



Insight

Hazard and Operability Studies (HAZOP)

By Mike Taylor, SHQ Associate Director

A HAZOP (Hazard and Operability) study is a tool designed to allow a team to identify and highlight deficiencies and shortcomings in the design and operation of industrial plants. It will enable design teams (and others) to predict where failures in systems might occur, and proactively take action to mitigate any risks prior to project implementation.

Background

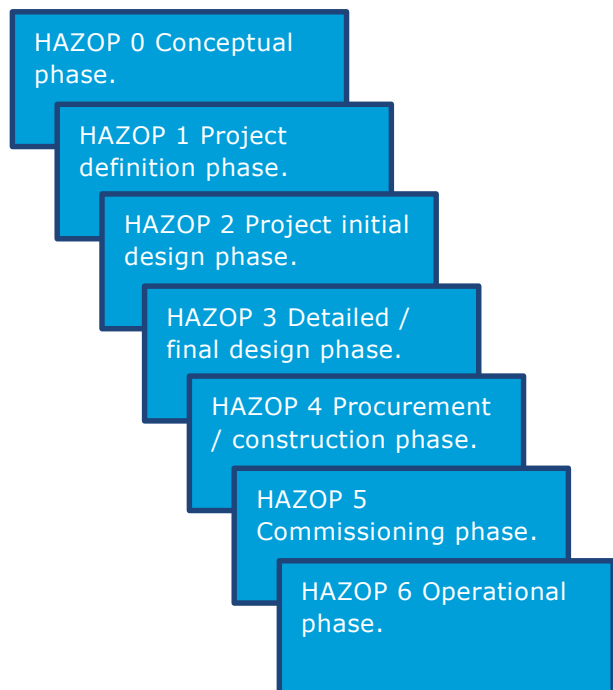
HAZOP studies aim to identify significant hazards and operability problems in industrial and process equipment, which if they were to occur, could reduce the ability to achieve target productivity in a safe manner. Initially developed ICI, the technique now has wide ranging acceptance within industry as a tool for qualitative hazard analysis. It and is now extensively used as a standard procedure for safety assessment in the process, chemical, engineering, petroleum industries, based on the international IEC 61882 standard.

A HAZOP should be conducted:

- As early in the design stage as possible - this allows effective design amendments with minimum additional costs; and
- When considering any major modification, to assess the safety of the proposed changes and any effect on the existing plant.

The HAZOP technique can be applied to either new or existing systems, whole or parts of a facility.

The HAZOP methodology should be applied at every phase of a projects development. At each phase, the outputs and requirements identified from the previous phase are verified and validated before moving on. These phases are typically:



How does a HAZOP work?

A knowledgeable team of people review an intended design by breaking it down into a series of manageable sections. These are known as nodes; which are defined as segments on the line diagrams / P&ID's, or key process operations. At each node the key parameters are investigated for deviations from the design intent, for example:

- Possible causes of the deviation are assessed e.g. 'Strainer S1 blockage due to impurities in Tank T1' might cause the deviation 'No flow'.
- The consequences that could arise, are then defined e.g. 'Cavitation in Pump P1, with possible damage if lack of flow is prolonged'.
- If existing / planned controls are unsuitable or inadequate, actions are generated to further improve and assure the design.

The HAZOP process then continues, reviewing all possible deviations for each node, until they have all been thoroughly assessed.

To allow effective analysis of each node and deviation, it is critical that all required information and documentation is provided for the HAZOP. This typically comprises:

- Piping & instrumentation drawings (P&ID) – this is a critical requirement;
- Layout / as built drawings;
- Vendor package and sub-system designs;
- Equipment and chemical specifications;
- Bespoke equipment designs and details;
- Service information (water, power, air etc.);
- Logic drawings for control & shutdown; and
- Operations and maintenance procedures.

It is important that the study is a creative process and stimulates the HAZOP team members to envisage how the deviations might occur and what might be the consequences.

The HAZOP Team Approach

HAZOP studies rely on a team approach to confirm all deviations and consequences are effectively assessed from all aspects; design, operation, maintenance etc.

They should be carried out under the guidance of a trained and experienced HAZOP facilitator, who will assure comprehensive coverage of the system under study using logical and analytical thinking. The study leader should preferably be assisted by a secretary who records identified hazards, consequences and controls.

It is crucial that technical expertise for the study resides within the project team, with the leader and secretary ensuring the process is focussed and is facilitated and recorded effectively.

An effective HAZOP study relies heavily on the availability of specialists from all disciplines, with the correct skills and experience, who display intuition and positive judgement. The team should include (as applicable):

- An independent study leader and secretary;
- Design Engineers (all relevant disciplines e.g. M&E, Civil, Control System, Process & Chemical Engineers, Environmentalist, Ergonomist etc.);
- The Design and Project Manager;
- Operations personnel;
- Maintenance engineers;
- A Health & Safety Advisor; and
- The Commissioning Manager.

The HAZOP should be carried out in a climate of positive creative thinking and discussion within the team. When a problem is identified, it is recorded for subsequent assessment and tracking to its resolution.

Benefits of Undertaking a HAZOP

Key benefits for undertaking a successful HAZOP within a project or design are:

- Any required design amendments are identified early in the design process, leading to minimum additional costs to rectify;
- A clear understanding of design risk control and mitigation is generated, allowing effective action planning and delivery within the project;
- Full application of the HAZOP process eliminates or manages identified hazards, prior to moving to the next phase within a design implementation;
- Using a common HAZOP approach enables hazards and risks from multiple systems to be combined, understood and mitigated, reducing duplication of effort and cost;
- Proposed changes and major modifications to existing plant can be studied to proactively assess the safety implications of the change; and
- Organisations gain a significant level of assurance that designs are both compliant and effective in reducing risks from major hazard processes and equipment.

The Turner & Townsend Approach?

The key attributes of our HAZOP process and core team are as follows:

- We have specific experience in delivering a range of pragmatic and successful HAZOP's based on our client needs;
- We operate an enhanced practical HAZOP process based on international standards and industry guidance is in place;
- We will supply a highly effective and efficient team to lead and facilitate HAZOP's;
- We have a comprehensive understanding of design risk control and mitigation, with a practical and reasonable approach to action planning and delivery;
- We are able to provide assistance, where required, to project manage the implementation and close out of HAZOP requirements and outputs;
- Our team are strong yet polite communicators with the ability to influence and facilitate;
- We have a positive work ethic and ability to operate in a team environment;
- The innovative approaches we use to identify solutions and improvement opportunities; and
- We are responsive to requests for advice and assistance – "nothing is too much".

About Turner & Townsend

Turner & Townsend is an independent professional services company specialising in programme management, project management, cost management and consulting across the property, infrastructure and natural resources sectors.

With 90 offices in 38 countries, we draw on our extensive global and industry experience to manage risk while maximising value and performance during the construction and operation of our clients' assets.

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