

Corrosion Under Insulation (CUI)

What Can Happen?

- A 4-in. (10-cm) pipe containing liquid ammonia leaked because of extensive corrosion. The quality of the pipe insulation was poor, allowing water to soak into the insulation. The piping system had been partially inspected during the previous turnaround, but this particular section of pipe was not examined.
- A 1-in. (2.5-cm) flammable gas feedline ruptured because of thinning of the pipe wall due to corrosion under the insulation, causing a gas fire. The pipe that failed was a bypass that was not actually in operation at the time. Because there was no flow through the line, it was cooler than the main process pipe. The temperature, about 80°C (175°F), was low enough that steam or moisture in the air could condense, and liquid water that contacted the insulated pipe did not evaporate quickly. This, in combination with damaged insulation, created conditions that make corrosion more likely.



▲ Examples of damaged insulation



▲ Corrosion resulting from damaged insulation

Do You Know?

- Corrosion under insulation (CUI) is corrosion of piping, tanks, or other equipment that occurs due to water under insulation or fireproofing. Faulty or damaged insulation is frequently a source of the water that causes corrosion, and the insulation may also hide the damage so you are not aware of it.
- Literature suggests that CUI may be a concern for equipment service temperatures of -4°C to 175°C (25–350°F).
- Some common contributors to CUI include:
 - ◆ Water in the insulation, because of improper storage before installation, improper installation, or damage after installation. This may be compounded if there is corrosive chemical contamination of the water that soaked into the insulation — for example, acids and other process chemicals, or chlorides, such as salt from the air near salt water or from de-icing chemicals.
 - ◆ Water or other fluids can flow through certain types of insulation and move away from the source of the leak. CUI may occur in areas farther from the leak than expected — especially in low spots.
 - ◆ Pinholes or small process leaks from gaskets and fittings underneath insulation, which may remain undetected until the damage causes a larger leak.

What Can You Do?

- For process plant construction or maintenance workers:
 - ◆ Make sure that insulation is always installed according to the specified procedures. This includes proper covers and seals on the insulation, and proper coating or painting of the equipment that is insulated.
 - ◆ If you must remove insulation, be sure to protect the removed insulation until the job is finished and the insulation is properly reinstalled.
 - ◆ When you remove insulation to do a maintenance job, take advantage of the opportunity to look at the equipment under the insulation. If you see evidence of corrosion, report it to management so experts can inspect the equipment.
- For process operators:
 - ◆ Look for damage to insulation or other signs of CUI as you work in the plant, and report your observations to management so that damaged insulation can be repaired and the insulated equipment can be inspected, if necessary.
 - ◆ When a maintenance job is complete, check the insulation to make sure it has been properly replaced.
- If you damage any insulation in the course of your work, report it and make sure it is repaired.
- See the February 2005 Beacon at www.sache.org for another example of CUI. You can also read more about the incidents above in: De Vogelaere, F., *Process Safety Progress*, **28** (1), pp. 30-35 (March 2009).

Take care of the insulation in your plant to prevent corrosion!

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