# Reliability analysis and risk analysis: integration between hazop and fault tree analysis

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In the field of risk analysis of major accidents, HazOp and Fault Tree techniques of analysis and evaluation are commonly adopted , for the application of which various software and established procedures are also available.

The integration between these two methods is known by the exposure of Lihou and others [1] [2] [3], but is infrequently applied.

In more recent years methodologies for assessing the level of protection (LOPA - Level Of Protection Analysis) provided by components and instrumentation systems have also been formalized, based on which you can determine the SIL (Safety Integrity Level); mainly the technique called FMEDA [4], further analysis of failure modes, formalized by IEC regulation and most commonly applied especially in the field of process automation. Tools that facilitate the application of these techniques[5] are available, although a specific training is nevertheless required for their use.

Systems reliability is a key element in risk analysis, along with human error, for the evaluation of which various methods are available as well; in general, however, for human error a simplified criterion is often used which combines a generic error probability with the number of chances on which the error may occur.

All of these techniques still require a considerable expenditure of time for a sufficiently accurate application, especially because they are not integrated with each other.

The instrument described in this presentation provides for the integration of some techniques, allowing a saving of time and also ensuring the congruence between them: by applying HazOp application the fault tree, in graphical and quantified form, is automatically obtained, with the possibility to calculate MCS and define the SIL.

The application of the HazOp criteria is done using a simple spreadsheet with the help of drop-down menus that can be customized by the user. The selection and input of reliability data is performed using a collection of data systematized in the same form, data that can also be provided by the user.

Once the worksheet has been filled out and the reliability data have been selected, the program builds the fault trees, calculates combinations of data, provides the Minimal Cut Sets and graphically represents the fault trees that derive from the analysis.

[1] Efficient Use of Operability Studies - D.A. Lihou - Safety Promotion and Loss Prevention in the Process Industries - London 1980.

[2] Fault Trees from Operability Studies - D.A. Lihou - Safety Promotion and Loss Prevention in the Process Industry - Londron1980.

[3] How to avoid the generation of loops in the construction of fault trees - Piccinini et al. - Reliability and Maintainability Symposium Proceedings IEEE – 2002 Vol. 2.

[4] Failure Modes Effects and Diagnostic Analysis – exida.com

[5] An examle of layer of protection analisys using the PROBE tool – E.M. Marszal – exida.com, etc.