Evaluation of Chemical Process Resilience

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Although many efforts have been focused on studying the method to prevent the incidents, the incidents in chemical plants still occur for various technical and human errors, terrorists, and acts of God. It means that many unexpected changes are unavoidable even under good risk management; especially, in these days, with more complex systems. Hence, resilience that is the ability to recover quickly after an upset has been recognized as an important characteristic in the chemical industry.

The objective of this work was to develop a systematic approach to evaluate the performance of resilience of chemical processes or units. The evaluation framework was constructed based on multi-level multi-attribute approach since resilience is by itself complicated and affected by many factors. The top-level factors include Design, Detection Potential, Emergency Response, Human, Safety Management. The factors have the challenges of the inability to measure exactly and objectively, and generally have non-physical structures and may be described as linguistic variables. Therefore, some of these factors and resilience index were evaluated by using fuzzy numbers instead of numbers. The approach was demonstrated in a case study, which compares resilience levels of two commercial ethylene production pathways. The approach can be applied as early as in process design step for more resilient designs.