Developing Key Safety Critical Elements Training Course

Introduction

The success of every company depends of each employee's understanding of the key business components. Employee training and development will unlock the companies' profitability and reliability. When people, processes, and technology work together as a team developing practical solutions, companies can maximize profitability and assets in a sustainable manner. Training and development are an investment in future success - give yourself and your employees the keys to success.

It is strategically important that your operations team understands Process Safety Management and developing key safety critical elements. This is the difference between being in the best quartile of operational safety ability and being in the last quartile. There is vast difference in the operational safety ability of operating companies and most benchmarking studies have confirmed this gap in operational abilities.

Whether you have a team of new or seasoned employees, an introduction or review of these concepts is very beneficial in closing the gap if you are not in the best quartile or maintaining a leadership position. Most studies show that a continuous reinforcement of best practices in operational principles is the most effective way to obtain the desired results. Training and learning should be an ongoing continuous lifelong goal.

Course Objective

This course will guide the participates to develop key concepts and techniques to develop process safety management (PSM) key safety critical elements. These key concepts can be utilized to make operating decisions that can improve your unit's safety performance.

Process Safety Management (PSM) is the identification, prevention, control, and mitigation of unintended release of hazardous materials or loss of primary containment that have the potential to become serious incidents (fires, explosions, mass injuries, fatality, etc.).

One of the key components to achieving a successful PSM is to create and maintain safeguards or barriers to prevent the release of hazardous materials and mitigate the effect/ consequence of those releases to personnel, asset, and the environment.

The safety-critical elements (SCEs) are those barriers of an installation or plant that can be subjected to failure and substantially cause, contribute, prevent or help recover from a major accident hazard or event.

Safety Critical Elements are the equipment and systems that provide the basis of risk management associated with Major Accident Hazards (MAHs).

Safety Critical Elements are any part of the installation, plant or computer programs the failure of which will either cause or contribute to a major accident, or the purpose of which is to prevent or limit the effect of a major accident.

This program will emphasize process safety management and safety critical elements and utilization of these fundamentals by operations and maintenance personnel. This program can be 3-5 days depending on the needs analysis of the participants.

Here is a complete list of Safety and Environmental Elements. Some of the elements are part of traditional safety programs and some are part of Process Safety Management.

Integrity Barrier	**Safety and Environmental Critical Elements**
Structural Integrity	• Foundation Structures • Surface Structures • Heavy Lift Cranes • Occupied Buildings
Process Containment	• Pressure vessels • Heat Exchangers • Rotating Equipment • Tanks and Piping Systems • Bunding and Drainage • Tanker Loading
Ignition Control	• Hazardous Area Ventilation • Non-Hazardous Area Ventilation • Certified Electrical Equipment • Tripping of non-certified Equipment • Inert Gas Systems • Earth Bonding • Hot surface management • Spark Arrestors and Flame and Flashback arrestors
Protection Systems	• Passive and Active fire Protection Systems • Layout and segregation • Explosion Protection • Firewater Pumps

Detection Systems	• Fire & Gas detection • Corrosion monitoring equipment • Flaring monitoring equipment
Shutdown Systems (Isolation and Blowdown)	• ESD including IPF and HIPPS • Depressurization • Equipment Isolation • Piping isolation • Valves • ESDV
Emergency response	• Protection Systems as above • Escape and Evacuation Routes • Emergency/Escape Lighting • Communication Systems • UPS • Open Haz/Non-Haz Drains • Emergency Power • Medical Emergency response times • Spill kits
Lifesaving	• Personal Safety Equipment • Tertiary means of Escape

To identify Safety Critical Elements, the first step is to identify what are the major accident events that may occur in a process plant. Site operation experience must be applied, and external consultants may be involved during this phase.

The second step is to assess what the prevention and mitigation barriers are that would prevent a major accident or would limit the effects of the aftermath on a case-by-case basis.

This is carried out using a series of hazard identification techniques, involving both qualitative and quantitative methods.

