



From HAZOP to BowTieXP

Visualising Process Hazard Analysis Studies

Hazard and operability (HAZOP) is a well understood and respected technique in the process (and other) industries. It offers systematic rigour in challenging the design and operating intent of a new, modified or established facility and provides a foundation for further analysis and risk assessment. While HAZOP has proven to be an invaluable hazard identification tool, it does have its limitations. The linear, tabular nature of recording tends to focus on a single Cause leading to one or more Consequences. The HSE Offshore Technology report ^[1] acknowledges that *“HAZOP is also weak in handling multiple cause events. Teams find difficulty in holding together and tracing through the implications of a number of failures at once”*.

Representing hazard scenarios in graphical rather than written format enables participants and stakeholders to better understand the risks and controls associated with the operation of their assets. This document briefly explains how a HAZOP study can be visualised with help of Bowties, clarifying the benefits of this approach.

Communication Challenges

The standard ^[2] format for a HAZOP worksheet only includes deviations, possible causes, consequences, but only a single column for Safeguards. With a single field to document all the prevention and mitigation measures for the cause-consequence scenario, it may be difficult to fully appreciate the balance of safeguards and their role in reducing risk.

Without a comprehensive appreciation of the contributions made by safeguards, their criticality (and therefore the maintenance, monitoring and management attention they require) is often subjective resulting in resources being deployed in the wrong areas.

It is also reported ^[3] that a disadvantage of HAZOP is that it "Focuses on one-event causes of deviation only. Only the hazards associated with single deviations can be studied. Hazards that are caused by two or more separate deviations cannot be identified by the technique".

Enhanced Engagement

Representing a HAZOP in a bowtie can easily be done without doing double work. Using the Scrapbook functionality of BowTieXP Advanced, existing HAZID/HAZOP worksheets can be migrated into bowties and evaluated using Advanced Filtering features to focus on specific areas (See figure 1).

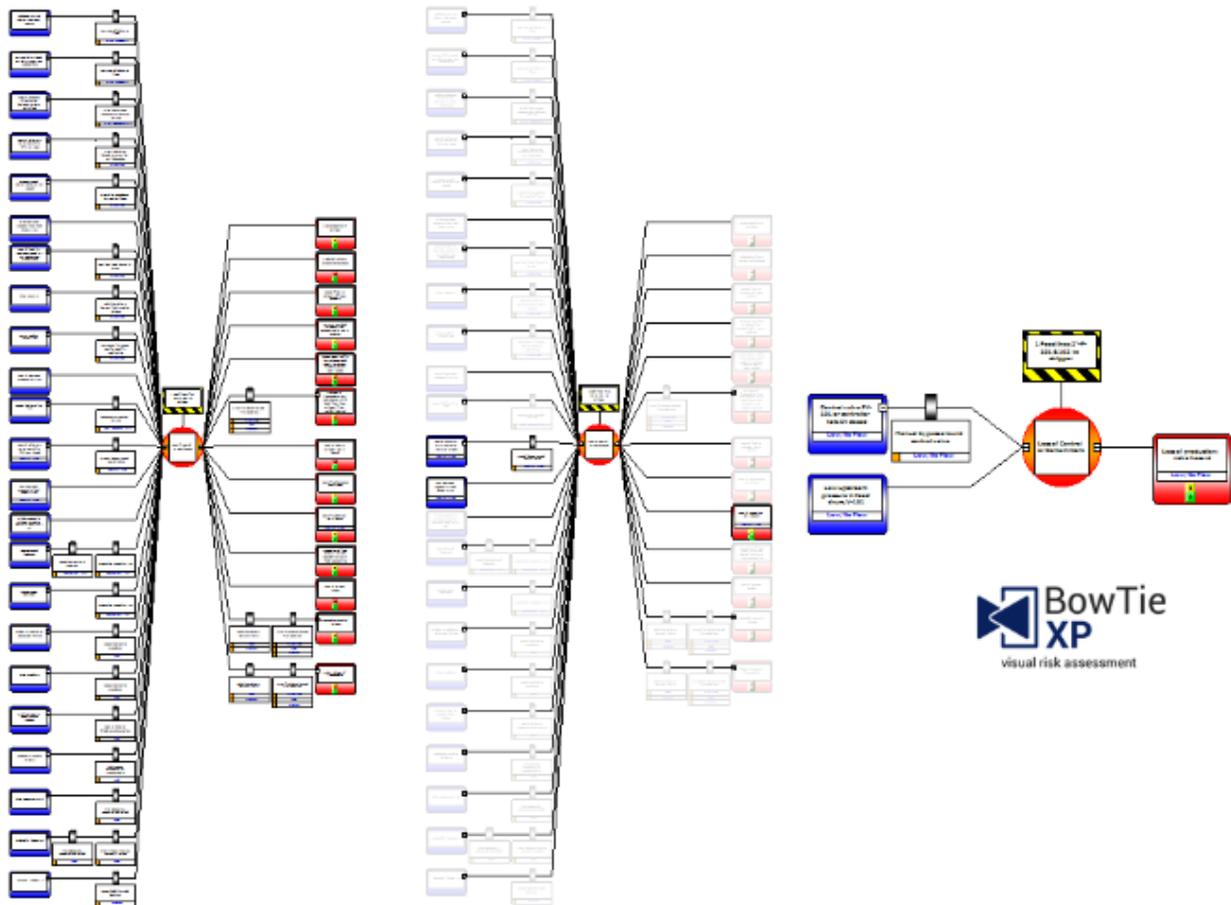


Figure 1: Advanced bowtie filter

A single view of a node presents oversight of the number of Threats to, Consequences from and the associated Barriers protecting an asset. Conversely, viewers can focus in on areas of interest, e.g. cause-consequence relationships or barriers which are deployed in multiple locations which may be susceptible to common cause failure by the nature of their type, technology employed or requirement for manual interaction.

