BUILDING PROCESS SAFETY CULTURE: Tools to Enhance Process Safety Performance

Process Safety Culture Toolkit

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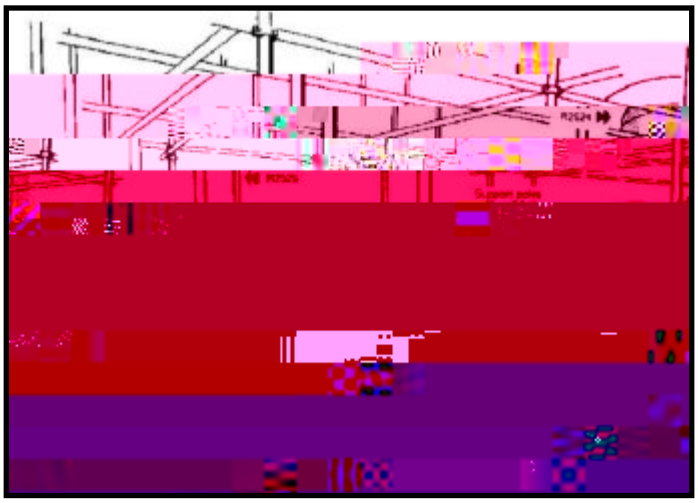
It is sincerely hoped that the information presented in this document will lead to an even more impressive safety record for the entire industry; however, neither the American Institute of Chemical Engineers, its consultants, CCPS Technical Steering Committee and Subcommittee members, their employers, their employers' officers and

Flixborough Case History

[The following information has been taken from the UK government publication *The Flixborough Disaster – Report of the Court of Inquiry.* While this summary has been condensed and paraphrased, it is believed to been consistent with the facts and conclusions outlined in the report.]

On June 1, 1974, the Flixborough Works

each successive reactor was at a lower elevation than the prior, in order to allow the cyclohexane to flow by gravity from one reactor to the next. The reactors were interconnected by 28-inch diameter lines with corrugated expansion bellows installed at the vessel outlet and inlet flanges.



Reactor 5 developed a leak in the vessel shell and had to be removed for repair. In order to permit continued operation, a temporary piping assembly was fabricated to bridge the gap between the outlet on reactor 4 and the inlet on reactor 6. Because of the elevation changes, it was necessary to incorporate a dogleg in this piping jumper. This reduced diameter jumper (only 20 inch diameter pipe was available on site) was supported by scaffolding.

In the onion of the investigators, the most likely source of the cyclohexane release was the dogleg piping jumper. It is believed that the unbalanced forces imposed on the bends in the piping, coupled with the flexibility introduced by the expansion bellows, allowed the inadequately supported and unconstrained jumper to oscillate. Ultimately, one of the bellows failed, releasing the process fluid.

The subsequent investigation revealed the following:

- The works engineer had left early in the year and had not yet been replaced. At the time the bypass line was being planned and installed, there was no engineer on site with the qualifications to perform a proper mechanical design, or to provide critical technical review on related issues. There were chemical and electrical engineers on staff, but no other mechanical engineers.
- Even though a significant crack (six feet long) was found in reactor 5, the decision was made to restart the process without inspecting the other reactors to determine if similar cracks existed.
- Staff involved in planning and implementing the bypass approached the task as if it were a routine plumbing job.
- In the opinion of the investigators, the urgency to resume production distracted staff from the sort of critical consideration of their plans that could have identified the hazards involved (i.e., they did not intentionally establish an unsafe condition but, rather, failed to fully assess the significance of what they were doing).
- The fact that the works manager position was vacant also shifted workload to remaining staff, contributing to the distractions discussed above. The report implies

that company management was not aware of the effect of the short staffing on the