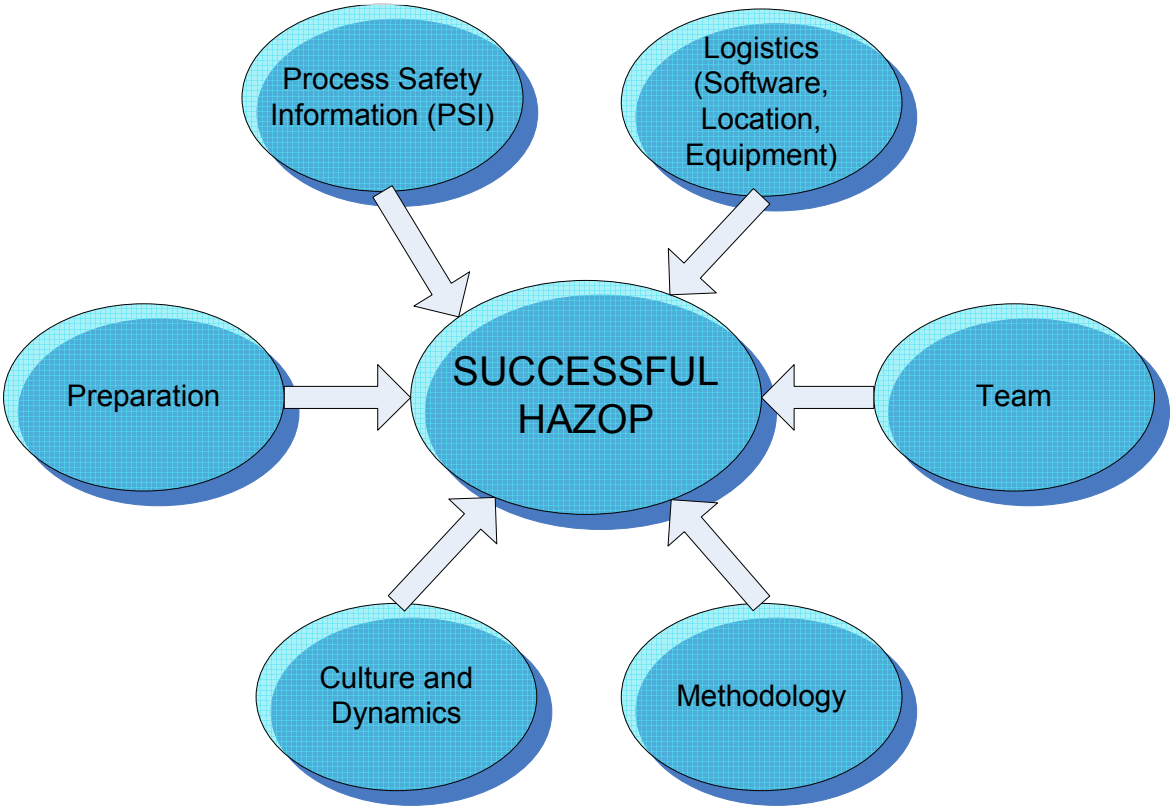
Successful HAZOPs (Part One)

The following diagram summarises the elements of a good HAZOP. This paper deals with these in turn.

Figure 1:
Elements of a Successful HAZOP



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ELEMENT 1: PREPARATION

Easily overlooked, it is important that the following issues be addressed prior to the HAZOP. Ideally this should occur in a HAZOP Planning Meeting between the system owners and the chairperson.

The HAZOP Planning Meeting should address the following questions:

- Purpose: Why is the HAZOP being held?
- Scope: What is the scope?
- Methodology: How it is to be carried out?
- Team: Who should attend?
- Schedule: When it is to take place?
- Logistics: Where it will happen? What software?
- PSI: What information needs to be provided?

[A formatable Agenda based around the above is available on request: info@flemingprofessional.com].

The meeting should be minuted and included in the HAZOP record.

Identification of Hazards should be the main purpose of any HAZOP. However, the HAZOP may also form the basis for other PSM processes such as COMAH, SIL and LOPA, and any requirements in this regard should be highlighted at the start. In addition, there may be requirements for qualitative risk assessment as part of the process, and other requirements such as checklists and ancillary activities, and these also need to be identified.

