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Vacuum Hazards - Collapsed Tanks



The tank on the left collapsed because material was pumped out after somebody had covered the tank vent to atmosphere with a sheet of plastic. Who would ever think that a thin sheet of plastic would be stronger than a large storage tank? But, large storage tanks are designed to withstand only a small amount of *internal* pressure, not vacuum (external pressure on the tank wall). It is possible to collapse a large tank with a small amount of vacuum, and there are many reports of tanks being collapsed by something as simple as pumping material out while the tank vent is closed or rapid cooling of the tank vapor space from a thunder storm with a closed or blocked tank vent. The tank in the photograph on the right below collapsed because the tank vent was plugged with wax. The middle photograph shows a tank vent which has been blocked by a nest of bees! The February 2002 Beacon shows more examples of vessels collapsed by vacuum.



Did you know?

- Engineers calculated that the total force from atmospheric pressure on each panel of the storage tank in the left photograph was about 60,000 lbs.
- The same calculation revealed that the total force on the plastic sheet covering the small tank vent was only about 165 lbs. Obviously this force was not enough to break the plastic, and the tank collapsed.
- Many containers can withstand much more internal pressure than external pressure – for example a soda can is quite strong with respect to internal pressure, but it is very easy to crush an empty can.



What can you do?

- Recognize that vents can be easily blocked by well intended people. They often put plastic bags over tank vents or other openings during maintenance or shutdowns to keep rain out of the tank, or to prevent debris from entering the tank. If you do this, make sure that you keep a list of all such covers and remove them before startup.
- Never cover or block the atmospheric vent of an operating tank.
- Inspect tank vents routinely for plugging when in fouling service.

Vacuum – it is stronger than you think!