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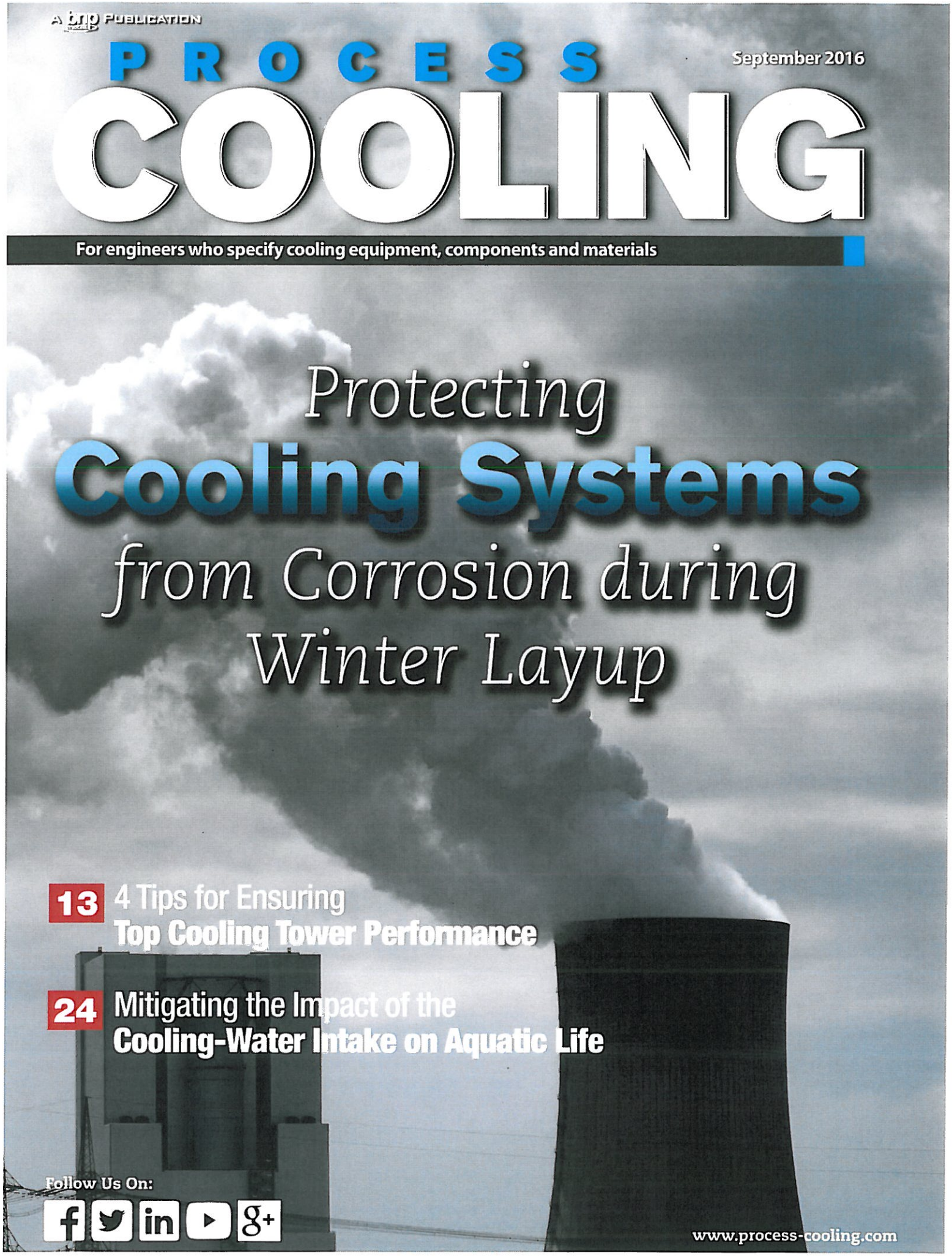

