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Process Safety Beacon

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Messages for Manufacturing Personnel

A Hidden Chain of Hazards

April 2020

A plant was restarting after a shutdown. The pulley of a double-lobe blower on a mist separator vent line (Figure 1) suddenly broke while rotating, explosively expelling fragments. Fortunately, the pulley guard (Figure 2) captured the fragments. If the guard had been intended only to prevent contact, or removed for inspection, anybody nearby could have been seriously injured or killed.

A significant amount of water was found inside the blower. The water came from the separator, which was designed to retain mist and small amounts of fibrous dust from the process. The water stopped the rotating lobes suddenly, shearing them off; their fragments were retained by the blower casing. Rotation of the pulley shaft was also stopped and this, combined with the continued rotation at the pulley rim, caused the pulley to break.

The separator drain line contained a water seal (Figure 1). This and a check valve were there to prevent reverse flow of air, enabling the separator to operate at slightly negative pressure.

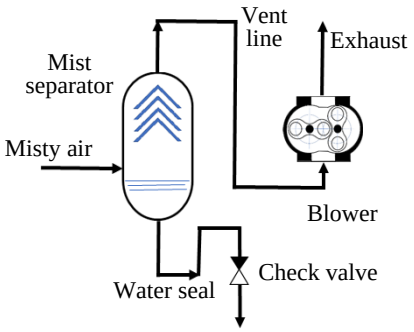

Figure 1. Mist separation process

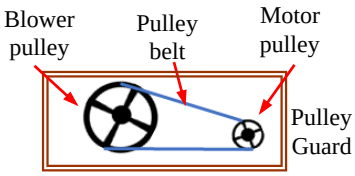

Figure 2. Blower pulley driven by motor

What happened?

- During shutdown, the mist separator and its drain had been cleaned and emptied.
- The start-up procedure did not require filling the water seal before starting the blower. With the drain blocked by the check valve, the water seal was filled by the water precipitated from the air. So it was empty at start-up.
- Dust particles held back by the mist separator stuck open the check valve. This allowed a stream of air to flow continuously back up the drain line.
- By this stream, water from the separator was carried into the blower intake and did not effectively fill up the seal.
- While the actual hazard was the shrapnel from the suddenly stopped pulley, its origin was the air entering from the drain.
- Failure of the check valve (perhaps long before the shutdown, with the water seal filled) could not normally be observed.

What Can You Do?

- During process hazards analysis, components whose failure has serious consequences are identified as Safety-Critical Equipment (SCE). Know them and understand their function.
- Make sure the Safety-Critical Equipment in your plant is properly inspected and maintained by qualified persons.
- Understand why the valves and check valves are provided in the process design. Consider what can happen if they do not work properly. If you take part in a process hazard analysis, make sure that all failure modes of valves are considered.
- Failure of internal parts of equipment, as well as piping components such as valves, may not be visible. If you suspect that any SCE component of your plant, especially one that is hidden (under insulation or behind other lines), may not be working properly, report your concern to engineers and management.
- Make sure all valve positions, the status of all equipment, and process conditions (including correct liquid level in vessels) are identified in start-up procedures. They need to be as specified before start-up: this is part of "Operational Readiness".

Think about your start-up procedures – and follow them!

The Beacon is usually available in Afrikaans, Arabic, Bulgarian, Catalan, Chinese, Czech, Danish, Dutch, English, Filipino, French, German, Greek, Gujarati, Hebrew, Hindi, Hungarian, Italian, Japanese, Korean, Malay, Marathi, Mongolian, Persian (Farsi), Polish, Portuguese, Romanian, Russian, Spanish, Swedish, Telugu, Thai, Turkish, Urdu, and Vietnamese.