



PROTECTING LNG **INFRASTRUCTURE** WITH CORROSION MITIGATION

Ricky Seto, ROCKWOOL Technical Insulation, highlights the importance of advanced corrosion under insulation mitigation and the role it plays in optimising LNG tank maintenance.

LNG facilities rely heavily on insulation systems to maintain the extreme cold required to safely store and transport cryogenic materials. This insulation, commonly applied around piping, tanks, and other equipment, ensures the LNG stays at or below -258°F (-161°C) to prevent it from reverting to its gaseous state.

Even a well-designed insulation system is not immune to the rigors of time, which makes routine inspections a critical component of any tank maintenance programme. Numerous insulation inspection methods exist, including non-destructive testing (NDT) methods that allow an inspector to peek in the insulation system

with minimal disruption. Common NDT methods include ultrasonic testing, X-ray testing, and moisture monitoring, to name a few. Inspection ports can also offer a way to see underneath an insulation system. Although, the placement and maintenance of these ports should not be overlooked as they can potentially become points of leakage.

The 'invisible' threat of water ingress

Routine insulation inspection is so critical because beneath the surface of even the most well-engineered insulation systems, an ongoing challenge persists: water ingress and the resulting threat of corrosion under insulation (CUI).

Water finds its way into insulation systems from various sources – rain, saltwater mist, condensation, washdowns, and even process leaks. Over time, cracks in cladding and gaps in insulation make it easier for water to migrate down to underlying metal surfaces. Once there, the contaminants brought in by the water can initiate localised corrosion. Known as CUI, this phenomenon is especially damaging due to its ability to stay hidden until failure occurs.

CUI poses serious risks for LNG operations. In addition to compromising thermal insulation performance, it can result in costly unplanned maintenance, ice accumulation, process leaks, and environmental and safety hazards. Industry data suggests that CUI contributes to up to 10% of total plant maintenance costs and as much as 60% of pipeline maintenance expenses.¹ While much of an LNG facility operates at cryogenic temperatures where corrosion risks are lower, certain areas – such as piping for process gases and vapours – can reach higher temperatures, which exacerbate corrosion rates and heighten the need for effective CUI mitigation. The risk for CUI actually goes up during higher temperatures to up to 350°F (177°C).



Figure 1. ProRox™ MA 960 with WR-Tech™ can be installed around large columns, tanks, and other equipment to minimise corrosion risks for high temperature applications.

Above these temperatures, water usually steams out of an insulation system, keeping the metallic surfaces underneath relatively dry and thus decreasing the risk of CUI.²

A sound tank and pipe maintenance programme must prioritise insulation materials that not only insulate effectively but also manage moisture and corrosion risks efficiently.

Keeping CUI at bay with water-repellent insulation

Recognising the scale of the CUI challenge, ROCKWOOL Technical Insulation has developed stone wool-based insulation solutions engineered specifically to repel water even at high temperatures and help facilities minimise the risks and costs associated with CUI. Stone wool insulation is typically used in high-temperature applications where CUI risk is high.

ROCKWOOL's ProRox™ MA 960 with water repellency technology (WR-Tech™) is one such solution. Designed for large diameter pipework, tanks, heat exchangers, and turbines common in high-temperature applications within an LNG facility, this mat (wrap) insulation combines robust thermal and acoustic performance with a breakthrough in water repellency. The WR-Tech binder coats every fibre of the stone wool insulation with an inorganic, high temperature-resistant hydrophobic agent. This helps minimise water absorption in the insulation and speed up the drying process, protecting both the insulation's integrity and the metal substrate beneath.

Testing to stringent industry standards

The effectiveness of WR-Tech has been demonstrated through rigorous industry-standard testing. Samples of ProRox MA 960 with WR-Tech were tested to the EN ISO 29767 (formerly EN 1609) standard, the European standard for determining short-term water absorption by partial immersion. Samples were partially immersed in water for 24-hour periods and tested under the following conditions:

- Immediately after heating to 482°F (250°C) for 24 hours.
- After ageing for six months at ambient temperatures.
- After cyclic heating at 122°F (50°C) and 482°F for 21 days.

All samples maintained the same low level of water absorption: less than 0.2 kg of water per m² of sample. This was five times lower than the water absorption of other insulation materials tested to the same standard.

