FOCUS on FACILITIES
Diocese of Cleveland Facilities Services Corporation

Mechanical System Water Treatment PM

(Open Systems, Closed Systems)

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This month in our *Focus on Facilities - Facility Management* column we are going to discuss water treatment for mechanical systems beginning with the two categories of water systems a building manager and facility maintenance person should know:

Closed Water System. A closed water system may be a hot water or chilled water where the water is circulated within a pipe distribution system and is not affected by atmospheric pressure. This type of application requires a large pump or small circulator, depending on the size and circulation network e.g., heating system serving one story building or a high rise multi-story facility, to move the water throughout the building.

Hot water heating systems will take heated water from a boiler or heat exchanger and distribute this hot water out to the terminal units that provide heat to the associated space e.g., entrance lobby, office, central warm air ventilation system, etc. Once the water passes through the perimeter baseboard radiation, unit heaters, etc. giving off its heat, this lesser hot water return will flow back to the boiler or heat exchanger to be reheated again. An example of this is hot water supply temperature to the building at 190F and the water returning to the boiler at 160F.

Chilled water systems function in similar manner with chilled water supplied through a refrigeration unit e.g., centrifugal chiller, reciprocating chiller, etc. delivered to perimeter cooling coils such as in fan coil units, chill beams, and/or air handling unit cooling coils. The chilled water return will be pumped back to the refrigeration unit to be cooled down again. An example of this is chilled water supply temperature to the air-conditioning equipment at 45F and the water returning to the refrigeration unit at 57F.

Open Water System. An open water system may be the condenser water system that removes the heat from a refrigeration unit. This warm water e.g., 95F is then pumped to an outdoor cooling tower where the tower will reduce the water temperature, e.g., to 85F via outdoor air passing over the tower's open water distribution baffles and water reservoir before being pumped back to the refrigeration unit. Another open water system is the water source one uses in their home or workplace for drinking, toilets, showers, etc. This pressurized water system is continuously pumped from a town or city's "potable" source with no water being returned to its origin e.g., well, pond. One's hot water heating system for domestic use, e.g., shower water is also an open pressurized system with town or city water pumped to the home or building and then into an electric or gas hot water heater for personal use or commercial use, e.g., restaurant kitchen.

Water Treatment

Closed water systems usually need little water treatment because these systems are not exposed to the atmosphere. Still, heating and cooling systems require some chemical treatment based on the water quality that filled the pipe distribution network, as well as to protect the inner wall of the pipe from corrosion due to the existence of air/oxygen inherent in the water, a.k.a., H2O. For this type of closed-loop application a "shot feeder" can be installed in the system in a manner that the maintenance person can open up the shot feeder, isolated from the rest of the water system, and chemicals can be poured into this device. Once closed, the feeder can be put back into operation where the hot water pump can push the chemicals out into the entire pipe distribution system.

Open water systems serving cooling application will most likely need some form of automatic water treatment system to maintain and/or improve the quality of the water. Cooling towers, serving refrigeration equipment, act like large air scrubbers as the water cascades over the tower's fill and air is forced across it to dissipate the water's heat. Any suspended particles in the air, as it contacts the cooling water, will become entrained in the water and begin circulating through the system. Water treatment devices/systems can reduce the risk of corrosion, scaling, and microbiological buildup within the tower and within the pipe distribution system. Because of the continuous need to treat the open water system, an automatic chemical treatment system will be the obvious choice in lieu of a manual fill chemical treatment system. Without chemical treatment, the results can be reduced cooling plant performance, unscheduled equipment downtime, and potential for costly equipment and/or pipe replacements due to corrosion.

As a rule, the water treatment of open systems will require contracting the services of a water treatment specialist proficient in the application of chemical treatment of these water systems. For closed water systems, the building's maintenance person may be able to maintain the chemical treatment requirements.

Another concern with water is the filtering of this water based on the application. Well water, serving potable water consumption, may require a water filter to capture the particles that can be found in the water entering the building. Depending on the type of filter furnished and installed, these devices can filter out undesired chemical compounds, organic and inorganic materials, and biological contaminates from the water. The purpose of water filters is to provide clean drinking water and clean heating and air-conditioning system water. Filtration is cost effective for closed water systems and potable hot water and cold water applications. Automatic water treatment for open water systems can be far more costly but still can be cost effective when considering what can happen to the cooling equipment, performance, and loss of equipment efficiency without the proper treatment of the water.

Scheduled PM Work Orders

We have discussed PM work orders in past columns, and we will reiterate the establishing of a scheduled PM work order process is essential to good facility management and to contributing to a safe and healthy building.

To start the development of a mechanical water treatment PM work order template the type of water system and the application it serves needs to be considered with the following:

- Open or closed water system
- Application including but not limited to:
  - Hot water heating
  - Chilled water cooling
  - Process heating or cooling
  - Potable domestic hot water
  - Potable domestic cold water
  - Condenser water serving refrigeration

Work Order Special Instructions:

1. This segment of the work order is intended to be a "heads-up" to the individual assigned to complete the work order beginning with highlighting materials to bring, such as the correct chemical(s) or filter. Cleaners "Safety Data Sheets" (SDSs) formerly MSDSs or Material Safety Data Sheets should be on file to assure protection for the user of these solutions.

2. Personal protection equipment (PPE), e.g., safety glasses should be used when pouring chemicals into

the shot feeder and automatic feeder.

3. Required equipment and tools should be specified on the PM work order, e.g., 8-foot ladder, trash bucket for discarded dirty water filer, etc.

4. Water system isolation instructions, piping flow diagrams, and associated photographs should be included with PM work order so as to make sure the water system shutoff valves, on both sides of the water treatment equipment and/or water filter, have been closed to prevent water leak when attending to the PM tasks note below.

5. A maintenance note pad to document additional comments from a visual inspection should also be included for the maintenance person to document unscheduled work requirements and incomplete PM work due to insufficient materials and/or additional parts to be requisitioned. This note pad should include a prepared checklist of standard things to look for, noted above when writing down maintenance comments made from visual inspection.

Tasking:

- For manual water treatment or water filter installations, weekly and/or monthly walk-thru inspections are recommended. Where possible, water system pressure gages located upstream and downstream of certain treatment equipment, e.g., in-line strainer/filter, are recommended to visually determine low chemical level solution or if filter replacement is needed.

- Equipment manufacturer's maintenance instructions should be copied into the standardize PM work order

- For automatic chemical water treatment, the service contractor should have his/her company's PM work order to complete and submit to the building owner for the facility's maintenance records. Refer to *Focus on Facilities-Asset Management* August 2019 Soliciting Service Contract Bids for additional information on PM work order requirements.

Summary

Mechanical water treatment and the filtering of open and closed water systems are essential to safe and reliable water systems within a building. The planned/ preventive maintenance work order process will also contribute to efficient reliable operation of the equipment within each water system.

Water within a pipe system can be "out of sight and out of mind" until a problem occurs, so a consistent PM work order will contribute to continuous performance and avoidance of unscheduled work due to inadequate mechanical water treatment.

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