
  - Projects in Petrochemical Waste Management: Types, success, failures and progression
  - Technology: Availability and Developments
  - Waste Management Treatment Plants: Designs and Productivity
  - Waste Reduction: Planning, organizational objectives / goals
  - Impact Analysis: Sources, Measurement, Equipment, Quantification and Reports
  - Waste Water: Recycling for re-use, chemicals and treatment processes
  - Flash Evaporators
  - Low & High Pressure Boilers
  - Boilers, Cooling Towers, Oil Water Separators, Waste and Sour Water, Treatment, Water Pollution Control
  - Physical Treatment: Sedimentation, Floatation, Coagulation, Flocculation
  - Oil Slicks: Formation of Emulsions, Containment, Dispersal
  - Waste Treatment and Environmental Management Systems
  - Pollution Monitoring Techniques and Tools
  - Pollution and Major Contamination Prevention
  - Information Management: Recording and Documentation
- 
- Case Studies, discussion groups and exercises

### **Program Support:**

This program includes videos to highlight the critical issues relating to ECO Systems and Pollution Monitoring Techniques.

### **Who Should Attend:**

Health, Safety and Environmental Systems Managers, Engineers, Environmental policy makers Chemists and Technicians. Also those interested in ECO Systems the problems and solutions.

## Safety in the Laboratory

### Course Background:

Handling and of modern laboratory chemical material and equipment can be hazardous and cause loss of life and limb. The implications of the latest regulations as regards to the Health, Safety and Environmental controls have to been strictly adhered to and every employee or persons involved within a Laboratory environment must understand the risks to themselves and to their colleagues. They must also understand the actions to be taken to prevent or minimize the risks and what actions to take if they need to take in a situation or emergency. This course is designed to tackle the issues and install the correct practical approach involved and the applicable systems.

### Who Should Attend:

The comprehensive course is designed for laboratory personnel responsible for the safe operation of chemical laboratories. It will also benefit administrative personnel related to the laboratories and with some knowledge on basic principles of safety.

### Course Objectives:

Participants will be taken through the fundamentals of laboratory operation safety and will gain a thorough understanding of safety procedures.

Participants will gain comprehensive knowledge on the handling of hazardous material and the precautions available as regards facilities, equipment and means personal protection and will be introduced to the technology available for monitoring the conditions in their laboratories.

Hazard identification will be an item for particular attention as it is the point from which management decisions regarding laboratory safety are initiated.

Course Duration: Five Days

### Course Contents:

- Introduction - Why is safety important
- Safety Policy
- Lab Safety Standards
- Laboratory Safety Procedures

- Accident/Incident Reporting; Near misses, The Safety Audits.
- Health and Safety Hazard Recognition.
- First Aid; Medical Support and Available Equipment
- The Emergency Response Team
- Communication, Training; Labelling
- The Material Safety Data Sheet (MSDS), Warning Clauses.
- Work permit system
- Alarm system, Fire alarm system
- Personal protective equipment
- Electrical Safety
- Static Electricity and Other Sources of Ignition in the Laboratory Environment
- Compressed Gases; Handling Compressed Gas Cylinders
- Handling of sample containers, sampling bombs
- Pressure Relief Devices. Flame arrestors
- Reactive and Toxic Chemicals.
- Health Hazards of Commonly Used Lab Chemicals.
- Storage, Distribution, and Disposal of Chemicals
- Air Sampling Methods; Badges, Detector Tubes
- Instrumentation for Air Sampling
- Biological Monitoring.
- Flammable Materials; Hazards; Characteristics; Explosion Potential; Control of Ignition Sources
- Ventilation Requirements; Extinguishing Agents
- Laboratory Ventilation: Hood Ventilation
- Spill control procedures
- Hazard identification
- Implementing the safety programme in the Laboratory
- Case study and exercises
  
- **Course summary and discussion**
  
- **Course Evaluation**

**Program Support:**

This course will involve interactive discussion to create maximum activity with students and will also include some practical demonstrations in the laboratory environment.

## Statistical Process Control (SPC)

### Course Learning Objectives:

- Participants will learn the methods in collecting Raw Data through sampling methods and techniques and collection of Quantitative and Qualitative Data
- The various terminology and tools applied to Statistics
- How to analyse, interpret and present meaningful information
- They will also learn how to utilise the acquired information for Data and Systems Modelling for Statistical Techniques and Experimental Planning

### Who Should Attend:

Engineers, Technicians, Chemical Engineers, Analysts, Quality Controllers, Staff involved in Planning and Forecasting in Operations, Maintenance & Process Engineers

Course Duration: Three Days

### Daily Course Contents:

#### Day One:

- **Types of Data**
  - Quantitative
  - Qualitative
  - Primary and Secondary Data
  - Population, Empirical Perception
  - Collection and representation
- **Data Summaries Methodologies**
  - Selective Sampling
  - Random Sampling
- **Numerical Summaries**
  - Averages, Arithmetic Mean, Moving Averages
  - Median, Mode Spread, Range
  - Standard Deviation (SD)
  - Central Tendency, Dispersion
  - Variance
  - Frequency, Dispersion
  - Quartiles

- **Probability**
  - Law of probability
  - Decision Trees
  - Expectancy
  - Inference, Monte Carlo Method
  
- **Graphical and Numerical Summary Presentation**

### **Day Two:**

- **Variable in a Sample**
  - Discretion & Continuous
  - Nominal & Ordinal
  
- **Graphical Display Methods**
  - Pie Charts, Bar Charts, Column Charts
  - Histograms, Time Series Plots
  - Scatter grams, Stem and Leaf Plots
  - Pictograms
  
