Building Better Bowties – Common Pitfalls in Risk Analysis

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ABSTRACT

Bow-tie analysis is a commonly used tool to identify, and display risks that have the potential for an undesired hazardous event. The output of the analysis are bow-tie diagrams, which are an effective and versatile communication format that can be applied to any type of risk.

Contrary to their simplicity, a proper bow-tie diagram that maintains its usefulness and clear communication is difficult to build. Over many years assisting Major Hazard Facilities with bow-tie analysis for Safety Cases, several common mistakes have been identified. This paper aims to highlight those issues with examples and provide improvement strategies.

A sample of the most common mistakes are:

- Not defining the scope of the study, consequences and 'critical controls'
- Poorly justified causes
- Identifying too many dependent controls.

Broad scopes lead to enormous and confusing bow-tie diagrams for both the user and the workshop team. Defining the scope of the study, the consequence severity of interest and critical control characteristics creates focused workshops and targeted analysis. With more definitive scope, there may be more bow-tie diagrams, however, they are succinct and specific.

Good justification in causes is imperative for clear communication to users, regulators and future bow-tie review workshop groups. It is best to use common wording structures and explain the event step-by-step. Also, clearly document any likelihood calculations and use data references where applicable.

Identifying all possible controls creates a false sense of security that there are many layers of protection. In reality, most controls are dependent on a single system or person and could all be compromised from a single failure. A definition of a 'critical' control is required whereby it must be independent from other controls.

Improving the bow-tie analysis process will assist operators in developing meaningful and 'operational' bow-tie diagrams to support risk management systems and practices.