BowTie analysis

BowTie diagrams are a powerful method for visually displaying risk assessments.

The diagrams provide a link between the hazard initiating event, through the hazard to the final consequence whilst also displaying the preventative and mitigating barriers. Operators of hazardous processes are required to demonstrate:

- Understanding of the potential for a hazardous event
- Identification of the barriers which prevent realisation of the hazardous event and its ultimate consequences
- Information which provides assurance that these barriers are effective

The process industries have developed many tools to assist in identification and management of major accident hazards - HAZOPs, HAZIDS and Process Hazard Review (PHR) are all techniques which will, in a systematic manner, identify:

- Hazard initiating event
- The ultimate hazard consequence
- The barriers standing in between the initiating event and the ultimate consequence

In addition, techniques such as LOPA studies or Quantitative Risk Assessment (QRA) may be used to demonstrate that the barriers have the required integrity.

When these studies have been properly undertaken and the actions generated have been followed up and completed there is good evidence that the organisation has endeavoured to understand and control the hazards. However, these studies produce extensive written output and so communication of key results can be challenging.

BowTie diagrams are a flexible and highly visual tool which can be used for such communication. ABB believes that BowTie diagrams are most powerful when they use the output from a structured hazard identification study to represent the results in a manner which powerfully communicates information to interested groups such as senior managers and operators of equipment. BowTie diagrams have also been shown to be suitable for inclusion in documents such as COMAH reports and offshore safety cases, to visually demonstrate to the regulator that hazards are identified and risks are being managed.

BowTie diagrams can be a useful tool in accident investigation, to demonstrate clearly how the accident happened and why barriers which were expected to interrupt the journey from initiating event to ultimate consequence were not effective.
BowTies can be used to illustrate:
- The path between the hazard initiating event and the ultimate consequence
- Availability of barriers
- Strength of barriers
- Classification of barriers
- Barrier criticality

The diagram can also be annotated with notes - however, over use of this facility can reduce visual impact. When displayed in the correct manner this information can be very powerful for those taking decisions relating to operation and modification of the asset. In particular, the visual display of barriers can be used to demonstrate the strength of the defence against realisation of a hazard and its top event and how vulnerable the facility is to degradation of these barriers.

What we offer
ABB's process safety consultants can:
- Facilitate initial risk assessment (HAZOP, HAZID, PHR)
- Analyse the initial risk assessment (this may have been carried out by ABB or another party) in order to identify the key hazards to be represented in BowTie diagrams
- In consultation with the client, construct the BowTie diagrams in order to illustrate the key features at the required level of detail. ABB normally use the BowTie XP™ software to do this
- Review current BowTie diagrams for clients in order to recommend any improvement either in the detail or presentation so that the communication of hazards and barriers is more effective

Benefits
- The completed BowTie diagrams will provide a clear visual communication of hazards, hazard initiating events, ultimate consequence and barriers
- The BowTie diagram can be designed in order to demonstrate which barriers are protecting against the ultimate consequence and the status of those barriers
- The BowTie is a useful and powerful visual tool, assisting operators and managers who are responsible for management of risk in understanding the current status of their asset and the potential impact of any proposed changes or modifications
- The BowTie diagram can be used as evidence that hazards are understood and risks are being managed, and may be included in documents such as the COMAH report or the offshore safety case

Why ABB?
ABB has a long track record of identifying hazards and assessing risks and achieving continuous safety improvements in both process and manufacturing industries. Being leading experts in this field, our technical expertise has enabled us to develop a widely-adopted methodology.

Our engineers and consultants have operational backgrounds and make pragmatic technical judgements based on their experience. It’s an approach that ensures cost-effective, practical-to-implement solutions which work. We prefer to work in partnership with our customers, where we deliver benefits together and transfer relevant skills such as greater staff awareness of safety risks, for ongoing improvement. We can help implement the resulting actions to ensure benefits are realised, by calling upon our broad range of expertise from across our service areas.