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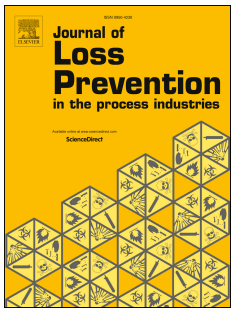

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Reliability modelling of over-pressure protection systems for oil and gas flowlines

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Abstract

Detailed analysis of the reliability of over-pressure protection systems for well flowlines is necessary given the potentially catastrophic consequences of loss of containment. This paper presents a method for modelling such systems, using simplified equations and the beta factor method for the analysis of common cause failures. Various scenarios were modelled, representing different configurations of safety instrumented functions (SIFs) and pressure relief facilities. Consideration was also given to the number of wellheads on a wellhead tower, as well as the number of wellhead towers connected to a common central processing facility.

Strategies such as providing a SIF on the common outlet from a wellhead tower, providing additional relief capacity and reducing sources of common cause failures were found to be effective in increasing the risk reduction factor achieved by the over-pressure protection system. Where such measures are insufficient, an alternative solution is to design all lines to the well shut-in pressure. This approach transfers the risk of over-pressure to the downstream separator, which must then be provided with adequate protection measures.

Nomenclature and Abbreviations

Roman letters

C	Configuration factor for special redundant configurations
C_{MooN}	Configuration factor for MooN redundant configurations
C_N	Parameter used in PFD calculations to account for multiple failures in NooN configurations (see Hauge et al., 2013)
CCF	Common cause failure
CPF	Central processing facility
ESOV	Emergency shut-off valve