

SAFETY IN CHEMICAL / PROCESS PLANTS

Introduction

Process industry is based on the cascading effect of various unit operations. In order to maintain these operations safe, proactive maintenance practices should be adopted.

Planned Maintenance and Autonomous maintenance should be adopted and integrated with safety aspects

Maintenance department is recognized as caretaker of company and must be integrated with safety initiatives such as safety messages, procedures, meetings, checks, equipment, training and permits, etc.

The overall objective of the maintenance process is to reduce downtime, increase MTBF, prevent deterioration of equipment and ensure that there are no accidents/incident in the workplace due to mechanical failures.

The process industry has witnessed some of the major disasters in the world. The prominent among them were Bhopal (India, 1984), Flixoborough (England, 1974) and Seveso (Italy, 1976).

The major reasons for the above disasters were due to negligence, not working in accordance with engineering practices and inadequate maintenance plan.

All the above incidents confirm that the accidents happened due to mechanical failures coupled with operational errors, so there is a need for proactive approach on maintenance of unit operations.

(I) Hazard recognition:

A hazard is the potential of an activity, material or process that could result in injury to workers, damage to equipment, structure or property or degradation of the function of the process. A hazard raises significant risk of bodily harm to employees.

On day to day maintenance, Workers must be aware of all potential hazards in their workplace and how to protect themselves. This will help them effectively eliminate costly industrial workplace hazards.

Training is an essential part of every employer's safety and health program for protecting workers from injuries and illnesses. Many researchers conclude that those who are new on the job have a higher rate of accidents and injuries than more experienced workers.

If lack of knowledge of specific job hazards and of proper work practices is even partly to blame for this higher injury rate, then training will help to provide a solution.

(II) Day to Day Maintenance Hazards and Prevention :

1. Fall .
2. Machine Guards
3. Machinery Lock out – Tag Out
4. Confined Space works
5. Working with pressure system
6. Safe scaffolds
7. Welding and Cutting
8. Hand and Power tools Hazards
9. Handling Overhead Cranes

Fall Protection :

Accidents involving falls are generally complex involving a variety of factors and deals with both the human and equipment-related issues in protecting workers from fall hazards.

When work is performed on elevated surfaces such as roofs, or during construction activities, protection against falls must be considered. Fall arresting systems, which include lifelines, body harnesses, and other associated equipment are often used when fall hazards cannot be controlled by railings, floors, nets and other means. These systems are designed to stop a free fall of us to six feet while limiting the forces imposed on the wearer.

Machine Guarding:

Effective Machine Guarding is a fundamental component of most workplace safety . Machine guarding helps to prevent items such as arms, fingers, hair and clothing from coming into contact with moving or dangerous parts of machinery. Without such guarding, the result can be severe or even fatal.

Identifying the "Points of Operation" and power transmission sources for each machine or piece of equipment. Knowing both the moving / non-moving hazards of the machinery and the "Points of Operation" will help to understand what types of guarding may be necessary.

Machinery Lock-out Tag-out

Apart from electricity being as a potentially hazardous energy source, there are other sources of energy, that can also be hazardous. These energy sources include thermal, chemical, pneumatic, hydraulic, mechanical, and gravity. It is important to remember that all sources of energy that have the potential to unexpectedly start-up, energize, or release must be identified and locked, blocked, or released before servicing or maintenance is performed.

Working in Confined Space

Entering manholes, vaults, pits, storage tanks, boilers and other types of confined spaces presents special hazards.

Confined Spaces are large enough to allow entry of any body part, and limited or restricted entry or exit, and not designed for continuous employee occupancy.

Before entering any confined space, there should be a permit. Survey of the confined space to assess the hazards and make certain all lines to and from the vessel are effectively blinded or disconnected , Lock out of all electrical equipment including pumps, agitators, fans, and the heat trace and level indicator to be made . The confined space shall be free from all toxic or flammable equipment gas- free.

Safe Scaffolds :

Scaffold failures can be avoided. Sensible use, careful maintenance and regular inspection is a must. The most dangerous element is the staging plank.

