

Abraham Sebastian, ROCKWOOL Technical Insulation, USA, outlines how insulation advances can mitigate noise and corrosion under insulation in LNG plants.

On the list of potential hazards in many industrial manufacturing and processing facilities, elevated noise levels rank near the top. The US National Institute for Occupational Safety and Health (NIOSH) estimates that more than 22 million workers in the US alone are exposed to harmful noise levels on an annual basis.¹

LNG terminals contribute to this statistic with their wide range of inherently noisy equipment that includes air-cooled heat exchangers, piping systems, compressors, and pumps. The noise generated by this equipment typically exceeds NIOSH's recommended exposure limit (REL) of 85 dB (as an eight-hour time-weighted average).

Plant personnel exposed to noise above the REL face serious physical and psychological problems, including tinnitus, permanent hearing loss, hypertension, and depression. High noise levels also raise the risk of accidents and can put the plant at odds with neighbouring communities by exceeding local noise ordinances and threatening the welfare and safety of nearby wildlife.

Given these threats to an LNG plant's performance and safety, operators continue looking for reliable, cost-effective noise-reduction solutions. This article reviews a solution advanced by ROCKWOOL Technical Insulation – ProRox MA-960® with WR-Tech™ – which leverages stone wool's unique properties to reduce noise from pipes, vessels, and other plant equipment in LNG facilities. Not only does this new insulation reduce noise levels to below REL, but it also counters the pervasive problem of corrosion under insulation (CUI) by incorporating an advanced water-repelling technology.

Reducing workplace noise with proper insulation

The turbulent flow of liquids moving through an LNG plant's piping network and other equipment is a major cause of excessive noise levels of 100 dB or more. Stone wool insulation excels as a noise suppressant by dampening the vibrations generated by this turbulent fluid flow.

For more than 80 years, stone wool insulation materials have leveraged the natural power of stone to provide effective thermal and sound resistance in industrial applications. These materials are manufactured by melting natural rock, spinning it into long fibre strands, and then weaving the strands into high-density mats or forms that can be easily affixed to the outside of piping systems and other LNG equipment.

On the 'hierarchy of controls' developed by NIOSH (Figure 1),² the application of sound-suppressing insulation to control the noise hazard from piping and other plant equipment generally has mid-range effectiveness (more effective than PPE, less effective than eliminating the



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noise altogether). However, advances in stone wool design and construction have made this insulation a cost-effective option. And when combined with other measures, such as PPE and exposure time limits, noise threats to workers are dramatically reduced.

Thoroughly tested to industry standards

ROCKWOOL tests its stone wool insulation materials to ensure that they meet certain industry standards prior to application in a plant. One widely accepted standard, ISO 15665, was developed by the International Organization for Standardization (ISO) to guide the selection and design of acoustic insulation for pipes, valves, and flanges.

ISO 15665, which has been adopted by major oil and gas operators, refineries, and LNG plants, defines different classes of sound control (Classes A, B, C, and D). The Class D specification was adopted by Shell and has become the predominant sound control class for LNG plants around the world. These four classes are further broken down into three subsets based on pipe diameters (small, medium, and large).

The standard sets requirements for minimum insertion loss, which is a measure of the minimum noise reduction in dB for each class when acoustic insulation is applied to a pipe system. Insertion loss testing is conducted in a sound room with a single steel pipe running the length of

the room (Figure 2). Noise is introduced at one end of the pipe via a loudspeaker and terminated at the other end by dampening materials that do not allow any noise to escape. A microphone is used to measure the noise before and after the installation of insulation to determine the total insertion loss.

The stone wool insulation effectively met the ISO 15665 standards for recommended insertion loss levels for Classes A, B, C, and D materials in this testing.

Delivering proven installation, noise-suppression benefits

ROCKWOOL conducted extensive testing and drew upon its widespread application experience to develop ProRox MA-960 with WR-Tech with design features that would ensure cost-effective installation and reliable performance in an LNG plant.

Effective acoustics performance from a thinner insulation layer

The stone wool insulation effectively meets ISO 15665 standards for acoustic insulation performance – at half the required maximum thickness of a conventional insulation material. Less thickness translates to lower installation costs, more effective use of installation crews, less storage space required for inventory, and lower transportation costs.

