

## Simple graphical method for inherent occupational health assessment

### Abstract :

The concept of inherently safer design was introduced to design a fundamentally safer process so that hazards can be avoided or minimized rather than controlled or managed. The ideology has later been extended to the environmental, but not health criteria due to its complicated underlying principles. Even though health risk methods are already established, majority are for existing plants assessment. Early consideration of health aspect starting from process design stage however, has received much less attention. This paper introduces a simple graphical method to evaluate the inherent occupational health hazards of chemical processes during the R&D stage. A survey was conducted to identify the important health parameters for the graphical method development, involving nine world inherent safety and health experts. Based on their input, process mode, material volatility, operating pressure and chemical health hazard (toxicity and adverse effect) are the significant factors affecting inherent health hazards of chemical processes. The choice of parameters was bounded by the information availability at this stage. The method was applied on six routes to methyl methacrylate and ten routes to acetic acid. The parameters were plotted for each subprocess of the alternative routes. The 'healthiest' route was selected based on thorough hazards assessment across all the subprocesses. The first case study reveals the tertiary butyl alcohol as the 'healthiest' one as it poses relatively lower, or at least comparable hazards to the other routes due to exposure and health impacts. Meanwhile the acetic acid case study indicates ethanol oxide and ethyl oxide based routes as the inherently healthier as they operate at lower operating pressure besides posing comparable hazards level for the other three parameters, compared to the other routes. The case studies show that the inherent occupational health of a chemical process can already be evaluated easily in the R&D stage with the simple graphical method proposed.