The chairman will usually have to review the scope in light of the information presented at the meeting in order to develop an estimate of duration. The biggest mistake in planning a HAZOP is not allowing enough time, especially if the HAZOP is to be loaded with additional activities.

For large HAZOP's the following rule of thumb can be used:
No of Nodes x 0.75 + 3h (Introductory activities) + Allowance for checklists etc.

Ideally, sessions would be well spaced (no more than 3 a week) half day affairs, but this is not always possible.

ELEMENT 2: PROCESS SAFETY INFORMATION (PSI):

Good PSI is indispensable for a successful HAZOP. Historically this has been a major failing in HAZOPs, the team often being blissfully unaware of some of the major inherent hazards in the process.

A comprehensive list of PSI requirements is provided in OSHA CFR 1910.119(d).
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9760

- Toxicity information
- Permissible exposure limits
- Physical data
- Reactivity data
- Corrosivity data
- Thermal and chemical stability data
- Hazardous effects of inadvertent mixing of different materials that could foreseeably occur.
- A block flow diagram or simplified process flow diagram
- Process chemistry
- Maximum intended inventory
- Safe upper and lower limits for such items as temperatures, pressures, flows or compositions
- An evaluation of the consequences of deviations, including those affecting the safety and health of employees.
- Materials of construction
- Piping and instrument diagrams (P&ID's)
- Electrical classification
- Relief system design and design basis
- Ventilation system design
- Design codes and standards employed
- Material and energy balances
- Safety systems (e.g. interlocks, detection or suppression systems).

In practice, it may not be possible to have all the above information available. Special attention should be paid to reaction chemistry, and data such as adiabatic temperature rises and gas evolution quantities and rates.

Lastly, and most importantly, it is not enough to have the PSI in folders – people on the HAZOP team must be sufficiently familiar with it so that it informs the conduct of the review.

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ELEMENT 3: LOGISTICS

The following items are obvious but nonetheless frequently and easily overlooked.

Location: Ideally:
- A large airy room with natural light
- Offsite with no interruptions
- A projector screen

Hardware:
- Laptop
- LCD Projector

Software:
Which and whose software is to be used needs to be decided.

[Investing in a proprietary HAZOP package is recommended. We utilise **HAZOP Manager** by Lihou Technical and **PHA-Pro** by Dyadem. Both have their advantages and disadvantages. If you are thinking of investing in HAZOP software, we will be happy to pass on our experiences of the various packages.]

All the above should be decided at the HAZOP Planning Meeting.

ELEMENT 4: TEAM

The team should be sufficiently experienced and involved with the system in question. There is often a temptation to delegate the task to less experienced colleagues. This should be resisted, as a team consisting of less experienced substitutes may be less motivated as well as being less informed, and in many cases are resentful at having to be there. This can make for very poor team dynamics.

A balance must be struck in the size of the team between bringing in as much experience as possible and the less efficient dynamics of larger teams. A team of around 5 or 6 excluding the chairman and scribe is probably optimal in this regard.

The lynchpin of the team is the person understanding the design intent, usually the **Process Engineer**.

The presence of person familiar with the hands-on operation of the system, i.e. an **Operator** or supervisor, is critical.

A **Chemist** is almost always a requirement, except where there are definitely no reactions, or reactive/incompatible materials. Non-attendance of a chemist is a frequent weakness in HAZOP teams.

The make-up of the rest of the team is not as 'set-in-stone'.

A **Maintenance** person should be present where existing systems are being reviewed. Experience shows that, whereas maintenance people may not contribute frequently during the course of a HAZOP, their input is often of a critical nature. Examples that spring to mind are: safety interlocks disconnected or malfunctioning, a patch between the vessel wall and cooling water jacket in a vessel containing water reactive chemicals, ingress of thermally sensitive materials into moving parts or bearings etc.

An **Automation** representative may be useful if the remainder of the team is not familiar with the controls and interlocks.

An **EH&S** person can be useful to support the process and bring a little 'steel' into the proceedings.

Ideally, a **Scribe** is provided in order to allow the Chairman to concentrate on guiding the team.

The experience of the **Chair** should be commensurate with the inherent hazard and complexity of the system in question.