



Safety and Security in Chemical Industry

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Introduction

It is of prime importance in any of the industries that the day to day activities are carried out in safe and secured manner as it involves lot of machines, processes and storages. The safety of the human, machines and plant as a whole needs to be taken care right from the inception stage to operation stages so that the accidents can be avoided causing damages to human, environment and society at large. The safe and secured operations are even more relevant in a chemical industry owing to the nature of the chemicals being handled and produced. The handling and storages needs to be given utmost importance so that there are no or minimum incidents which may cause losses to the stakeholders. A detailed health, safety and environment (HSE) plan is chalked out prior to setting up any industry during the basic engineering phase of the project.

Safety studies

The purpose of the HSE plan is to have a

- means of creation and maintaining strategies on continuous monitoring and improvements, ensuring proactive hazard controls in a plant and implementing and adhering company's HSE policies and procedures based on the prevailing industry standards for safety, security and risk management
- mechanism for ensuring compliance in line with regulatory requirements and referenced industry codes of practice
- assurance that no environmental hazards are created which will upset the ecology of the surroundings

By implementing the HSE plan the client of any chemical industry will achieve the following

- a healthy, safe and secure work premises
- no accidents, no injuries and no harm to operators
- protecting the health and safety of all stakeholders

- minimized environmental impacts
- compliance with legal requirements.

Following activities need to be conducted by a team of people to implement effective safe and secured work place:

- full investigation of incidents and lessons learned
- regularly monitor performance and conduct audits
- set objectives & targets and report performance
- emergency preparedness
- regular interactions with stakeholders
- provide HSE leadership to achieve the HSE vision of the company

Safety studies

During basic engineering and detailed engineering design phases, the following safety studies needs to be performed to identify and mitigate the possible safety risks that may arrive during the operation and maintenance of any chemical industry:

Hazard identification (HAZID)

HAZID study needs to be conducted to identify potential internal as well as external hazards. This systematic study will result in identification of major hazards. Based on the identified hazards recommendations will be made to reduce the likelihood of hazard occurrence. The HAZID report shall provide an auditable trail with regard to decisions about which hazards require further investigation.

Hazard and operability study (HAZOP)

HAZOP study will be conducted during basic engineering completion and the final study will be conducted prior to a/c release of p&id's and other relevant documents. This study forms an important part of formal safety assessment. HAZOP study



shall be conducted to identify the potential hazards caused by plant operations and to ensure that suitable safeguards are incorporated into the plant design. An independent HAZOP chairman approved by owner shall conduct the HAZOP study.

Quantitative risk assessment (QRA)

In this assessment, all the hazardous scenarios that can be associated with the operation of the equipment or plant are identified and by using hazard identification techniques viz., HAZID and HAZOP, the outcome of these studies determines scenarios that are relevant shall be included in a QRA. The most likely occurrence of the scenarios identified as hazardous shall be assessed in detail by reviewing accident data history, previous studies conducted on similar processes if any and expert knowledge of the team conducting the QRA. These initial events lead to establishing the consequences. QRA evaluate the risks levels associated, in terms of individual risk and societal risk, with the identified hazardous scenarios.

Safety integrity levels (SIL)

The SIL study shall be carried out after completion of HAZOP study. Safety integrity levels(SIL) shall define safety performance criteria for safety instrument system (sis). SIS configuration shall be verified by SIL studies to meet or exceed the required SIL ratings and in turn the system reliability. The SIL study helps to prevent (or) mitigate scenarios which may result in - equipment or production loss, injury to the operators or even loss of life.

Project health, safety and environment review (PHSER)

This review will be carried out at around 40% and 80% engineering progress of the project with participation from client's health & safety and engineering divisions. The objective of the PHSER is to provide assurance through auditing that sensitive areas have been identified and that control measures have been or shall be developed for the identified hazards.

The findings and recommendations of all the above safety assessment studies shall be documented and used for detailed engineering. The findings from all risk analysis studies and

assessments will be incorporated into the equipment layouts to minimize risk to as low as reasonably practicable (ALARP). The recommendations of third party reviews shall also be incorporated and close out reports needs to be prepared.

HSE action monitoring

A list of recommendations arising out of HSE reviews shall be maintained and tracked for close out and approved actions shall be incorporated into the design for further implementation. HSE activities and update status of these actions shall be included in weekly and monthly progress reports of the design and construction phases of the project.

Ergonomic study

The objective of ergonomic study is to understand typical human responses to events and how they could affect levels of risks. Ergonomic studies shall be carried out for central control room of the plant.

Emergency evacuation plan

A systematic emergency plan considering incidents like fire, natural calamities like earth quake, floods, cyclones etc., needs to be prepared for the plant. The emergency evacuation plan (drawing) showing assembly points, location of first aid kits with evacuation route in case of emergency needs to be prepared.

Codes

Various national and international codes, standards and guidelines are available for driving safety in industries. Some of them are listed below:

- i) OISD standards, SMPV rules
- ii) National electrical safety code
- iii) National fire protection association
- iv) Occupational Safety and Health Administration
- v) Indian standards.

Safety and Security Aspects

1. The plant shall have the first level of security barrier in the form of compound wall and gates. At the security gate the personnel and vehicles



entering the plant are to be frisked for any unwanted and potentially dangerous material. If found will be retained at the gates itself.

2. Hazardous material storage yards are fenced and only authorized personnel are allowed to enter the premises like LPG, natural gas or HSD unloading and storage areas.

3. Gas and liquid leak detection systems shall be installed near the storages of hazardous / hydrocarbon storages and handling facilities.

4. CCTV cameras, public address system, fire detection systems shall be installed as per the code requirements.

5. Fire protection system shall be installed including active and passive fire protection systems to douse fire in incipient and advanced fire scenarios. The system installed shall be in compliance with relevant codes and standards.

6. Dust suppression and extraction systems shall be provided to comply the central pollution control norms.

7. The finished floor levels of the plants shall be preferably above the highest flood level. The roads shall not have steep gradients and the plant shall be provided with proper storm water draining system to avoid flooding during rainy days.

8. The tank farms shall be provided with secondary containments to contain the spilled liquid within the dykes and are provided with impervious layer so that the contents shall not contaminate the ground water.

9. Adequate cooling shall be provided for the tanks that store class a liquids so that the tanks are cooled in the event of fire in the vicinity.

10. All the works shall wear adequate ppe (personal protective equipment) as per the detailed plan and shall positively de-energize the electric equipment / components prior to working on such areas. One needs to follow loto (lock-out tag out) procedures.

11. All handling equipment like EOT cranes, hoists, mobile cranes, hydra etc, shall have valid lifting certificates

12. All in-plant vehicle shall not be allowed to cross the speed limits indicated.

13. Proper sign boards shall be displayed regarding emergency evacuation routes and assembly points.

14. Permit systems shall be followed for hot work, entering confined spaces, working on heights, deep excavations etc. Proper barricading, scaffolding shall be utilized.

Conclusion

By employing safe practices and security measures the risks in the operation and maintenance of a chemical plant can be identified and mitigated well ahead in the design phase itself. Regular safety orientation programs shall be conducted in the plants including fire drills and emergency evacuations will bring the safety culture in any industry. Periodic safety audits and implementation of the outcomes can make the plant safer and better place to work.

Reference

Safety studies and importance of close-out reports – V. A. Kunte