An AIChE Technology Alliance
CCPS Center for Chemical Process Safety

Process Safety Beacon

This Issue Sponsored by
ioMosaic
www.iomosaic.com

Messages for Manufacturing Personnel
http://www.aiche.org/CCPS/Publications/Beacon/index.aspx

April 2013

Have You Heard a Pressure-Relief Valve Chatter?

In the November 2012 *Beacon*, many readers correctly identified one safety issue with the relief valve in Figure 1: The block valve does not appear to have anything to prevent someone from closing it, which would isolate the relief valve so it could not provide protection against excess pressure. A second possible problem, a piping system that may cause the relief valve to chatter, was not identified by nearly as many people.

What is chattering?

Chattering is the rapid opening and closing of a pressure-relief valve. The resulting vibration may cause misalignment, valve seat damage, and, if prolonged, mechanical failure of valve internals and associated piping.

Why does a relief valve chatter?

Some causes of chattering include: excessive inlet pressure drop; excessive backpressure; an oversized relief valve; and a relief valve that must handle widely varying flowrates. We will explain the first of these in more detail.

Under normal process conditions, the vessel pressure is below the set pressure of the relief valve, and the pressure at the relief valve is the same as the vessel pressure (Figure 2a). If a process upset increases the vessel pressure, the pressure at the relief valve increases by the same amount, and if the pressure exceeds the relief valve set pressure, the valve opens (Figure 2b). As soon as the valve opens, flow begins through the pipe to the relief valve, and the flow results in a pressure drop between the vessel and the valve. If this pressure drop is large enough, the pressure at the relief valve can be low enough that the relief valve closes (Figure 2c). The flow stops, the pressure at the relief valve increases back to the vessel pressure because there is no flow to cause pressure drop, and the relief valve opens again (Figure 2d). This happens over and over, and can be very rapid, causing vibration and damage to the relief valve, pipes, and equipment.


Figure 1

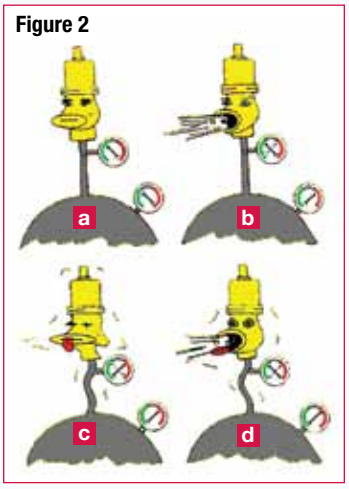

Figure 2

What Can You Do?

- If you observe a relief valve chattering, inform someone who is qualified to identify and correct the problem.
- Look for potential problems in relief-valve piping design that could cause relief valve chattering, such as:
  - An inlet pipe to a relief valve that is smaller than the valve inlet (see Figure 3).
  - Many valves, fittings, and other obstructions between a process vessel and a relief valve, as in Figure 1.
  - A very long pipe between a vessel and relief valve, or piping with a lot of bends.
  - Evidence of line plugging from corrosion or process materials observed when removing a relief valve for maintenance.

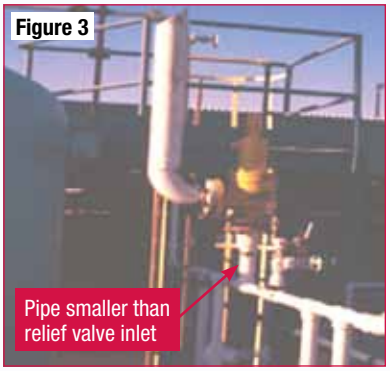

Figure 3

Don't let your relief valves chatter!

The Beacon is usually available in Afrikaans, Arabic, Czech, Chinese, Danish, Dutch, English, French, German, Greek, Gujarati, Hebrew, Hungarian, Italian, Japanese, Korean, Malay, Marathi, Norwegian, Persian, Polish, Portuguese, Romanian, Russian, Spanish, Swedish, Telugu, Thai, Turkish, and Vietnamese.

Circle 103 on p. 71 for a free electronic subscription to the Beacon.