

**HAZARD OPERABILITY TECHNIQUE**

**BY**

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**HAZARD OPERABILITY**

A **hazard and operability study** (HAZOP) is a structured and systematic examination of a complex planned or existing process or operation in order to identify and evaluate problems that may represent [risks](https://en.wikipedia.org/wiki/Risk) to personnel or equipment. The intention of performing a HAZOP is to review the design to pick up design and engineering issues that may otherwise not have been found. The technique is based on breaking the overall complex design of the process into a number of simpler sections called 'nodes' which are then individually reviewed. It is carried out by a suitably experienced multi-disciplinary team (HAZOP) during a series of meetings. The HAZOP technique is qualitative, and aims to stimulate the imagination of participants to identify potential hazards and operability problems. Structure and direction are given to the review process by applying standardised guide-word prompts to the review of each node. The relevant international standard calls for team members to display 'intuition and good judgement' and for the meetings to be held in 'a climate of positive thinking and frank discussion'.

The HAZOP technique was initially developed in the 1960s to analyze major chemical process systems but has since been extended to other areas, including mining operations and other types of process systems and other complex systems such as [nuclear power plant](https://en.wikipedia.org/wiki/Nuclear_power_plant) operation and software development. It is also used as the basis for reviewing Batch processes and operating procedures.

**Guide words and parameters**

In order to identify deviations, the team applies (systematically, in order) a set of Guide Words to each node in the process. To prompt discussion, or to ensure completeness, it may also be helpful to explicitly consider appropriate parameters which apply to the design intent. These are general words such as Flow, Temperature, Pressure, Composition. The current standard notes that Guide Words should be chosen which are appropriate to the study and neither too specific (limiting ideas and discussion) nor too general (allowing loss of focus). A fairly standard set of Guide Words (given *as an example* in Table 3 of) is as follows:

|  |  |
| --- | --- |
| **Guide Word** | **Meaning** |
| NO OR NOT | Complete negation of the design intent |
| MORE | Quantitative increase |
| LESS | Quantitative decrease |
| AS WELL AS | Qualitative modification/increase |
| PART OF | Qualitative modification/decrease |
| REVERSE | Logical opposite of the design intent |
| OTHER THAN / INSTEAD | Complete substitution |
| EARLY | Relative to the clock time |

**SIGNIFICANCE OF HAZOP TECHNIQUE**

The HAZOP (Hazard and Operability) method is a widely used technique for identifying the hazards on process facilities. Even those who are not familiar with the hazards analysis process will often have heard of the term HAZOP, even if they are not really sure what it means.

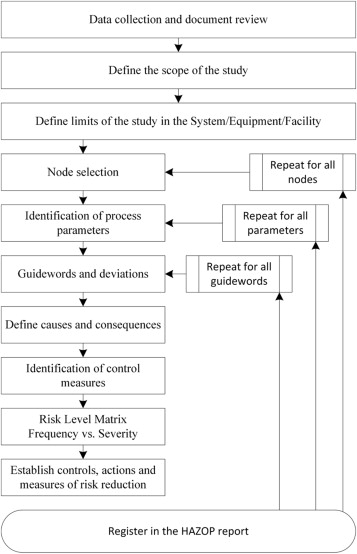
For example, when the Process Safety Management (PSM) regulations in the United States were being promulgated in the early 1990s it was not unknown for a plant manager to say, "I know what PSM is, it's HAZOPs!" In fact the HAZOP method is just one of the many types of Process Hazards Analysis (PHA) techniques that are available, and PHAs are just one element of a PSM program. Nevertheless, these managers were somewhat justified in what they said because they knew that, unless they could identify the hazards on their facilities, they could not reduce risk. Furthermore, both regulators and legal advisors generally support use of the HAZOP technique because of its reputation and because it is so thorough. The use of the HAZOP technique is very defensible if a company is challenged regarding its safety performance, particularly in a legal dispute.

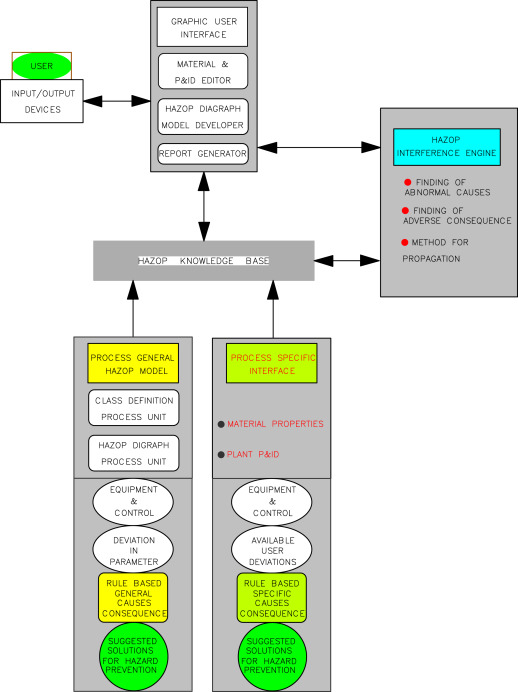
## ****Steps in a HAZOP****

The HAZOP process can be organized into the steps shown in

1. Select a node, define its purpose and determine the process safe limits.
2. Select a process guideword.
3. Identify the hazards and their causes using the deviation guidewords.
4. Determine how the hazard is "announced", i.e., how the operator knows a safe limit has been exceeded.
5. Estimate the consequences (safety, environmental, economic) of each identified hazard.
6. Identify the safeguards.
7. Estimate the frequency of occurrence of the hazard.
8. Risk rank the hazard, with and without safeguards.
9. Develop findings and potential recommendations.
10. Move on to the next process guideword, or to the next node if the guideword discussion is complete.

**COMPONENTS OF HAZARD OPERABILITY**

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