

### Model-based analysis of process safety

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As process systems become more complex and operate under more extreme conditions, ensuring their safety becomes more challenging and, as demonstrated by recent well-publicized accidents, the risks associated with their operation become significantly higher. Hazardous situations often arise not from a single event, but from combinations of several factors and events, the occurrence and consequences of which are difficult to analyze in a purely qualitative manner. This presentation considers the use of detailed first-principles models to support the analysis of process safety. Particular emphasis is placed on high-pressure processing equipment under conditions of rapid depressurization (“blowdown”), which can lead to extremely low temperatures which, in turn, may cause catastrophic failure. The presentation also considers the model-based analysis of process safety systems, such as flare networks. It is argued that the use of detailed, dynamic models of such systems can lead to a proper assessment of the risks inherent in their operation while eliminating excessive overdesign.