Nitrite Loss in Closed Systems

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The Problem
Virtually all closed heating and cooling water systems require chemical treat-ment to prevent corrosion. Typically, nitrite based inhibitors provide the best available corrosion protection in closed systems. However, low nitrite levels can result in pitting problems and must be avoided.

The Cause
Low nitrite levels can result from a water loss. If the conductivity, pH, alkalinity, and nitrite level of the system water all decrease, a system water loss has occurred. The fresh water added to replace the lost system water lowers the treatment level, conductivity, and alkalinity via dilution. Low nitrite levels can also be caused by biological denitrification. If the conductivity of the system water remains about the same while the nitrite level decreases, it is probable that bacteria are using the nitrite as a food source. Note that the pH and alkalinity may also decrease as the result of denitrifying bacteria.

The Solution
Low nitrite levels due to water loss can be addressed by
1. Locating and eliminating the source of the water loss. This is the most desirable option, but not always the most practical. See Locating Water Losses in Closed Systems (TB3-003) for additional information.
2. Installing an automatic chemical feed system. A feed system that adds the inhibitor based on conductivity or makeup water usage can help ensure the desired nitrite level for corrosion control is consistently maintained.
3. Switching to a treatment approach that is less sensitive to low treatment levels. Although nitrite programs typically provide the best available corrosion protection, pitting that can occur at low levels warrants consideration of alternate approaches if water loss is an ongoing problem. Alkaline phosphate/sulfite technology has provided adequate results at an economical cost in these situations.

Low nitrite levels due to bacterial degradation can be addressed by
1. Periodic application of Bacticide 45B or Chem-Aqua 40215 according to label directions. These biocides are effective against denitrifying bacteria and maintain a high level of biocidal activity at the alkaline pH levels normally encountered in closed systems. The required frequency of biocide additions can only be determined based on experience. Field test methods for bacteria or evaluation in our Microbiological Laboratory can be of assistance.
2. Switching to a treatment approach that does not contain nitrite. Although nitrite programs generally provide excellent corrosion protection, the biological concerns associated with their use can make using a molybdate, silicate, and/or phosphate-based treatment program a better choice. Depending on the combination of inhibitors used, these non-nitrite programs can provide similar results to a nitrite-based program.

Conclusion
Since low nitrite levels can result in pitting corrosion, systems treated with nitrite-based programs must be tested regularly and action taken to consistently keep the nitrite level in the desired range. By routinely checking the conductivity, nitrite level, and pH/alkalinity, you can determine whether a reduction in the nitrite level is due to system leaks or to bacterial degradation. Once the cause is identified, the proper corrective and treatment measures can be taken.