- **Distribution Analysis**
  - Frequency Distribution
  - Exponential Distribution
  - Normal Distribution
  - Poisson Distribution
  - Probability Distribution
  - Binominal Distribution & Skewness
  
- **Significant Testing / Hypothesis & CIH Square Test**
  
- **Measures of Association: Correlation and Coefficient**

### **Day Three:**

- **Regression Analysis**
  
- **Forecasting Methods of Estimation - Confidence Intervals**

➤ **Control Charts**

➤ **Statistical Techniques**

- Variance
- Cluster
- Component
- Discriminant

➤ **An Overview of Statistical Computer Software Programs**

➤ **Examples of Case Studies exercises and discussion including:**

- Budget Preparation, Manpower
- Planning,
- Maintenance Shutdown Planning
- Sales Forecasting
- Accounting and Forward Business Planning (five year strategies)

## TQM in Laboratory Operations

### Course Background:

The purpose of a laboratory is to extract the information contained in a sample and present it to decision makers who must decide on their further actions based on the laboratory results. The risks of a wrong decision can be enormous. In this course the basic aspects of Quality in Laboratory Operations will be examined from the Total Quality Management (TQM) perspective. This means that all the influences and sources of uncertainty which could cast doubt on the reliability of a laboratory result must be identified and suitably addressed.

### Course objectives:

**This course is designed to give the participants:**

- A thorough understanding of the factors which could influence the results of laboratory analyses.
- The factors, which are important for good laboratory operations.
- The use of statistical techniques to estimate the uncertainty in measurements.

### Who Should Attend:

Research Directors and Managers, Laboratory Managers, Laboratory Chemists and Engineers, Laboratory operators. Persons using the results of laboratories.

**Course Duration:** 5 days

### Course Support & Methodology:

The course includes highly interactive discussions and group case studies and exercises to involve and practice the students in the methods available to them.

The course leader encourages students to bring their specific problems in order to work through and be able to solve realistic problems using the methods taught.

## **Daily Course Contents:**

### **Day 1**

- Introduction to Total Quality Management Concepts
- Laboratory organization based on the TQM concept
- The factors which could affect Measurement Quality
- Quality assurance of chemical measurements
- Introduction to basic statistical concepts – a refresher
- Refresher exercises on statistics

### **Day 2**

- Frequency distributions, probability
- The normal curve and its properties
- Sources of error, confidence intervals
- Principles of Measurement
- Sensitivity, limits of detection, selectivity
- Calibration principles, Reference materials
- Blank correction
- Traceability, standards

### **Day 3**

- Sampling discrete items and from bulk
- Sample tracking, Laboratory Information Systems (LIMS)
- Standard operating procedures (SOP)
- Reproducibility, repeatability
- Calculation of measurement uncertainty
- Case Study & Exercises

### **Day 4**

- Calculation of confidence intervals from measurement data
- Comparison of values.
  - Single tail tests.
  - Two tail tests
- Analysis of variance
- Exercise, and examples

## Day 5

- Regression analysis
- Construction of calibration lines
- Construction of relationship lines
- Exercises and examples
- Summary
- Course evaluation

**Students must bring to the course a calculator with statistical functions.**

## Waste Management

### Course Background:

There is growing concern about the legacy every country or the global village is leaving to the next generation and the planets condition and what the environment can stand before total breakdown of the Eco systems. This affects every person and therefore every person in any industry has to share the eve growing responsibility.

This course is designed to give the facts and the practicalities in details and with shared interaction from the speaker to the students. It uses graphical explanations and videos to demonstrate good and bad waste management systems and the subsequent consequences in the event of continual industrial neglect.

### Course Objectives:

**On completion of this course the trainee/s will be competent in:**

- The methods of industrial waste treatment in conjunction with environmental management / ecosystems systems.
- The International and EU Regulations, Health & Safety Laws and compliance with the laws regarding pollution.
- The organizational benefits in costs and profitability.
- Effective Waste management Systems

**Course Duration:** Five Days

### Daily Course Contents:

#### Day One

- Introduction to Social Responsibilities and environmental damage caused by poor waste management technology: the effects and the potential remedies
- Effects on Environment and Humans
- The Environmental cost's
- International and EU laws
- Effluents and Water Systems
- Health and Safety Regulations: The requirements and the penalties

#### Day Two

- Pollution: Types, effects, limiting, degradation
- Waste Treatment: Methods, natural, burning, burying, break down, recycling, recovery and disposal
- Projects in Petrochemical Waste Management: Types, success, failures and progression

- Effective Waste management Systems

### **Day Three**

- Technology: Availability and Developments
- Waste Treatment Plants: Designs and Productivity
- Waste Reduction: Planning, organizational objectives / goals
- Impact Analysis: Sources, Measurement, Equipment, Quantification and Reports
- Waste Water: Recycling for re-use, chemicals and treatment processes
- Flash Evaporators

### **Day Four**

- Low & High Pressure Boilers
- Boilers, Cooling Towers, Oil Water Separators, Waste and Sour Water, Treatment, Water Pollution Control
- Physical Treatment: Sedimentation, Floatation, Coagulation, Flocculation
- Oil Slicks: Formation of Emulsions, Containment, Dispersal

### **Day Five**

- Waste Treatment and Environmental Management Systems
- Environmental Monitoring Research and Results
- Information Management: Recording and Documentation
- Case Studies,
- Discussion groups
- Group Exercises
- Course Evaluation
- Course summary

### **Who Should Attend:**

Managers, Engineers, Environmental policy makers Chemists and Technicians