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White Paper

Closed water systems: is your management approach protecting your building?

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Closed water systems are essential to the comfort and process heating and cooling of many buildings. They act as a heat transfer medium between central heating and cooling plant, for example boilers and chillers, and the areas where heating and cooling is needed. Because these systems are sealed and don't have the same stringent health requirements as open water systems they operate quietly in the background and can be easy to overlook. When heating or cooling continues to be delivered, it may be assumed that the system is healthy and everything is working as it should be. However, declining water quality, corrosion and microbiological fouling can develop before an obvious operational failure occurs.

Poor closed system management can contribute to:

- Reduced heating or cooling performance;
- Blocked strainers, valves and heat exchangers;
- Increased maintenance requirements;
- Corrosion of pipework and associated components;
- Premature failure of plant equipment;
- Occupant complaints and loss of service; and
- Significant and unexpected remedial costs.

Effective management is therefore not simply about obtaining periodic water sample results. It requires an understanding of the systems and suitable and sufficient water treatment and monitoring regimes. In turn, the monitoring regimes should have clear records with good recommendations and commentary for each system. Finally, good trend analysis of historic results will help to spot emerging issues, a clear reporting structure will also ensure that any issues are addressed and recorded.

A Closed Water System Management Review provides an independent assessment of these arrangements. It can help facilities and building managers understand whether their systems are managed effectively and where further attention may be required.

This white paper outlines:

1. Why do closed water systems need active management?

In theory, a closed system should contain a relatively stable volume of treated water. However, in reality systems are never completely stable and fluctuate with the changing seasons. Water may be lost through scheduled or unscheduled flushing, leaks, expansion or equipment replacement. Fresh make-up water is then introduced, potentially bringing additional oxygen, minerals and microorganisms into the system. Building alterations can also introduce new materials, contaminants from sections of pipework that have not been adequately cleaned before connection.

Water treatment is essential for reducing the risk of biofouling, corrosion and scale. Current guidance covers measures including the treatment of make-up water, dissolved oxygen removal, chemical water treatment, pH management, filtration, and the control of bacterial growth. The consequences of ineffective management may not be immediate; a system can and will continue operating while its internal condition gradually worsens. Often problems can be treated as isolated issues when they are symptoms of a bigger water quality concern within a system.