Hand and Power tools Hazards

Hand and portable power tools are simple, everyday tools can be very helpful in getting a job done faster. At the same time, hand and portable power tools can one of the biggest hazards employees may encounter and can cause serious injury if not used and maintained properly.

Since many power tools utilize a chorded power source, the possibility of electrical burns or shocks exists.

- Damaged electrical cords or connections should be replaced.
- The cord or connection should be inspected prior to use.
- Use of a ground fault circuit interruptor (GFCI) / Earth Leakage Circuit Breaker (ELCB) will help to reduce the risk of shock
- Electric-powered tools in damp or wet locations should not be used.

Fundamental concept for using hand and power tool:

- Using the right tool for the job
- Keeping all tools in good working condition
- Inspecting all tools prior to use
- Using the tools as designed by the manufacturer
- Never removing guards or modifying safety features built into switches
- Protecting employees by using appropriate PPE

(I I I) PROCESS SAFETY MANAGEMENT SYSTEM

It is a management system based on the Occupational Safety and Health Administration (OSHA) of the USA. The goal of the Process Safety Management System is to proactively avoid any incident or accident in a Chemical Process Plant facility that handles or processes hazardous chemicals. The system develops administrative controls and procedures using these 13 standards. These standards have been developed after analyzing incidents/accidents in the chemical industry.

STANDARD

A standard is a set of written minimum requirements for each element, which have to be met compulsorily.

Topmost priority is to protect the health and safety of its employees, the community, environment and facility assets. The process Safety Management System focuses on excellence, by continuous improvement and employee involvement in the safe operation of plants.

ELEMENTS OF PROCESS SAFETY MANAGEMENT SYSTEM

Process Safety information
Process Hazards Analysis
Safe Operating Procedures
Contractor control
Training
Pre-start up Safety Review
Safe Work Practices
Mechanical Integrity
Incident Investigation
Emergency Response and Planning
Management of Change
Employee Participation
Compliance audit and management review.

a) Process Safety information

Every plant personnel must be able to get ready information on Safety information of hazardous chemicals and Material Safety Data sheets , Safe operating limits and consequences of deviating these limits. Maximum and safe operating inventory data , Up to date Process and instrumentation drawings, Up to date Process flow drawings. Design information like material of construction, Relief system design basis, Emergency interlock system etc.

Calculations performed to verify relief device settings, Documentations of inspections, testing of safety critical devices

b) Process Hazard Analysis:

This is a standard which requires a scientific system of evaluating process hazards associated with the daily operation of the facilities and to provide recommendations. The most common method used is Hazard and Operability (HAZOP) studies.

c) Contractor Control

Standard describes the steps necessary to ensure an effective system for contractor to perform all work in a safe manner and that they are fully prepared to work in the facilities environment.

d) Training:

This Standard ensures that each employee presently involved in a process and each employee before being involved in a newly assigned process are trained in the overview of the process and procedures. Special emphasis on specific safety and health hazards, emergency operations shutdown and safe work practices applicable to the employees' job task.

e) Pre-Start up Safety Review

This standard ensures that systems are in place to prevent process related incidents caused by inadequate, incomplete or unauthorized design and / or installation.

f) Safe work practices:

This standard ensures that systems are in place for the safe performance of operations, maintenance and construction work practices. It also ensures that there is a system to control materials and substances that could affect process safety.

g) Mechanical Integrity:

This standard requires effective systems to establish and maintain safety critical equipment in proper condition. Safety critical equipment are those equipment whose failure could result in release of hazardous chemicals.

h) Incident Investigation:

This standard ensures that a system is in place to provide effective investigations of process related incidents, which result in, or could reasonably have resulted in injury to personnel, fire, explosion, toxic release or damage to equipment.

i) Emergency Planning and Response:

This standard ensures that an effective system is in place for an emergency management program and response plan.

j) Management of change:

This standard ensures that a system exists for management of changes to process units that process or handle hazardous materials. When changes occur, this system ensures that they do not cause a process related incident. The changes governed by this standard deal with process technology, facilities, procedures, materials of construction, equipment and protective system.

k) Employee participation:

This standard ensures that employees are involved in the operation and improvement of the PSM system. Employees are involved in every element of PSM in a structured way.

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