New research has combined two different techniques for identifying hazards and assessing risks into a single dynamic risk assessment process. The new approach fills a gap in many current risk assessment techniques as it can be applied throughout the lifetime of a process, not just during its design phase, taking into account new information to update risk assessments and calculations systematically.

Quantitative risk assessment (QRA) and management is one of the most common approaches to hazard identification and accident prevention in the chemical and process industries. QRA, a project management technique which pinpoints the probability of a risk event occurring and the impact the risk will have if it does occur, can be used in this particular context to determine the potential loss of life caused by undesired events. Software can be used to model the effects of such an event and even to calculate the potential loss of life.

However, while many risk assessment methods have proven extremely effective in managing major accident hazards, they are often limited by being static, one-time processes performed during the design phase of chemical plants or industrial processes.

As such they often use older data or generic data on potential hazards and failure rates of equipment and processes and cannot be easily updated in order to take into account new information, giving a more complete view of the related risks. New information may take the form of, for example, ‘early warnings’ (i.e. near-miss accidents) or other events which may occur during the operational phase of a process.

This failure to account for new information can lead to unrecognised hazards, or misunderstandings about the real probability of their occurrence under current management and safety precautions.

This research aimed to develop and demonstrate a more dynamic approach to risk management, allowing new information to be taken account of more easily.

The researchers identified two different hazard identification and risk assessment techniques, which both used a ‘Bow-Tie analysis’ as part of their hazard identification processes. This overlap allowed the models to be integrated under a single approach (‘framework’) for continuously improving, iterative risk analysis.

The first technique, the Dynamic Procedure for Atypical Scenarios Identification (DyPASI), is a systematic process which screens for and identifies possible accident scenarios related to the equipment or process.

The second technique, Dynamic Risk Assessment (DRA), estimates the frequency of different accident scenarios, using a statistical technique called ‘Bayesian inference’, which updates the probability of an accident on the basis of abnormal situations or incident data as they occur in real time.
The researchers tested the effectiveness of this approach using a case study of metal dust accidents at the Hoeganaes Gallatin facility in Tennessee (USA) where atomised steel and iron powders are produced. The facility experienced three serious accidents in 2011 relating to metal dust which, the authors say, are examples of a lack of hazard identification and laxity in the management of safety.

According to the authors the accidents at the Hoeganaes Gallatin facility would both have been predictable and preventable if a dynamic risk approach had been used. A number of specific measures for prevention, mitigation and control were identified which would have helped prevent the accidents. These measures included eliminating or mitigating escaping dust at the source, as well as administrative controls such as worker training and operating procedures.

The authors conclude that the dynamic approach to risk assessment outlined in this study could allow for more complete and precise hazard identification, triggering real-time risk assessments to raise general risk awareness in the company.

However, the authors highlight that no matter how good risk assessments may be they are only effective if used in association with a proper learning safety culture, and constant monitoring and recording of performance and incidents in order to respond to emerging risk issues.