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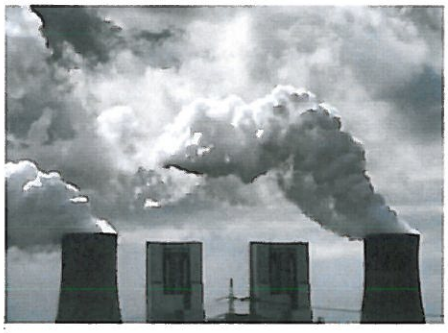

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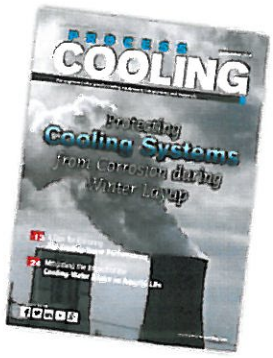
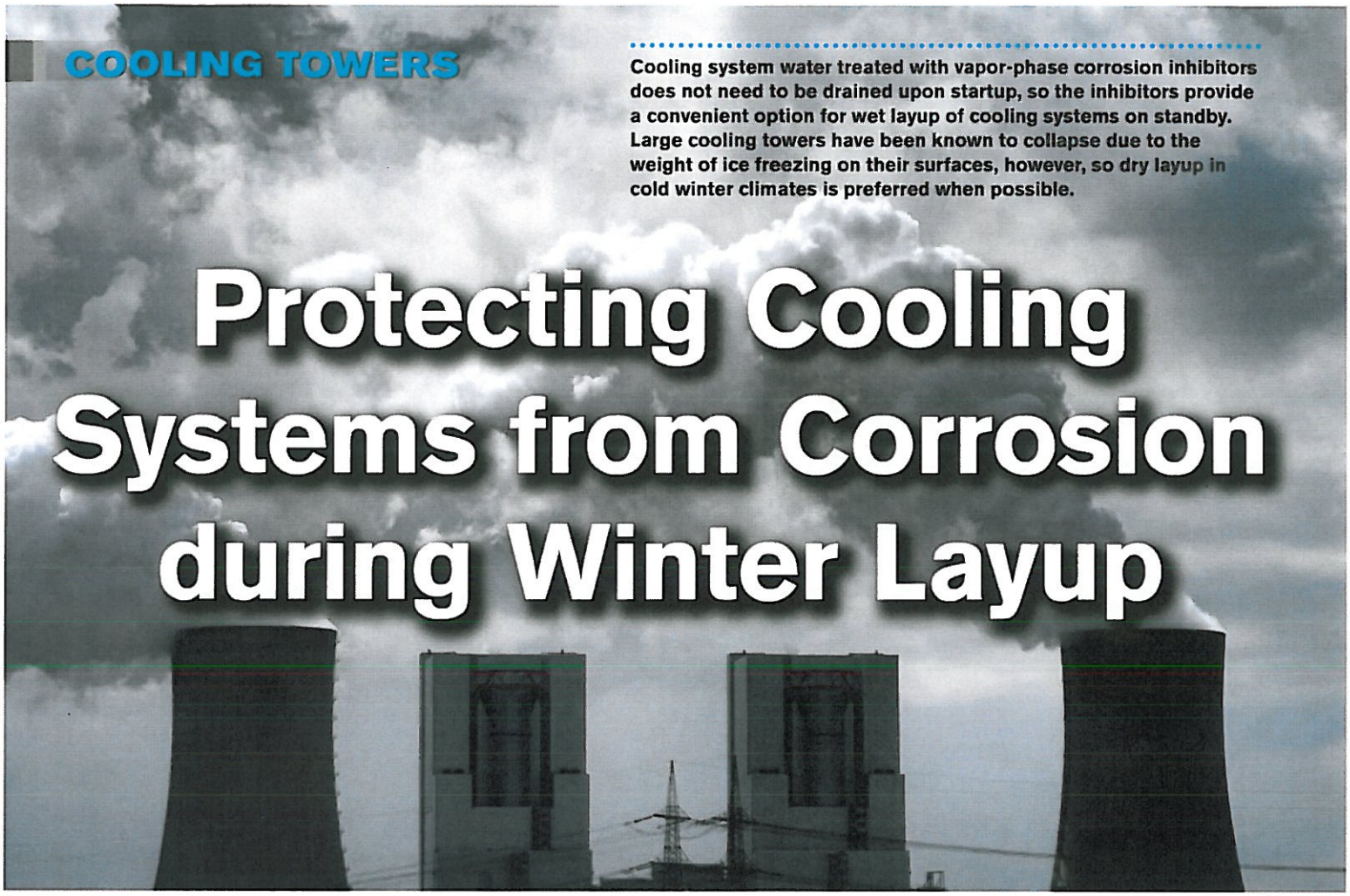


