Chain of accidents (domino effect) in chemical process industries

Bahman Abdolhamidzadeh a, Tasneem Abbasi b, D. Rashthcian a, and S. A. Abbasi b

a Department of Chemical & Petroleum Engineering, Sharif University of Technology, Tehran
b Center for Pollution Control and Energy Technology, Pondicherry University, Pondicherry 605 014

Abstract

A past accident analysis (PAA) covering major accidents that have occurred in the chemical process industry from the dawn of the previous century up to the present day, reveals that such accidents have rarely began and ended with a single episode of explosion and/or fire. More often than not the first episode has set off another major accident; the letter, in turn, provoking a third accident, and so on. For example a vapour cloud explosion caused by a leak in the polyethylene plant of a Phillips unit near Houston, Texas, (the USA) on 3 October, 1989, led to the damage, one after another, of as many as nine other installations, each of which exploded violently. The well-known disasters at Feyzin (1966), Laurel (1969), and Mexico City (1984), are among innumerable instances that have occurred throughout the history of chemical process industry when one event of fire or explosion has caused a second event. Iran has witnessed such 'knock-on' events at Neyshabur and Zahdan (2004), in which the transportation of flammable chemicals was involved. In some instances, as in Mexico City (1984), and Sydney (1990), the chain of secondary, tertiary, and higher order accidents was very long and lasted for several hours.

But whereas domino effect is a very frequent occurrence, much less attention has been paid towards its forecasting and control than has been towards stand-alone accidents. In this review several illustrative examples of past accidents are presented to indicate the prevalence and the nature of domino effect. The methodologies developed thus far to forecast domino effect and assess its consequences are critically reviewed. In the back-drop of this state-of-the-art, avenues for further research in this area have been explored.