**IAQ Culprits:  
Hiding in Plain Sight**

*by Ted Fitzmeyer*

**Unlikely suspects  
- boilers, chillers and cooling towers  
- can jeopardize indoor environments without proper maintenance.**

The key to maintenance and engineering managers’ success is staying ahead of maintenance requirements critical in ensuring a safe, efficient and healthy building. System operators and managers play key roles in determining whether indoor air quality (IAQ) problems will or won’t occur, since they oversee preventative maintenance of heating, ventilation and air conditioning (HVAC) systems.

But oversights often occur, despite the best efforts of the maintenance manager. These IAQ problems typically result from improperly functioning key mechanical systems that are not generally associated with IAQ issues, such as cooling towers, chillers, humidifiers and boilers.

To eliminate the likelihood of these HVAC components creating IAQ problems, they must be regularly inspected, tested, cleaned and repaired. Although there is no substitute for a qualified technician, a series of specific maintenance tips can help identify the most common IAQ problems associated with these HVAC components.

**Cooling towers**  
Cooling towers use water to remove heat from cooling processes and equipment such as chillers. Cooling towers can be the cause of a variety of IAQ problems.

First, the cooling tower can be a breeding ground for bacteria. In addition to ensuring proper heat rejection, cooling towers require careful and thorough maintenance to ensure that pathogens such as Legionella do not occur. Pathogenic growths can be prevented by proper biocide chemical treatment and preventive maintenance.

Managers should schedule periodic water testing conducted by a qualified chemical treatment specialist, as well as oversee the installation and maintenance of a system to deliver appropriate chemicals to the water. Technicians should monitor these systems continuously.

Cooling tower inspection is critical in verifying that the chemical treatment system is doing its job. Managers should schedule a quarterly inspection to look for bacteria growth, tower overflow and effluent drift or carryover. Signs of bacteria growth include slimes and algae in the cooling tower sump and within the spray area.

If such growth occurs, properly protected and qualified technicians should perform the cleaning. Any leaks or overflow problems should be repaired. If effluent drift occurs, a drift eliminator can be installed. Managers must make sure that effluent from a cooling tower is never drawn into outdoor air intakes or openings.

A cooling tower that does not permit the associated cooling equipment to properly control building humidity levels also may be an indirect cause of IAQ problems.

**Chillers**  
Water chillers provide cold water — typically 45 degrees or colder — to air handlers and terminal equipment to control space temperature and relative humidity. If a chiller is not providing cold enough chilled water, adequate dehumidification may not occur, which can lead to mold growth within the HVAC ductwork, air handlers or the building itself.

Refrigerant leaks from chillers also can cause IAQ problems. Weekly visual inspections and checks of refrigerant levels will verify any possibility of leaks. Continual monitoring of the refrigerant leak monitor which is now required by many of today’s codes, warn of leakage as measured in parts per million.

Technicians should repair any leaks immediately. As with most HVAC equipment, only properly protected and qualified technicians should perform refrigerant repairs. Managers must make sure that waste oils and spent refrigerants are stored and disposed of properly.

Technicians also should repair insulation on piping in and around the chiller to prevent the formation of condensation. Many systems use glycol in the chilled water system to prevent freeze problems. Toxic glycol, such as ethylene, however, should never be used, because a leak within an air handler could cause a catastrophic IAQ problem and jeopardize the health of building residents.

**Boilers**  
Boilers also can contribute to IAQ problems if they do not provide proper heat or reheat. Increased ventilation rates require that many systems use reheat to ensure spaces will not overcool, while still delivering the proper amount of outdoor air. This situation may require the boiler system to operate year round.

Boilers also contribute to IAQ problems by permitting the products of combustion and carbon monoxide to inadvertently enter the building because of leaking boiler flues or stacks positioned too close to air intakes. Managers should schedule monthly inspections during the heating season to ensure proper flue drafting and that the flue system and fuel systems are not leaking.

Older boilers can contribute to IAQ problems, especially if they have inadequate ventilation for combustion. In general, a minimum of 1 square inch of free area per 2,000 Btu is acceptable. Check local codes. Often, combustion air openings are bearded up to reduce freeze problems which further contributes to ventilation problems.

Gas or oil leaks at the boiler are not only fire hazards, but they can cause odor and health problems elsewhere the building. Qualified and properly protected technicians should repair all such leaks immediately.

Properly maintained HVAC components can eliminate or reduce the likelihood of IAQ problems and permit quick repair of problems that do occur. Proactive facilities engineers who have documented preventive maintenance procedures and repair follow- up are protecting building’s occupants, as well as themselves, if IAQ problems arise.

**Too much of a Good Thing?**  
Humidifiers typically are installed for areas such as computer rooms, libraries and museums. In colder climates, they are used to increase space humidity levels to within acceptable ranges, usually 20-30 percent relative humidity. ASHRAE 55-1981 provides guidelines on acceptable temperature and humidity levels.

Problems linked to low relative humidity include dry irritated eyes, nose and throat, as well as high static electricity. Ironically, humidifiers installed to help control these problems can cause IAQ problems. Humidifiers generally deliver humidity to a space by adding steam vapor to the air stream. Although this is accomplished by different methods, each system has the same IAQ problem potential.

If a humidifier is oversized or not controlled properly, the humidifier can increase the humidity level in the duct stream to a level that supports biological growth. When humidity levels in an air distribution system are above 70 percent, bacteria growth can occur. This risk can increase dramatically when the air system is dirty or a duct liner is used in the air stream.

Usually, humidifiers have a control that shuts down the humidifier when the air stream in the duct becomes too moist. Technicians should test this monthly in the heating season to ensure it is calibrated properly.

Many humidifiers have a condensate drain system that can become a breeding ground for bacteria if not regularly monitored. System leaks also can provide warm moist areas that bacteria need to grow.

If the space humidistat is set at levels above 45 percent relative humidity, humidifiers can cause mold growth within the occupied space itself. In cold climates, a high humidifier set-point can cause condensation on glass.

Generally, occupants do not understand the importance of proper humidistat settings and tend to turn the humidity levels up too high. If this is a recurring problem, locking the humidistat cover may be a good idea.

Steam humidifiers should use clean steam that is provided by a boiler or generator that uses non-toxic EPA approved chemicals or no chemicals at all. A steam to steam heat exchanger humidifier is an excellent choice where only unclean steam is a available.

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