Problems in Idle and Standby Systems
Many cooling systems are seasonally taken out of service or put on standby in lead-lag configurations. When these systems are idle microbiological growth and corrosion problems can develop and cause:

- Reduced equipment life from corrosion
- Increased operational and production costs
- Increased maintenance and utility costs

Corrosion in Offline or Standby Systems
Unless continuously replenished, the protective films formed by cooling water corrosion inhibitors tend to degrade over time, leaving chiller condensers, piping, and heat exchangers vulnerable to pitting and accelerated corrosion.

Offline corrosion can cause exfoliation or iron chip scale: flakes or pieces of iron oxide break loose and clog tower distribution deck nozzles, pump strainers, and condenser tubes after spring startup. Iron chip scale tends to occur in partially drained systems where sections of piping have water and air exposure, but can occur in idle systems containing water. If there is significant pre-existing corrosion in the piping, there may not be an easy solution.

Microbiological Growth in Offline or Standby Systems
Idled systems with no water circulation or flow provide ideal conditions for problem-causing anaerobic, sulfate reducing, and iron related bacteria to grow and cause corrosion and fouling concerns. Slime-forming bacteria can also cause severe fouling in unprotected offline systems. The problems can lead to high condenser head pressures, high electricity costs, and/or chiller shutdown when the systems are put back in service.

Concerns with Enhanced Tubes
Enhanced chiller tubes have spiral grooves or "rifling" to increase surface area, which permits greater heat transfer. They are particularly vulnerable to pitting damage and tube fouling from biofilms. Improper lay-up can significantly shorten their life.

Guidelines for Cooling System Lay-up

- The best option for idle or offline chillers and cooling systems is to drain them completely and store dry. If that is not feasible, maintain water circulation through the chiller tubes and piping. Water circulation should be continuous, but periodic flow may suffice (duration and frequency may vary depending on design, controls present, and propensity for microbiological growth).
  - For chillers with enhanced tubes, a minimum of one to two hours per day may be satisfactory
  - At a minimum, chillers with conventional tubes should have water circulation several times per week
  - It may be desirable to install small bypass lines at chiller inlets and outlets and use small capacity re-circulating pumps to maintain continuous flow through the unit
- If offline or standby conditions cannot be avoided, implement proper lay-up procedures.
  - Provide proper microbiological control and inhibitor feed
  - Higher dosages* of microbiocides, dispersants, and corrosion inhibitors may be needed for protecting offline chillers with intermittent or reduced flow
  - The treatment program for standby equipment needs to be monitored by facility personnel and corrective actions taken as needed to avoid problems

*Consult product labels for directions and precautions before using.
Procedures for Lay-up of Idled Equipment

**Tower Side Pre-shutdown**
1. Approximately one week before shutdown, gradually reduce system conductivity to below the recommended limit. This will help reduce scaling potential, levels of dead microorganisms, and contaminants. Maintain inhibitor levels.
2. Within two days before shutdown, if high levels of dirt, suspended solids, or microbial growth exist, feed a polymer dispersant and a bio-surfactant at normal dosages. If side stream filtration is present, backwash as needed.
3. Wait several hours after dispersant feeds and add sufficient oxidizing biocide to achieve desired total and free halogen residuals.
4. Flush and/or drain drip legs and dead spots that could harbor iron and anaerobic bacteria, such as SRB.
5. Follow test procedures (ampoule or growth strip) to check aerobic or anaerobic bacterial activity. If microbiological counts are high or SRB are present, re-treat with oxidizing and/or non-oxidizing biocides at a high dosage.
6. Ideally, maintain corrosion inhibitor levels at the upper control limit during the pre-shutdown time.

**Tower Side Dry Storage Shutdown**
1. Shutdown the system, drain, and inspect. Clean and flush the tower, removing accumulated debris.
2. Add passivation treatment and copper corrosion inhibitor at high dosages.
3. Add the non-oxidizing biocide at the maximum labeled dosage for the system volume. Circulate for 8-24 hours and drain the system completely, including all dead legs.
4. Inspect chillers at earliest opportunity to allow for drying of equipment. Use warm air to dry both condenser and evaporator sections. After inspection, close and seal tightly.

**Tower Side Wet Lay-up Shutdown**
1. Follow shutdown steps one and two.
2. Treat chiller condensers or cooling heat exchangers with compatible closed-system inhibitors and a non-oxidizing biocide for the system metallurgies present, volumes, and duration of storage.
   - Add closed-system inhibitor to maintain a minimum of 1,000 ppm as sodium nitrite or 200 ppm as molybdenum.
   - Add glutaraldehyde according to label directions.
   - If the system contains aluminum, contact Chem-Aqua Engineering for best recommendations.
   - Feed supplemental copper corrosion inhibitor in systems containing a large amount of copper or enhanced condenser tubes.
3. Bypass galvanized towers or evaporative condensers to minimize potential for white rust formation.
4. Maintain <1,000 microorganisms per mL bacteria count and negative testing for SRB and other anaerobes.
5. Provide water circulation.

**Chilled Water Side Wet Lay-up Shutdown**
1. Flush and/or drain drip legs and dead spots that could harbor iron and anaerobic bacteria.
2. Add closed-system inhibitor to obtain a minimum of 1,000 ppm as sodium nitrite or 200 ppm as molybdenum.
3. Add glutaraldehyde according to label directions.
4. Check microbiological activity with recommended test procedures. If microbiological counts are high and/or SRB exists, re-treat with non-oxidizing biocides.
5. Maintain <1,000 microorganisms per mL bacteria count and negative testing for SRB and other anaerobes.
6. Provide water circulation.

**Cortec® Cooling Loop Gator™**
This VpCI is added to a cooling system at a rate of one Gator per 250 gallons system volume. After addition, the water must be circulated 10-12 hours. The water can remain in the system or be flushed, as long as it is tightly sealed immediately afterward. See product label for more details.

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