Winter layup of process cooling allows you to idle equipment that is not needed when ambient temperatures fall. One risk of winter layup, however, is corrosion weakening the idled equipment. Corrosion inhibitors can help protect water-contacted process equipment. Learn more about vapor-phase corrosion inhibitors in an article beginning on page 19.

Cooling system water treated with vapor-phase corrosion inhibitors does not need to be drained upon startup, so the inhibitors provide a convenient option for wet layup of cooling systems on standby. Large cooling towers have been known to collapse due to the weight of ice freezing on their surfaces, however, so dry layup in cold winter climates is preferred when possible.



Protecting Cooling Systems from Corrosion during Winter Layup

Vapor-phase corrosion inhibitors can help protect cooling systems during both wet and dry layup. Before your system is put to bed for the season, learn about these treatments.

By Casey Heurung and Julie Holmquist, Cortec Corp.

Winter layup is a perilous time for cooling systems: Cooling towers and pipes that are shut down risk severe corrosion. This can take a toll during spring startup. Flaking metal and chip scale from rusting interiors can plug equipment, interrupt operation and even cause asset failure — despite traditional corrosion-inhibiting treatments.

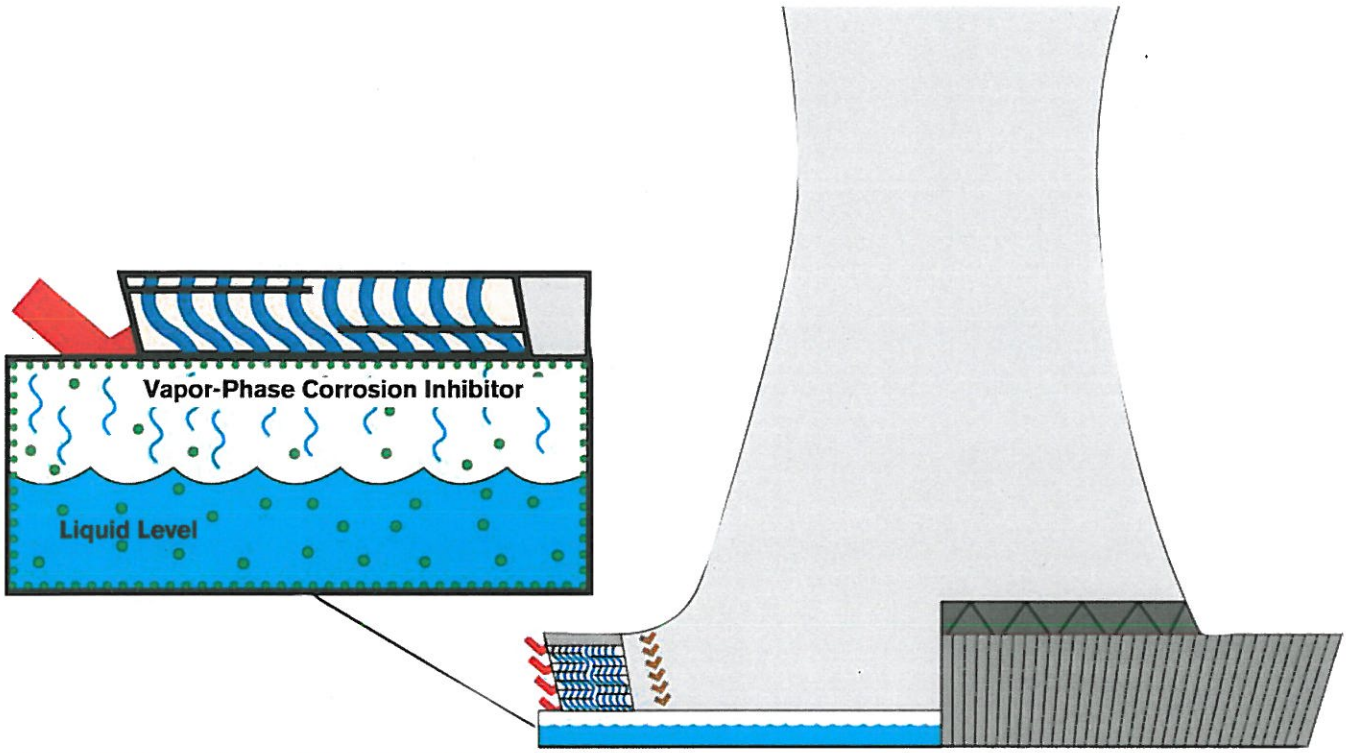
Vapor-phase corrosion inhibitors (VpCIs) help protect systems in both wet and dry layup. These treatments are effective and may be safer than traditional corrosion inhibitors. They offer the flexibility of continued use after startup and during operation.

