ABSTRACT

A major share of plant accidents is caused by dangerous "sub-processes" that occur concurrently within the arena of regular processes. The regular processes (fractionation, absorption, dehydration, pumping, etc.) are well addressed in corporate operating and maintenance procedures and training programs. However, plant personnel are usually poorly trained to recognize and to respond to the incidental sub-processes that initiate so many plant catastrophes, injuries and fatalities.

Sub-processes are the natural (sometimes unavoidable) consequences of handling and processing flammable and toxic chemicals. The sub-processes usually occur beyond the sensory perception of plant workers. That is why they are so dangerous! Some examples are as follows: (1) The act of pumping a non-conductive, flammable fluid to a storage tank is a regular process, whereas the fluid's electrostatic charge (a dangerous sub-process created by pump and flow line turbulence) may create a high-energy spark in the tank, causing it to explode. (2) An acid storage tank may have overflow piping that prevents over-filling and over-pressure (a regular process design), but the piping may also become a tank crushing siphon (a dangerous sub-process) during the over-flow event. (3) The excess weld metal reinforcement on the crown of a high-pressure pipe weld may give the weld extra strength (a regular process), but if too thick, it may also function as a weld-weakening mechanical notch flaw (a dangerous sub-process) capable of causing sudden, premature pipe failure. These examples show that some plant processes are readily sensed by the employee while others are not. Surviving the dangerous sub-processes is achieved by employee training and the acquired ability to predict the occurrence of the dangerous sub-processes without the need of sensory input.

The intent of this paper is to exhibit an operator-friendly way to train plant personnel to recognize and address the dangerous sub-processes. Sub-processes are like criminal serial killers. They are sneaky, subtle (often masquerading as routine process variables) and can be ruthless killers.