

**Method**

**Bow-tie analysis**

**Description**

The BowTie method can be considered to be a combination of earlier developed fault tree analysis (FTA) and event tree analysis (ETA) methods. The first BowTie diagrams seem to have appeared in the Imperial Chemistry Industry course in Australia 1979, but how and when the method found its exact origin is not completely clear. A significant milestone in the history of BowTie was the catastrophic incident on the Piper Alpha platform in 1988, which shook the oil and gas industry. In the early 1990s, the Royal Dutch Shell adopted the BowTie method as part of its methodological toolbox for managing risks. The method rapidly gained support throughout the industry because the BowTie diagrams appeared to be a suitable visual tool. Nowadays, the BowTie method is also used for risk management related to different transport modes such as maritime and aviation.

**Basic procedure**

1. Determining the main hazard source and the top event.
2. Extracting all possible causes that could contribute to the top event.
3. Extracting all possible consequences that could result from the occurrence of the top event.
4. Determining the escalation and preventive controls for the corresponding causes.
5. Determining the mitigation and recovery controls for the corresponding consequences.

**Prerequisites/Aids**

Bow-Tie template

**Effort**

Experienced persons are required to investigate all possible causes, consequences and the associated factors which, as quantity, increases the time effort.

Advantages	Disadvantages
<ul style="list-style-type: none"> <li>• The main strength of the Bow-Tie is its simplicity</li> <li>• Overall idea of the possible causes and consequences in one picture</li> <li>• The Bow-Tie method also makes it possible to explore the robustness of preventive and recovery controls, including escalation factors, which can have potential negative effects on the success of control measures implemented.</li> </ul>	<ul style="list-style-type: none"> <li>• It may over-simplify complex situations, particularly where quantification is attempted</li> <li>• It cannot reflect the situation where multiple simultaneous causes can result in specific consequences</li> </ul>

Related Literature
<p>Mokhtari, K. / Ren, J. / Roberts, C. / Wang, J. (2011): Application of a generic bow-tie based risk analysis framework on risk management of sea ports and offshore terminals, <i>Journal of Hazardous Materials</i>, 192(2), 465–475</p>