Corrosion-Inhibitor Alternatives

Traditional wet or dry layup of cooling systems is often inadequate to protect the system from corrosion. For instance, in one application involving winter layup of an HVAC cooling system, corrosion problems arose even after the system had been drained and treated with biocide, molybdate, phosphate and TTA inhibitors.[1] Typical contact-type corrosion inhibitors such as those used can fail because they cannot reach all overhead or recessed surfaces. Oil-based inhibiting products can cause fouling or even encourage bacterial growth.[2]

Other options include nitrogen blanketing or dry-air systems, but these require regular maintenance. These traditional layup methods work on the concept of keeping out corrosive elements such as oxygen or moisture. The corrosion-protection systems can fail if a leak allows all the nitrogen used for nitrogen blanketing to escape or the power fails while using a dry-air system.

If a leak occurs in a nitrogen-blanketed system, the corrosion protection is removed and can only be restored by a repeated application of nitrogen. If the nitrogen leak goes undetected and fills an unventilated space where the cooling system is stored, an unwary individual could enter the space and be overcome (suffocation) before realizing the danger.



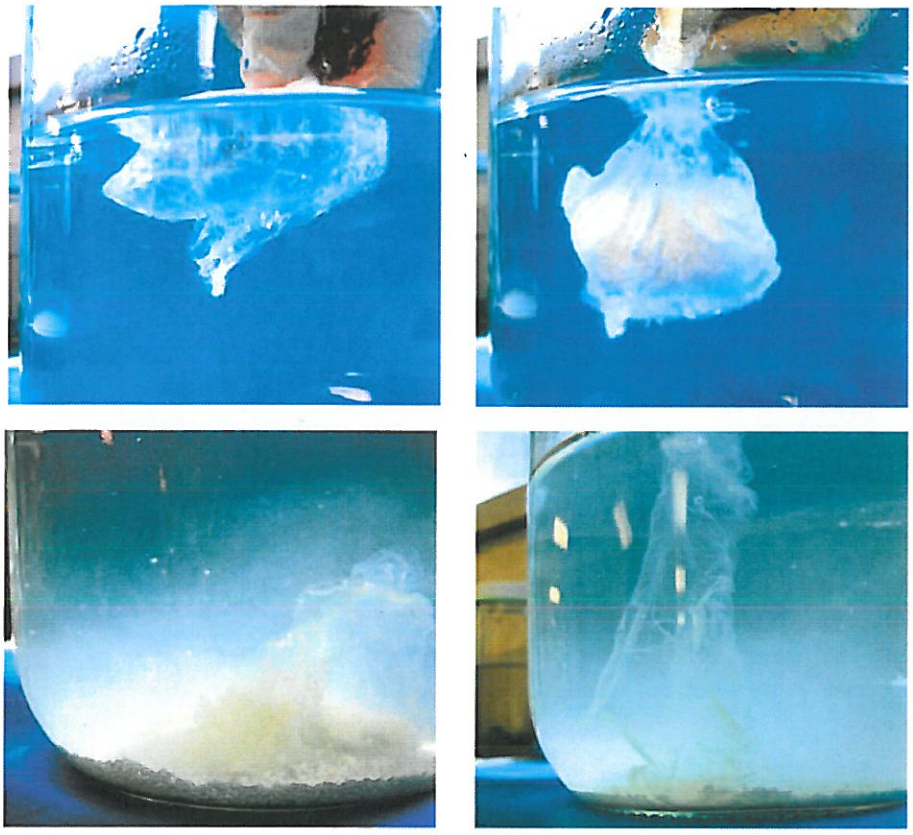
Vapor-phase corrosion-inhibitor treatments typically do not need to be removed at startup because of their high compatibility with cooling tower materials, biocides and antiscalants. In order for the vapor-phase corrosion-inhibitor protection to be effective, the protected area should be covered and closed off during layup.

By contrast, vapor-phase corrosion inhibitors are not limited to needing a perfect seal or a continuous source of power. For example, if the seal breaks on a space protected with vapor-phase corrosion inhibitor, the corrosion inhibitor will go on replenishing and protecting the area after the leak is fixed.

One of the advantages of using vapor-phase corrosion inhibitors to reduce corrosion is the effective protection of multi-metals in all phases: liquid phase, vapor phase and even at the air-water interface. Whether a cooling system is under wet or dry layup, vapor-phase corrosion-inhibitor treatments adapt to the situation to protect surfaces that are immersed in