

## Case Study: Illiopolis, Illinois (April, 2004)

In the following example, the use of a safety system final element bypass feature without adequate access restriction leads to a release with fatal consequences.

Impact: Explosion; 5 fatalities, 3 hospitalized, and 4 minor injuries; plant damaged, laboratory, safety, and engineering buildings destroyed; 150 evacuated; roads closed.

### Cutaway of reactor building

#### CSB Report Figure 7



### Summary:

On the night of the accident, all polyvinyl chloride (PVC) reactors were making PVC except reactor D306, which was being cleaned. After washing the reactor from the upper level, the operator went downstairs to drain out the contents of D306. Turning the wrong way coming down the stairs, the operator went to the bottom valve of reactor D310 by mistake and tried to open the bottom valve to empty the vessel.

The reactor pressure safety interlock prevented the reactor bottom valve from opening. The operator, presumably under the belief that he was still on D306 and that the interlock was therefore in error, connected an emergency bypass air hose to the actuator to force the interlocked valve open. He did not request permission to do the bypass or inform anyone of the

bypass.

The reactor contents rapidly emptied through the bottom valve, forming a vapor cloud. Although area release monitor alarms activated and most personnel evacuated, some operators remained at the equipment in an attempt to mitigate the situation. They were still present when the vapor cloud ignited.

### Photograph of facility damage from the explosion CSB Report Cover



### Instrumentation and Controls Gaps:

- Interlock bypassed with air hose, procedure not used, no authorization obtained
- No access restriction in bypass design, in addition to administrative controls
- Area alarms ignored during attempt to mitigate the release
- 1992 PHA identified this scenario; recommendations never adopted
- Scenario re-identified in 1999 PHA, but team concluded existing interlock was sufficient
- Similar near miss VCM transfer incidents occurred at sister plants before and after this incident; changes to bypass capability could not be agreed upon prior to this incident

### Key Automation Learning Points:

The use of an unsecured air hose to bypass a safety interlock final element in this manner is poor practice as its use cannot be controlled or alarmed. When local manual operator overrides or other bypass features are provided, access and use of the bypass should be secured using engineered means as well as being controlled by administrative procedure. In addition, compensating measures should be put in place to address the gap in process safety risk reduction that results from using the bypass.

### Sources:

CSB. 2007. Investigation report - vinyl chloride monomer explosion at Formosa Plastics Corporation. Report 2004-10-I-IL. Washington, D.C.: U.S. Chemical Safety Board.