Human Factors in Process Safety & Ergonomics

Course general description:

This advanced course explores **human factors engineering and ergonomics** within **high-risk process industries** such as oil & gas, petrochemicals, and manufacturing. The course focuses on how **human errors, workplace design, cognitive load, and organizational factors** impact process safety and operational performance. It also provides **ergonomic solutions** to reduce risks and optimize human-system interaction.

Audience:

This course is intended for:

- Process Safety & HSE Professionals
- Risk & Reliability Engineers
- Operations & Maintenance Leaders
- Process Engineers & Control Room Operators
- Industrial & Occupational Ergonomists
- Regulators & Compliance Officers

Course objectives:

By the end of this course, participants will:

- **Understand the role of human factors in process safety incidents.**
- **Identify and mitigate human errors in high-risk operations.**
- **Apply ergonomic principles to process design and operations.**
- **Assess cognitive workload and operator fatigue risks.**
- **Develop human-centered safety strategies and safety-critical task analysis.**
- **Implement human performance monitoring in process industries.**

Course duration:

5 days

Course location:

Dubai

Course contents:

Day 1: Introduction to Human Factors & Process Safety

- Pretest
- **Human Factors & Process Safety: An Overview**
  - Importance of human factors in process safety incidents
  - Case studies: Human errors in major process accidents (e.g., Texas City Refinery, Bhopal, Piper Alpha)
  - Regulatory frameworks (OSHA, CCPS, ISO 45003, HSE HSG48)
- **Human Error & Organizational Influence**
  - Types of human errors (slips, lapses, mistakes, violations)
  - Error reduction strategies (task simplification, automation, training)
  - Organizational culture, leadership, and safety behavior
- **Practical Exercise:** Human error analysis using real-case scenarios

Day 2: Human-Centered Process Safety Design

- **Safety-Critical Task Analysis (SCTA)**
  - Identifying safety-critical tasks in operations
  - Task complexity, automation, and decision-making errors

    - Conducting a human error probability (HEP) analysis
- **Human-Machine Interface (HMI) & Control Room Design**
    - Principles of effective control room design
    - Alarm management & operator decision fatigue
    - Digital vs. analog instrumentation considerations
- **Practical Exercise:** Evaluating a control room for human factors issues

Day 3: Ergonomics in Process Safety & Industrial Workspaces

- **Workplace Ergonomics & Process Safety**
    - Ergonomic risk factors in process operations
    - Design of workstations, tools, and equipment to minimize injuries
    - Musculoskeletal disorders (MSDs) prevention in industrial environments
- **Fatigue Management & Shift Work Optimization**
    - Fatigue risk in process industries
    - Best practices for shift scheduling & workload balancing
    - Use of biometrics and AI for fatigue monitoring
- **Practical Exercise:** Ergonomic assessment of an industrial workstation

Day 4: Behavioral Safety & Cognitive Workload in High-Risk Environments

- **Human Reliability & Cognitive Load in Process Operations**
    - The impact of mental workload on safety performance
    - Cognitive biases in decision-making under pressure
    - Situational awareness in emergency response
- **Human Factors in Safety Leadership & Culture**
    - Developing a safety-focused mindset among leaders
    - Behavioral safety and worker engagement strategies
    - Psychological safety and communication in safety-critical environments
- **Practical Exercise:** Measuring cognitive workload in process operators

Day 5: Human Factors Risk Management & Continuous Improvement

- **Human Factors in Incident Investigation & Root Cause Analysis**
    - Using the Human Factors Analysis and Classification System (HFACS)
    - How to integrate human factors into risk assessments (HAZOP, LOPA)
    - Case study: Human factors lessons from real process safety incidents
- **Human Performance Monitoring & Continuous Improvement**
    - Safety performance metrics & leading indicators
    - Integrating human factors into process safety management (PSM)
    - Future trends: AI, virtual reality, and digital twins in human factors engineering
- **Final Exercise:** Developing a human factors improvement plan for a facility

Methodology:

- 50% lectures & concepts
- 10% Videos
- 10% Case studies
- 10% Exercises
- 10% Discussions
- 10% Software (if applicable or examples)

Assessment and Certification:

Upon successful completion, participants will receive a **Certificate in Emergency Response & Crisis Management for HSE Professionals**, demonstrating their expertise in **emergency planning, crisis leadership, and risk mitigation**.

Course code: (THSE009)