water or those that are dry and difficult to reach. In the former case, inhibitors dispersed in the water provide contact protection. In the latter, vapor-phase corrosion inhibitors are able to vaporize and diffuse through void spaces, where they adsorb and form a thin protective layer on metal surfaces. Should this film be compromised, additional vapor-phase corrosion inhibitors in the surrounding air space will migrate in to replenish the protective layer.

Using Vapor-Phase Corrosion Inhibitors for Wet Layup

The multiphase nature makes vapor-phase corrosion inhibitors easy to apply for layup. For example, a water-soluble bag containing the corrosion inhibitors can be thrown into a system filled with cooling water, cycled



This series of photos simulates the progression that takes place when a water-soluble pouch of vapor-phase corrosion inhibitor is applied for wet layup. Once the pouch is dropped into the water, it begins to dissolve and release the vapor-phase corrosion inhibitor powder contained inside. The vapor-phase corrosion inhibitor itself then dissolves and disperses through the water to do its protective work. For maximum effectiveness, it is important to cycle the treated water through the system before enclosing it for layup.

and the system drained (if desired) and sealed. The bag will dissolve, and the corrosion inhibitors will adsorb on the exposed metal surfaces to create a strong, protective layer. At startup, the vapor-phase corrosion inhibitors do will not need to be removed: They are compatible with cooling tower materials, biocides and antiscalants.

Vapor-phase corrosion-inhibitor compatibility and low toxicity are important features where wet layup of cooling systems is concerned. Due to the friendly nature of vapor-phase corrosion inhibitors, treated cooling system water does not need to be drained upon startup. This is a convenient option for cooling systems on standby. Up to six months of wet layup protection is possible by throwing a combination of antiscalants and contact and volatile corrosion inhibitors directly into a full system. This approach offers corrosion inhibition in the water-filled area of a tank. It also provides a measure of protection in the void vapor headspace of the tank where there could be additional risk of corrosion from liquid evaporation and condensation.

