Corrosion Under Insulation (CUI) is one of the most dangerous degradation mechanisms in plant and topside facilities. This deterioration is hazardous because it is unseen and difficult to detect without proper assessment. Studies have shown that 40% to 60% of piping maintenance costs are from CUI related activities, which can often amount to 10% of a company's total maintenance budget.

Effective protective coatings and weather barriers can help minimize the potential for CUI; however, coatings and insulation under cladding deteriorate over time. External maintenance alone is not a feasible solution without a well thought out inspection strategy.

Adopting a risk-based approach to CUI is considered the best solution industry-wide. This approach aims to develop practical inspection and maintenance strategies to minimize risk and maintenance costs.

CUI Damage Mechanism

CUI is corrosion resulting from the ingress of water and contaminants through breaks in the cladding or jacketing. Water may come from numerous sources such as rainwater, a deluge system, process spillage, or condensation in humid environments. This water is then trapped under the insulation or fireproofing.

CUI damage in carbon and low alloy steels is characterized by either general metal wastage or pitting due to the localized breakdown of passivity. CUI damage in austenitic and duplex stainless steels is a form of pitting and Chloride Stress Corrosion Cracking (CSCC).

Managing CUI

There are several approaches to managing CUI:

- Strip and repaint the asset;
- Manage the leaks as they occur;
- Adopt a risk-based approach and carry out a targeted inspection program.

The process of stripping and repainting the asset whilst managing leaks is reactive and dangerous, especially where hydrocarbons are concerned. A risk-based approach is therefore the best solution to be able to direct resources to the highest risk assets at the right time.
... the purpose of a risk-based approach is to identify susceptible piping and equipment subject to CUI, to prioritize inspections, and to develop an inspection plan to reduce risk.

Our Approach

Cygnus possesses a good understanding of the CUI damage mechanism, its prevention, and inspection. Our integrity engineers are experts with hands-on experience in materials selection, condition assessment, corrosion mechanisms, Risk-Based Inspection, and non-destructive testing (NDT). Through this, we can ensure that your CUI issues are adequately managed.


Our assessment methodology covers unit level prioritization, challenging the need for insulation, initial inspection and data validation, production of detailed risk assessments, and the development of inspection plans (see Figure 2).

Our engineers will review your asset materials, operating profile, coating/cladding/insulation type, condition, and environmental factors to determine the probability of CUI. We then calculate the risk level using the likelihood and consequences of failure.

Based on the risk-based assessment outcomes, we develop inspection activities and strategies for your asset. We identify locations that are the most susceptible to CUI and develop a targeted inspection plan. This inspection plan includes nominating a suitable inspection method and packaging the assessment results into a CUI Inspection Program.

Figure 4: Our five-step process for developing a risk-based CUI inspection plan

Supporting Software

• Cygnus has an in-house software for the assessment of equipment susceptible to CUI using RBI.

Why Cygnus?

• Cygnus has credible experience across a range of disciplines combining skills and knowledge in materials and corrosion engineering, metallurgical failure analysis, Risk-Based Inspection (RBI), condition assessment, and inspection engineering. Our customer portfolio contains major oil and gas operators;

• We have a thorough understanding of inspection practices, standards, systems and processes relevant to CUI;

• We collect the appropriate data and predict the risk of CUI damage, based on design and inspection data. We review both visual and non-destructive testing (NDT) inspections, updating the risk profile based on the findings.