By, for example, categorising Threats by cause (e.g. Equipment Failure or Control Malfunction), Consequences by impact (e.g. Personnel, Environment, Asset or Reputation) and Barriers by type, effectiveness, criticality and accountability, the simple HAZOP worksheet can yield hidden information that can be used to evaluate the adequacy of the protection portfolio.

Complete Clarity

Visual representation facilitates more efficient validation after the study (e.g. exposing scenarios that were not apparent from original tabular recording) and routine re-validation as part of regulatory compliance. The graphical illustration of the Threats (causes), Barriers (safeguards) and Consequences make it easier to share the outcome from the HAZOP to those who are responsible for sustaining the protection measures but were either not present or some time has passed since the study was conducted and the results published.

The action management and reporting functionality of BowTieXP provides the same continuous improvement and collaboration features that conventional HAZOP software tools offer, however these are part of a platform that genuinely makes risk understandable and therefore more manageable.

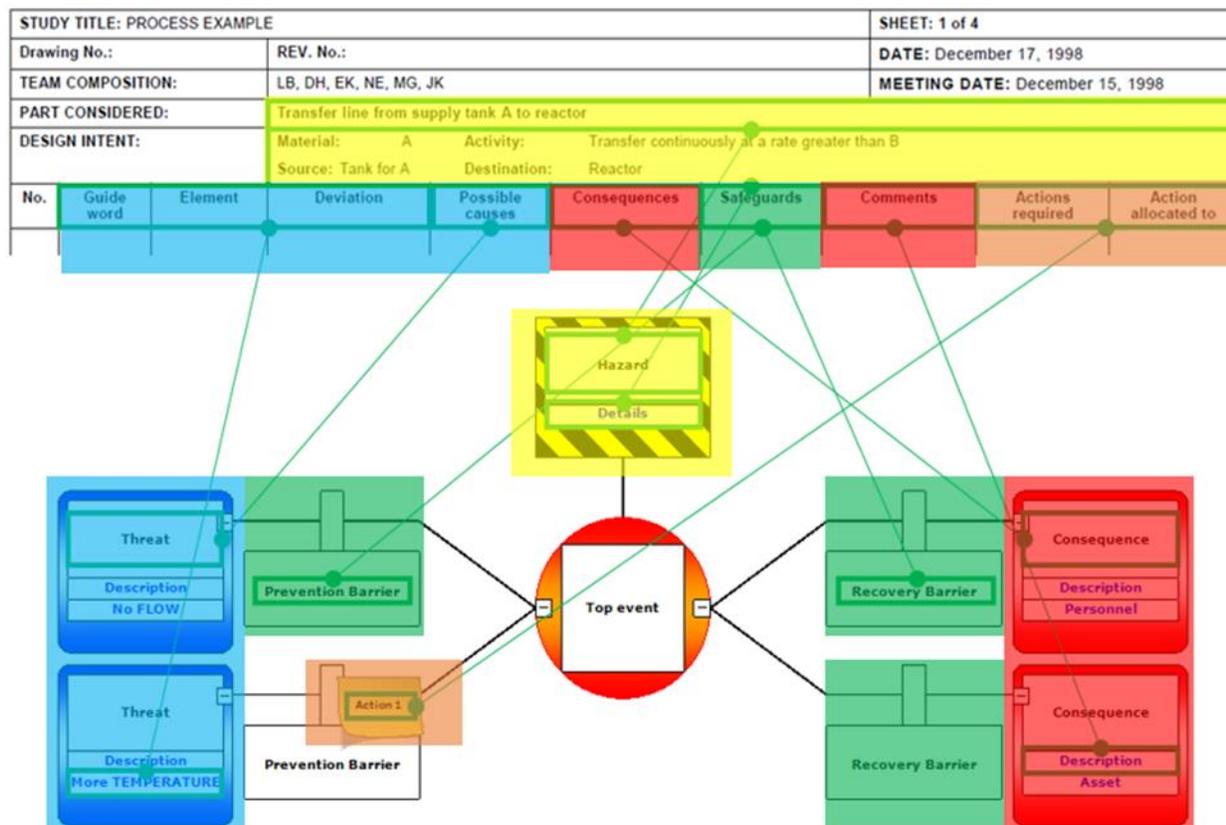


Figure 2: Example HAZOP worksheet

References

1. HSE Offshore Technology Report OTO 96 002, Quality Assurance of HAZOP.
2. IEC 61882: 2016 Hazard and operability studies (HAZOP studies) – Application guide.
3. Health & Safety Laboratory: Review of Hazard Identification Techniques, HSL/2005/58.

Related article

Read more about using bowties to pep up your HAZOP in the IChemE November 2017 edition (issue 917) of The Chemical Engineer: <https://www.thechemicalengineer.com/features/visual-hazop/>.