The fact that vapor-phase corrosion-inhibitor treatment components can be left in the system safely at the end of the layup season is helpful for cooling systems dealing with large quantities of water. If the system is drained, however, the low toxicity of vapor-phase corrosion inhibitors helps minimize disposal costs due to the layup protection.

Using Vapor-Phase Corrosion Inhibitors for Dry Layup

Often, it is necessary — and more effective — to drain a cooling system and perform dry layup. This is especially critical in northern climates where winter temperatures reach below freezing. Because cooling systems naturally contain high volumes of water, there is the potential for these water-laden structures to freeze and experience serious complications from ice buildup. The sheer weight of the ice can be a problem and can lead to structural damage or collapse. Large cooling towers have collapsed due to the heavy weight of ice freezing on their surfaces. Because of potential problems like these, dry layup in cold climates is far safer when possible. It also tends to be one of the simplest and most effective methods of winter cooling tower preservation.

Powder fogging is a good dry layup method. It offer more corrosion-inhibiting vapor activity than a vapor-phase corrosion inhibitor wet layup. However, the project scope and metals involved should first be considered for compatibility. For instance, some vapor-phase corrosion-inhibitor powders only can be used on ferrous metals. Others offer protection to both ferrous metals and yellow metals. Given the likelihood of copper being included in a cooling system, this is an important factor to consider.

In addition, the efficient flow of vapor-phase corrosion-inhibitor powder can be obstructed by twists and turns in the cooling system. Therefore, the extent and intricacy of a system should be evaluated before choosing which vapor-phase corrosion-inhibitor fogging method to use.

Another alternative for dry layup is liquid-vapor-phase corrosion-inhibitor fogging, which can be done on both ferrous and nonferrous metals. Liquid-vapor-phase corrosion inhibitor is applied by low pressure air hose. It

Water-soluble vapor-phase corrosion-inhibitor pouches can be added directly to cooling tower water. The pouch will dissolve to release the powder into the water for protection of metal surfaces. The water can then be cycled and drained for dry layup or left in the cooling tower for wet layup. (The internal spaces should be enclosed and covered during layup to keep the vapor-phase corrosion inhibitor from escaping).

travels through an emptied cooling system well, leaving a thin protective film on metal surfaces. The film can replenish itself from other vapor-phase corrosion inhibitors in the space and does not need to be removed at startup. Relatively easy to apply, fogging with liquid-vapor-phase corrosion inhibitor provides thorough protection.

Other benefits of vapor-phase corrosion inhibitors includes the fact that most do not contain chemicals such as nitrites, phosphates and chromates. They can be complemented with water-treatment additives such as oxygen scavengers, antiscalants or formulations containing volatile neutralizing amines, oxygen scavengers and metal passivators. The latter combination can serve as a total replacement for traditional hydrazine treatment, which is highly toxic. The low toxicity replacement does not leave residue in the system and is efficient against corrosion from oxygen and carbon dioxide. This enhances the effectiveness of vapor-phase corrosion inhibitors.

In conclusion, using vapor-phase corrosion inhibitors for winter layup has reduced corrosion and startup problems in cooling systems. Vapor-phase corrosion inhibitors are effective and can lower maintenance costs. They offer ease of use and protect several metal types in multiple phases. These characteristics make vapor-phase corrosion-inhibitor treatment a choice to consider when preparing for winter layup of cooling towers and systems. **PC**

Casey Heurung is technical service engineer and Julie Holmquist is marketing content writer at Cortec Corp., St. Paul, Minn. For more information about corrosion and scale inhibitors for cooling systems from Cortec Corp., call 800-426-7832 or visit www.cortecwatertreatment.com.