White Paper

H2OMEYER CONSULTING SERVICES, INC.

Glycol Contamination

– Understanding the threats of glycol to the system –

Introduction

Glycol contamination occurs when small amounts of glycol are introduced into a system (generally a chill water loop) after the incomplete flushing of winterized coils. The glycol may be present at levels as low as 2 PPM, and usually no higher than 500 PPM.

A chill water loop is generally treated with Molybdenum, Nitrite, Silica, or Phosphonate to control mild steel corrosion, and treated with azole to control copper corrosion. The pH of these systems is kept between 8.0 and 10.3.

Bacteria are present in these systems in a variety of strains and forms. Bacterial spores are always present in the deposits of closed loops, and are waiting for the correct environment to prosper.

Creating Problematic Environments

Creating Problematic Environments When glycol enters a system, the strains of bacteria (which use glycol as a food source) leave their spore form and become active bacteria cells. These strains of bacteria are generally facultative anaerobes, which mean that they can live with or without oxygen present in the system. This bacterium feeds on the glycol, and breaks it down by the way of the Krebs cycle as a normal course of digestion.

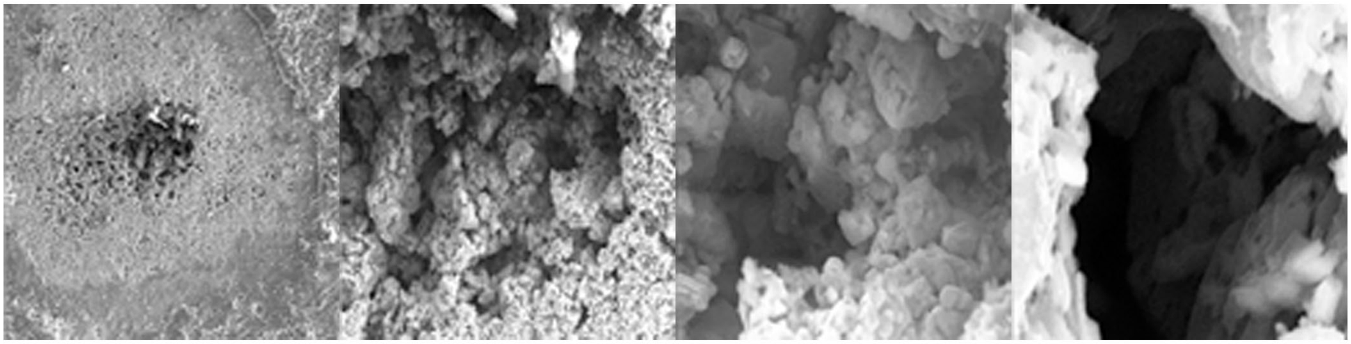
The waste products of the bacteria are butyric acid (rancid butter), formaldehyde, and acid aldehydes. These acidic products rapidly reduce the pH of the loop well below the minimum 8.0 necessary to impede corrosion.

Once the pH is reduced, it begins to solubilize old iron corrosion products along with these more-bacterial spores. Iron levels increase dramatically, bacterial counts and turbidity increase, and the acidic water turns black and develops the odor of rancid butter.

Threat of Steel Piping

The threat to the system has always been the reduction in steel piping life. Mass-moved iron eventually redeposit onto clean steel, fouling the entire system with iron deposits. The system is then subjected to under-deposit corrosion conditions, and the life of the piping can be reduced by decades.

New studies we have conducted now show that copper may be at even greater risk if certain conditions exist. Chiller evaporator tubes can become iron-fouled and subjected to biologically induced under-deposit conditions.



Analysis of the evaporator tube by a scanning electron microscope shows areas of intense micro-pitting consistent with biological attack. Pitting in this situation has resulted in tube wall losses of greater than 40% in an 8 year old chiller.