

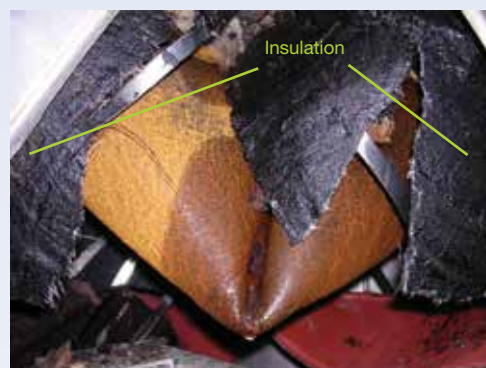
## Corrosion Under Insulation

Operators at a plant detected a pinhole leak in an 8-in.-diameter insulated steel line containing noncorrosive cracked gas (~40% ethylene). The line was 30 years old and was in a regeneration service, which cycled between 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 moisture from the atmosphere to condense on the outside of the pipe and then re-evaporate. This situation can cause corrosion under insulation (CUI). It can easily be missed if the mechanical integrity inspection team is not aware of the changing operating conditions.

While the leaking line was being isolated and depressurized, it failed catastrophically. Fortunately, the pipe folded as it failed, which limited the size of the release, and there were no injuries.



▲ Only after the insulation was removed were operators able to determine the cause of the failure to be external corrosion under insulation.

### Did You Know?

- CUI occurs on the outside of pipes and vessels. It can happen when water or a corrosive fluid, including leaked process fluid, is trapped under insulation or fireproofing and kept in continued contact with the exterior of pipes or vessels.
- Trapped precipitation or condensation of atmospheric moisture can cause CUI, particularly on metal surfaces cold enough for water to condense.
- CUI occurs most often when the operating temperature is between 10°F and 350°F (-12°C and 177°C) or in cyclic service with temperatures going 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 initially occurred.
- The insulation jacket is an important layer of protection to keep the metal pipe or other equipment dry. Damaged insulation may allow water to enter, causing CUI. A common cause of insulation jacket failure is impact caused by people stepping on insulated pipe.
- Insulation hides corrosion from view.

### What Can You Do?

- Understand which equipment in your plant is most susceptible to CUI. Steel piping, piping in cold or cycling service, and piping that contains a corrosive fluid are especially vulnerable. Your corrosion experts can provide information to help you understand the risks of 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 you observe. Look for signs of liquid inside the insulation jacket, such as drips or puddles — even if it is only water. Discoloration, rust stains, and blistering on insulation should also be noted. Follow up to make sure the leak and its damage are repaired in a timely manner.
- If insulation is removed during maintenance, use this chance to check the equipment for signs of corrosion. Remember that the job is not complete until the insulation is replaced.
- Read the Process Safety Beacons from Feb. 2005 and Jan. 2014 for other examples of CUI.

**Beware of corrosion under insulation!**

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