

# **I-GRAND Method for Graphical and Numerical based Technique for Inherent Safety Assessment**

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It is important to understand the hazards posed by a process during early process design stage through hazard assessment in order to built an inherently safer, user-friendlier and cost effective chemical plant. The Integrated Graphical and Numerical Descriptive (I-GRAND) technique proposes by this research incorporates inherent safety and economic aspects in assessing alternative chemical process synthesis routes during the R&D phase. I-GRAND eliminates the problem of subjective scaling in hazard scores assignment as suffered by the existing inherent safety methods. This technique is also capable of highlighting chemical and process properties that contribute significantly to the most dominant hazards in a particular process through visualization. Subsequently, the users will be able to select the best safety measures that need to be taken for avoiding the hazards identified at initial screening stage, even before the process flowsheeting. I-GRAND is developed through the application of logistic functions. Eight logistic curves are produced for the inherent safety parameters which are operational temperature, pressure, heat of reaction, process inventory, flammability, explosiveness, toxicity and reactivity. As for the economic aspect, gross profit and net profit margin are calculated based on raw material and product cost due to the very limited data at the R&D stage.