Qualitative techniques include studies like:

- Hazard Identification Studies (HAZID)
- Hazardous Operation Studies (HAZOP)
- Risk Assessment Workshops
- Simultaneous Operation studies (SIMOPS)
- Control Hazardous Studies (CHAZOP)

Semi-quantitative techniques include studies like:

- Layer of Protection Analysis (LOPA)

Quantitative techniques include studies like:

- Quantitative Risk Analysis (QRA)

Any element that prevents a catastrophic event is a safety critical element and should be recorded in a register. a) Identification of equipment as SCE; b) Setting performance standard requirement; c) Regular maintenance to comply with set performance standard; and d) Reporting of anomaly and corrective actions.

Outline

Introduction

- Overview of the Chemical Processing Industry
- Chemistry of the Processing Industry

Review of Process Incidents

- Safety for the Operation and Maintenance Groups

Introduction to Process Hazard Analysis

- Hazard Identification Studies (HAZID)
- Hazardous Operation Studies (HAZOP)
- Risk Assessment Workshops
- Simultaneous Operation studies (SIMOPS)
- Control Hazardous Studies (CHAZOP)

Review of Hazard Analysis Techniques

- Hazard Identification
  - energy sources
  - electrical sources
  - chemical sources
- Case Study on Hazard Identification
- HAZOP System Methods
- Root Cause Analysis Methods
- Case Study on Root Cause Analysis
- Incident Investigation

Introduction to LOPA

- Concept, purpose and principles of LOPA
- LOPA methodology (selecting scenarios, the LOPA process, describing scenarios, estimating initiating event frequencies, independent protection layers and their reliability)
- LOPA study and documentation
- Advanced aspects
- Facilitating a LOPA study
- Responsibilities and challenges

Control Measures

a. elimination
b. substitution
c. engineering
d. administration
e personal protective equipment

Control Measures – Engineering

a. process design
b. relief valves
c. Safety Integrity Levels
d. fire protection and controls

Developing Critical Safety Elements

- By extracting the IPL that have been credited for risk reduction in the LOPA, we have a well-defined list of SCE. Applying LOPA rules correctly we can easily dismiss controls that appear to provide protection but might not be significant enough to be allocated independent risk reduction.

- This means time and money can be focused on looking after the equipment that is important.

- Note for identifying all control measures bowtie techniques can be used in a similar way, as these will include administrative controls and help to determine effectiveness etc.

- The following are some examples of what may be considered as SCE.
  - Safety Trips (sensor, pushbutton, logic solver, final element).
  - Pressure relief device (safety valve or rupture disk).
  - Secondary containment (bund)
  - Containment with scrubber systems

- Below are some areas we've seen where the rigors of managing SCE have been applied incorrectly.
  - Traditional Safety Items

Conclusions

- Who is the Captain of Your Ship?
- Building Safety Awareness

Who Should Attend:

- People who are making day to day decisions regarding operation, design, safety and economics of processing plants;

    1. 1st Line Operations personnel,
    2. Operation Supervisors,
    3. 1st Line Maintenance personnel,
    4. Maintenance Supervisors,
    5. Senior Plant Supervisors,
    6. Operations Engineers
    7. Process Support Engineers,
    8. Design Engineers,
    9. Cost Engineers

- Engineers, Operating Personnel, PSM Coordinators, HSE Managers and Engineers

- Ideal for veterans and those with only a few years of experience who want to review or broaden their understanding of process safety.

- Other professionals who desire a better understanding of the subject matter.

What you can expect to gain:

- How to conduct a Hazard Identification and Risk Analysis (HIRA)
- Learn Core Knowledge needed in a Hazard Identification
- How to perform a Process Hazard Analysis to meet Process Safety Management requirements for initial PHAs and management of change analyses.
- How to analyze operating procedures for critical scenarios.
- Review of Engineering Controls
- LOPA Guidelines
- How to develop Safety Critical Elements