Long-lasting insulation performance under extreme ambient conditions

After being subjected to pre-heat stress tests of 482°F (250°C) for 24 hours, the insulation stays well within industry-standard boundaries for effective acoustics suppression and water repellence.

Fast and easy installation in the plant

Only one insulation product and one heavy mass layer are necessary to provide the required acoustics insulation performance. This solution eliminates the need to glue individual layers and avoids the use of specialised PPE or other special safety requirements during installation. An easier, faster install also translates to less downtime.

Mitigating CUI with water-repellent technology

In many plant operations, the ingress of water through the insulation and onto the metal surfaces of pipes and other equipment can cause aggressive CUI. The severity of the CUI is related to the temperature of the pipe or equipment: higher temperatures translate to more aggressive and higher corrosion rates. While most insulation requirements in an LNG plant are for low-temperature applications, there are some critical areas in the plant that operate at elevated temperatures where CUI will pose a higher risk.

For these applications, ROCKWOOL's WR-Tech gives the insulation improved water-repellent properties that mitigate against CUI. This binder technology coats each individual fibre of the stone wool insulation with an inorganic, hydrophobic additive during the manufacturing process. This ensures that the stone wool maintains superior water repellence, even at elevated

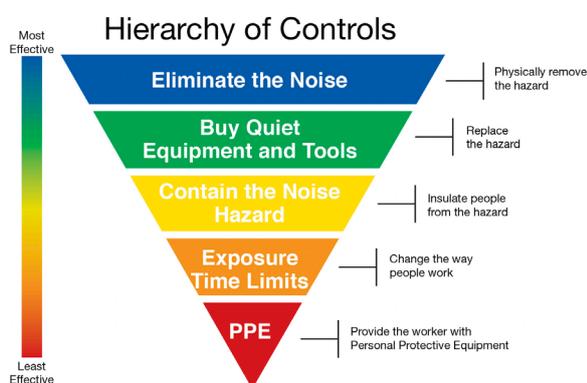


Figure 1. The National Institute for Occupational Safety and Health hierarchy of controls.



Figure 2. A sound room measures insertion loss after acoustic insulation is applied, per ISO 15665.

operating temperatures, while preserving the insulation's thermal and acoustics performance as well.

The water-repellent additive dramatically lowers CUI and extends the piping network's operating life in several ways.

Lowest water absorption

The treated insulation has five times lower water absorption than the next-closest insulation material tested by the EN 13472 standard (the European standard for determining short-term water absorption in pipe insulation). The treated insulation maintains this water repellence, even after heating and ageing.

Low water leachable chloride content

Insulation treated with WR-Tech contains less than 10 ppm water-soluble chloride content, making it compliant with strict industry standards such as ASTM C795 and EN 13468 and ensuring its safe application over steel.

Fast water dissipation

The insulation's vapour-open structure ensures that water can evaporate freely if it should reach the pipe surface and provides short dry-out times according to ASTM C1763.

Providing acoustics/CUI mitigation on complex equipment geometries

The new acoustic insulation material with WR-Tech is delivered as a mat (wrap) product to provide effective

CUI protection while insulating large-diameter pipework, vessels, columns, or applications requiring design flexibility.

This flexibility of design is important to LNG liquefaction facilities along the Gulf Coast region of the US. Many of these facilities are located in close proximity to areas with a wide diversity of fresh and saltwater wildlife, hundreds of species of birds, and local communities. As part of their ongoing commitment to safeguarding the environments in which they operate, a growing number of LNG facilities are selecting ROCKWOOL's MA-960 Mat (Wrap) with WR-Tech to provide long-term acoustics and thermal insulation while protecting against CUI.

The global demand for LNG is expected to rise in the coming years, which brings with it a ramping up of new supply projects, particularly in the US. As existing LNG facilities expand and new projects are built to meet growing demand, LNG operators will need proven, cost-effective solutions that improve the safety and long-term productivity of their facilities. Material advances, such as ProRox stone wool insulation with WR-Tech, offer the promise of effective noise suppression and superior water repellence to keep personnel safer and plant equipment running longer. [LNG](#)

References

1. 'Occupational Health Watch: January 2022', *California Department of Public Health*, (28 July 2022).
2. The National Institute for Occupational Safety and Health, 'Reducing Noise Exposure: Noise Controls', *Centers for Disease Control and Prevention*, (19 April 2018).