



Corrosion Under Insulation

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There are numerous causes of corrosion within piping systems, and the rate at which this phenomenon takes place is based on the factors working independently or in combination with each other. Studies have shown that pipes left poorly or completely unprotected may experience corrosion in as little as two years.

Corrosion is a chemical or electrochemical process in which the deterioration of material properties is caused by adverse interactions with their environment. The majority of metals are naturally existent as stable ores of oxides, carbonates, or sulfides. The production of most of these metals involves adding energy to the original state, and as a result, the metal has a natural instinct to return to its original, low energy oxide state. In order for this to happen, an electrolyte solution, or liquid water and air is required.

The pH levels in water, water's chemical make up, the amount of oxygen in water, the temperature of the water, and the velocity of the water are all active components to the corrosion process. (In terms of velocity, any excessive/sudden changes in direction can lead to erosion and corrosion because of water turbulence.)

The rate at which corrosion occurs is dependent not only on the nature of the environment, but also on the surface of the material at hand. Not all metals have a composition that leaves them as susceptible to corrosion as others. Aside from the many different factors that can cause corrosion, there are also many different types of corrosion that can occur. The most common and threatening form of corrosion is Galvanic corrosion, which is caused when two unlike metals are in contact with the presence of an electrolyte (liquid that is capable of conducting electricity, such as salt water). This mixture acts as a catalyst for one the more active metal (anode) to corrode, while the more noble metal (cathode) is protected. If the makeup of the pipe doesn't contain any noble metals (i.e. Gold, silver, platinum) then the result is both active metals corroding.

Although Galvanic is the most common, any form of corrosion is detrimental, especially when it occurs underneath pipe insulation. This is commonly known as Corrosion Under Insulation, or CUI. CUI can compromise the strength of the pipe and the efficiency of the insulation.

Temperature is a leading factor in corrosion; for example, If the pipe's normal operating temperature is elevated above ambient temperature, condensation could occur during an operational pause or shutdown when the pipe's temperature is reduced to the ambient temperature range. Condensation between the pipe and insulation can produce conditions that promote CUI.

In order to mitigate or lessen CUI, careful consideration should go into the design, specifications, installation, and material of the pipe and insulation, as well as a consistent and rigorous maintenance routine. This maintenance routine should include the periodic removal and inspection of the underlying pipe.

