

Corrosion under insulation

June 2019

A plant experienced a catastrophic piping failure of an 8-inch (200 mm) insulated steel line containing noncorrosive cracked gas (~ 40% ethylene). The incident started as a pinhole leak that was detected by operators. The pipe failed while the line was being isolated and depressurized. Fortunately, the line folded as it failed, which limited the size of the release. There were no injuries.



The line was 30 years old. It was in a regeneration service where operation alternated among three different temperature conditions:

- Normal operation at 1 °F (−17 °C)
- Regeneration at 428 °F (220 °C)
- Standby at ambient temperature

These changes in operating temperature caused condensation of moisture from the atmosphere on the outside of the pipe, and re-evaporation. This is a well-known high-risk situation for corrosion under insulation (CUI). It can easily be missed if the mechanical integrity team is not aware of the changing operating conditions.

Reference: Morey, A. "Corrosion Under Insulation Revisited: Aren't We About to Finish that Project?" *Process Safety Progress* 37 (4), pp. 502-505, December 2018.

Did You Know?

- Corrosion under insulation (CUI) is external corrosion of pipes and vessels. It can happen when a corrosive fluid, including process fluids which have leaked, is trapped under insulation or fireproofing and kept in continued contact with the outside of pipes or vessels.
- CUI can also result from trapped water from precipitation or condensation of atmospheric moisture.
- CUI often occurs in carbon steel that is cold enough for water to condense on the external surface.
- CUI occurs most often when the operating temperature is between 10 and 350 °F (− 12 and 177 °C) or in cyclic service where temperatures go in and out of this range.
- Corrosive liquid may accumulate at the lowest part of the piping or vessel, rather than where the leak, spill, or condensation occurred.
- Damaged insulation may allow water to enter. The insulation jacket is an important layer of protection to keep the metal pipe or other equipment dry.
- A common cause of jacket failure is from people stepping on insulated pipe to reach something.
- Insulation hides corrosion from view.

What Can You Do?

- Understand which equipment in your plant is most susceptible to CUI. Some examples include steel pipe, pipe in cold or cycling service, and pipe containing a corrosive fluid. Your corrosion experts can provide information to help you understand CUI in your plant.
- When you walk through the plant, look for damaged insulation, jackets, or seals where water can enter. These areas should be inspected, and the insulation repaired.
- Immediately report signs of any leak that you observe. Look for signs of liquid inside the insulation jacket such as drips or puddles (even if "only water"), discoloration, rust stains, and blistering. Follow up to make sure the leak is repaired in a timely manner.
- If insulation is removed during maintenance or repairs, use this chance to check the equipment for signs of corrosion. Also, remember that the job is not complete until the insulation is replaced.
- Read the February 2005 and January 2014 *Beacons* for other examples of corrosion under insulation.

Recognize corrosion under insulation hazards!

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