

Why Can't I Open That Valve?

In April 2004, an explosion and fire at a polyvinyl chloride (PVC) plant killed five people and severely injured three others. The explosion and fire destroyed most of the reactor building and an adjacent warehouse. Because smoke from the fire drifted over the community, authorities ordered an evacuation. The plant was never rebuilt. The U.S. Chemical Safety Board (CSB) issued a report and video on the incident: <http://www.csb.gov/formosa-plastics-vinyl-chloride-explosion>.

The CSB investigation identified multiple root causes for this incident, including inadequate consideration of potential human error in the design and operation of the plant; failure to follow up on recommendations from a previous incident; reliance on operators to carry out procedures in order to prevent a major incident; and inadequate emergency response procedures for a large release of flammable materials.

This Beacon focuses on the specific event that initiated the incident. The plant had 24 essentially identical batch polyvinyl chloride reactors. At the end of a batch, the reactor was purged of flammable and toxic vapors and cleaned with water. The water was then emptied to open sewer drains on the floor below the reactor. It is believed that the incident was initiated when an operator intended to drain water from a reactor that had been cleaned. However, the operator went to the wrong reactor — a reactor that was in the reaction stage. The reaction mixture, at an estimated pressure of 70 psig, contained flammable vinyl chloride. The operator was not able to open the pneumatic valve on the bottom of the reactor — there was a safety interlock that prevented the valve from being opened while the reactor was under pressure. It is also believed that the operator connected a nearby air supply to the valve and forced it to open, releasing the reaction mixture into the building. Flammable vapors from the released material ignited.



What Can You Do?

- If you try to operate a pneumatic or electric valve (open or close it), and it will not operate, stop and think. Perhaps there is a good reason why the valve will not operate. For example:
 - ◆ Maybe you are trying to operate the wrong valve.
 - ◆ A safety interlock might be preventing the valve from opening.
 - ◆ The valve may be locked out or de-energized because scheduled maintenance work or other activity requires equipment isolation or lockout.
- Never force a valve to operate by connecting the actuator to air or another type of power supply if the valve will not operate by its normal control system.
- If a valve will not open, and it has a bypass around it, do not use the bypass to establish flow until you understand why the valve won't open.
- Investigate why you are not able to operate the valve. Do not take any action until everybody understands why the valve will not operate.
- Do the same for any piece of equipment that you cannot operate — for example, a pump or agitator that you can't start or stop. Understand why, and never force equipment to operate.
- Watch the CSB video on this incident to understand all of the root causes and lessons.

If you can't open a valve, don't force it — find out why!

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