Further, in full immersion tests for two hours per ASTM C1763, the ProRox MA 960 with WR-Tech demonstrated rapid drying behaviour:

- Immediately post-immersion, only 1.2% water was absorbed by volume.
- After 2 hours, samples demonstrated only 0.5% water by volume.

- After 48 hours, the samples showed essentially 0% by volume of water absorbed.

This rapid dry-out capability is crucial in active plant environments where insulation must perform even after it is exposed to water.

Another key feature of WR-Tech is its low, water-soluble chloride content – below 10 ppm – which minimises the insulation's influence on accelerating corrosion on steel surfaces. This complies with critical industry standards like ASTM C795 and EN 13468.

Additional performance benefits for LNG operations

Solutions such as ProRox MA 960 with WR-Tech bring several operational advantages to LNG plants and maintenance and operations teams.

Easy installation with less downtime

With fewer application layers than conventional insulation options, solutions such as ProRox MA 960 are faster and easier to install. The mat (wrap) insulation applies easily to vessels, columns, and complete pipeline systems – including around bends – without the need for sealants, off-site cutting, or specialised personal protective equipment.

Freeing up space in tight places

In the case of ProRox MA 960, it installs at a fraction of the thickness of conventional insulation materials, making it easier to apply around tight pipe bends or in areas with limited clearance space.

Delivering effective acoustics suppression in a thinner profile

In addition to excellent thermal insulation performance, solutions like ProRox MA 960 deliver effective acoustics insulation for inherently noisy plant operations. With stone wool as its base material, ProRox MA 960 meets ISO 15665 standards for recommended insertion loss levels for Classes A, B, C, and D, and sometimes at less than half the thickness of other insulation materials.

Minimising a plant's carbon footprint

Stone wool insulation, such as ProRox MA 960, minimises heat losses in hot pipes and tanks to save on the plant's energy consumption and greenhouse gas emissions. On average, ROCKWOOL's stone wool insulation saves more than 100 times the energy consumed and CO₂ emitted in its production of a 65-year lifetime.³

Field-proven success

The advantages of WR-Tech are already evident in real-world operations. At an LNG liquefaction facility in southwest Louisiana, US, ProRox MA 960 was chosen for its thermal, acoustic, and corrosion protection. This facility, which has a capacity of producing up to 6.75 million tpy of LNG, is located near ecologically sensitive wetlands and coastal areas. As a result, the facility prioritises operational safety and environmental stewardship. WR-Tech-supported insulation has proven durability and water resistance that has helped

the facility meet its insulation performance and sustainability goals.

Ongoing innovations for pipework protection

ROCKWOOL's efforts to mitigate CUI continue with the introduction of ProRox PS 965, a mandrel wound pipe insulation with corrosion-resistant technology (CR-Tech™), an advanced corrosion inhibitor embedded directly into the inner layer of the insulation – right where moisture first contacts the pipe surface.

CR-Tech is activated by water ingress. When moisture reaches the pipe wall, the embedded inhibitor forms a passivating film that impedes corrosion development. Used in combination with WR-Tech's water repellence, CR-Tech represents a dual-defense system for high-risk areas.

Laboratory testing has confirmed the long-term performance of CR-Tech solutions:

- Simulated 15-year rainfall exposure per a modified ASTM G189 method.
- Cyclic wet-dry testing at elevated temperatures (284°F/140°C dry and 140°F/60°C wet).
- Exposure to high-chloride environments.

In all scenarios, insulation containing CR-Tech consistently outperformed other insulation materials – offering five times better corrosion protection while maintaining insulation and acoustic performance.

Looking forward to future LNG plant maintenance improvements

As the global LNG industry continues to expand, the need for durable, high-performance insulation systems will only grow. Whether retrofitting ageing infrastructure or constructing new facilities, LNG operators must prioritise long-term reliability, safety, and environmental responsibility.

Solutions like ProRox MA 960 with WR-Tech and ProRox PS 965 with CR-Tech offer a compelling path forward – delivering proven performance in water repellency, corrosion resistance, and insulation efficiency. By reducing the hidden costs and risks associated with CUI, these advanced materials enable more predictable maintenance schedules, better asset protection, and improved safety for workers and communities alike. **LNG**

References

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