

Industrial Safety & Hazard Analysis

HAZARD ANALYSIS

1. INTRODUCTION

A hazard is defined as a "Condition, event, or circumstance that could lead to or contribute to an unplanned or undesirable event." A hazard is a situation that poses a level of threat to life, health, property, or environment. Most hazards are dormant or potential, with only a theoretical risk of harm; however, once a hazard becomes "active", it can create an emergency. A hazardous situation that has come to pass is called an incident.

A hazard analysis is used as the first step in a process used to assess risk. The result of a hazard analysis is the identification of different type of hazards. A hazard is a potential condition and exists or not (probability is 1 or 0). It may in single existence or in combination with other hazards (sometimes called events)

Risk is the chance or probability that a person will be harmed or experience an adverse health effect if exposed to a hazard. It may also apply to situations with property or equipment loss.

2. PROCESS HAZARD ANALYSIS(PHA)

PHA is a thorough, orderly, and systematic approach for identifying, evaluating, and controlling the hazards of processes involving highly hazardous chemicals. The process hazard analysis methodology selected must be appropriate to the complexity of the process and must identify, evaluate, and control the hazards involved in the process.

First, the facility must determine and document the priority order for conducting process hazard analyses based on a rationale that includes such considerations as the extent of the process hazards, the number of potentially affected employees, the age of the process, and the operating history of the process. The process hazard analyses should be conducted as soon as possible.

Whichever method(s) are used, the process hazard analysis shall address the following:

- The hazards of the process
- The identification of any previous incident that had a likely potential for catastrophic consequences
- Engineering and administrative controls applicable to the hazards and their interrelationships, such as appropriate application of detection methodologies to provide early warning of releases.
- Consequences of failure of engineering and administrative controls
- Human factors

A qualitative evaluation of a range of the possible safety and health effects of failure of controls. The process hazard analysis shall be performed by a team with expertise in engineering and process operations, and the team shall include at least one employee who has experience and knowledge specific to the process being evaluated. Also, one member of the team must be knowledgeable in the specific process hazard analysis methodology being used.

3. HAZOP

A **hazard and operability study** (HAZOP) is a structured and systematic examination of a planned or existing process or operation in order to identify and evaluate problems that may represent risks to personnel or equipment, or prevent efficient operation; it is carried out by a suitably experienced multi-disciplinary team (HAZOP team) during a set of meetings.

As a risk assessment tool, HAZOP is often described as:

- A brainstorming technique
- A qualitative risk assessment tool
- An inductive risk assessment tool, meaning that it is a "bottom-up" risk identification approach, where success relies on the ability of subject matter experts (SMEs) to predict deviations based on past experiences and general subject matter expertise

A HAZOP study is a team effort. The team should be as small as possible consistent with their having relevant skills and experience .

A minimum team size of 4-5 is recommended. The Hazard and Operability Analysis (HAZOP) was originally developed to identify both hazards and operability problems at chemical process plants, particularly for processes using technologies with which the plant was not familiar. The technique has been found to be useful for existing processes as well.

A HAZOP requires an interdisciplinary team and an experienced team leader. The purpose of a HAZOP is to review a process or operation systematically to identify whether process deviations could lead to undesirable consequences. AIChE states that the technique can be used for continuous or batch processes and can be adapted to evaluate written procedures. It can be used

at any stage in the life of a process.

HAZOPs usually require a series of meetings in which, using process drawings, the team systematically evaluates the impact of deviations. The team leader uses a fixed set of guide words and applies them to process parameters at each point in the process. Guide words include "No," "More," "Less," "Part of," "As well as," "Reverse," and "Other than." Process parameters considered include flow, pressure, temperature, level, composition, pH, frequency, and voltage.

As the team applies the guide words to each process step, they record the deviation, with its causes, consequences, safeguards, and actions needed, or the need for more information to evaluate the deviation. HAZOPs require more resources than simpler techniques.

AIChE states that a simple process or a review with a narrow scope may be done by as few as three or four people, if they have the technical skills and experience. A large or complex process usually requires a team of five to seven people. AIChE/CCPS estimates that for a small or simple system a HAZOP analysis will take 8 to 12 hours to prepare, 1 to 3 days to evaluate the process, and 2 to 6 days to document the results. For larger or more complex processes, a HAZOP will take 2 to 4 days to prepare, 1 to 3 weeks to evaluate, and 2 to 6 weeks to document.

3.1 HAZOP Procedure

- Familiarisation with background documentation
- Planning of the workshop meeting in a pre-meeting with the customer in order to identify
- HAZOP strategy, division of the subsystems/nodes (e.g. line, pump, vessel, compressor),
- choose relevant Piping and Instrument Diagrams (P&ID), and identifying guide words

- Accomplishment of the HAZOP review
- Documentation of observations into information and actions point, document findings on the
- P&IDs.
- Draft report for client review.
- Final HAZOP report.

The success or failure of the HAZOP depends on several factors:

- The completeness and accuracy of drawings and other data used as a basis for the study
- The technical skills and insights of the team
- The ability of the team to use the approach as an aid to their imagination in visualizing deviations, causes, and consequences
- The ability of the team to concentrate on the more serious hazards which are identified.

4. MATERIAL SAFETY DATA SHEETS

A Material Safety Data Sheet (MSDS) is a document that gives detailed information about the nature of a chemical, such as physical and chemical properties, health, safety, fire, and environmental hazards of a chemical product. In addition to giving information about the nature of a chemical, an MSDS also tells

how to work safely with a chemical and what to do if there is an accidental spill.

A Material Safety Data Sheet (MSDS) is a document that contains information on the potential hazards (health, fire, reactivity and environmental) and how to work safely with the chemical product. It is an essential starting point for the development of a complete health and safety program. It also contains information on the use, storage, handling and emergency procedures all related to the hazards of the material. The MSDS contains much more information about the material than the label. MSDSs are prepared by the supplier or manufacturer of the material. It is intended to tell what the hazards of the product are, how to use the product safely, what to expect if the recommendations are not followed, what to do if accidents occur, how to recognize symptoms of overexposure, and what to do if such incidents occur.

MSDSs must contain the same basic kinds of information, such as

Chemical Identity: Name of the product.

Manufacturer's Information: Name, address, phone number and emergency phone number of the manufacturer.

Hazardous Ingredients/Identity Information: List of hazardous chemicals. Depending on the state, the list may contain all chemicals even if they are not hazardous, or only those chemicals which have OSHA standards. Since chemicals

are often known by different names, all common (trade) names should be listed. The OSHA Permissible Exposure Limit (PEL) for each hazardous ingredient must be listed

Physical/Chemical Characteristics: Boiling point, vapor pressure and density, melting point, evaporation rate, etc.

Fire and Explosion Hazard Data: Flash point, flammability limits, ways to extinguish, special firefighting procedures, unusual fire and explosion hazards.

Reactivity Data: How certain materials react with others when mixed or stored together. **Health Hazard Data:** Health effects (acute= immediate; chronic= long-term), ways the hazard can enter the body (lungs, skin or mouth), symptoms of exposure, emergency and first aid procedures.

Precautions of Safe Handling and Use: What to do in case materials spill or leak, how to dispose of waste safely, how to handle and store materials in a safe manner.

Control Measures: Ventilation (local, general, etc.), type of respirator/filter to use, protective gloves, clothing and equipment, etc.