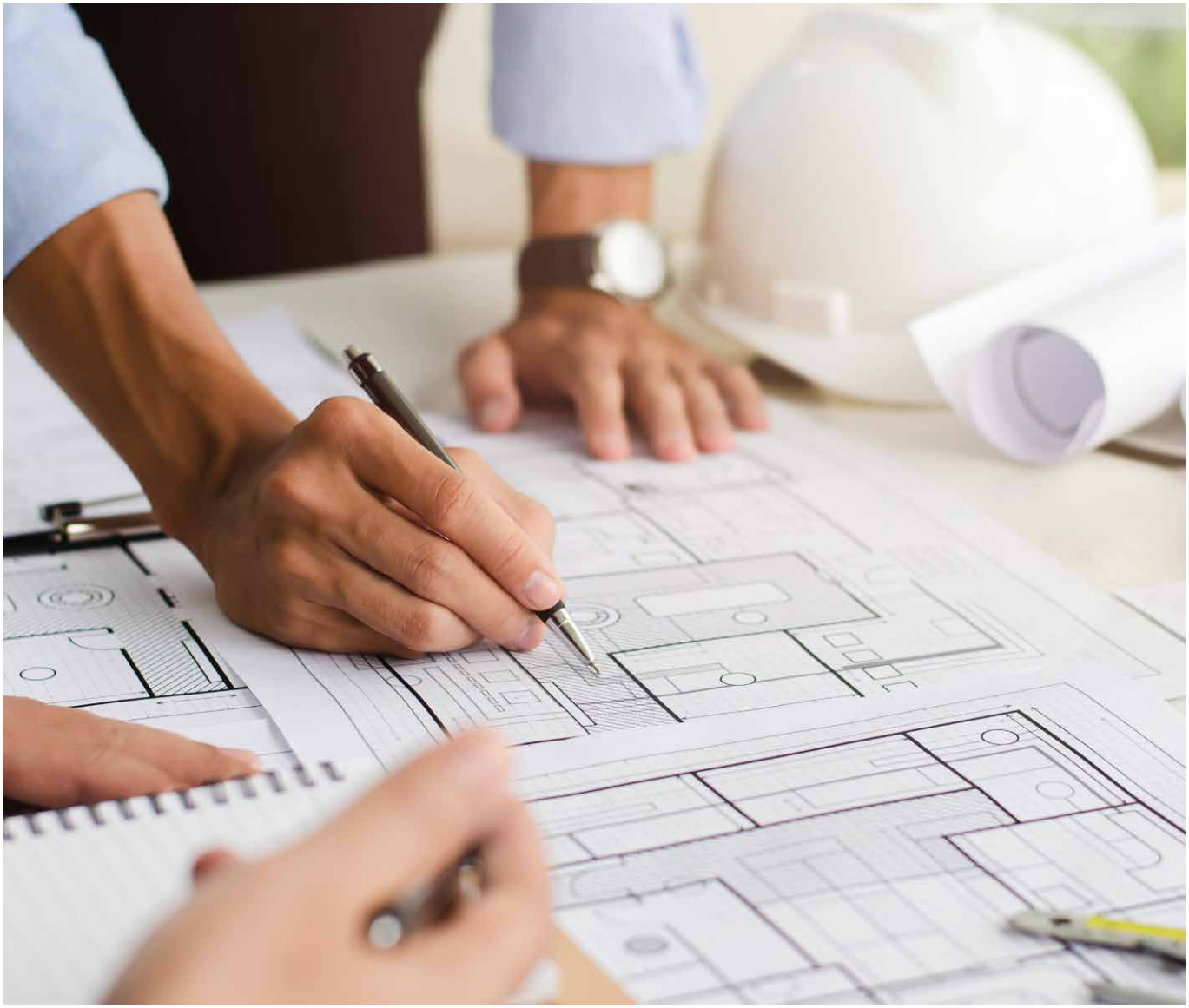
2. Understand the system you are managing

Good management always starts with reliable information; this is true for all industries.

Building management teams should know what closed systems are present at their sites, the areas they serve, their approximate volume, what metals they are made of, their operating conditions, and the water treatment regimens being employed. It is also important to know key assets and how they fit into each system, this should cover boilers and chillers and other large plant but should also include smaller plant equipment such as dirt and air separators, dosing pots, pressurisation units, and other associated equipment.

A common problem is that information for closed systems is divided between operation and maintenance manuals, drawings, water treatment reports and the knowledge of individual contractors. Some of the information, particularly if moving into an older building may no longer reflect the installed system. Often drawings and descriptions are not updated or can be lost altogether which can make understanding a system difficult. Without an accurate system description, it is difficult to determine whether sampling locations are representative or if the water treatment regime is following best practice defined in the guidance.

A management review will consider whether sufficient information is available to support informed decisions, not just if there is a file with historic water treatment records available.



3. Define ownership and responsibilities

Closed system management often involves multiple organisations. The building management team may have responsibility for the system, a mechanical and electrical (M&E) contractor may maintain the day-to-day maintenance of the system, and a specialist water treatment company may undertake sampling and chemical dosing, looking after the internal conditions of each system.

Each party may perform its own tasks correctly, but separately. Gaps can arise through familiarity and complacency. For example, a water treatment company that has been in place for many years could be trusted to attend site without much handholding, but in the process, they may miss essential communication about the system from the M&E provider. Additionally, the water treatment provider might be recommending remedial dosing but does not have the authority to sign off on the works. Or a project team in the building might connect new pipework to an existing system without providing suitable commissioning records to the building management team.

Loss of communication or a lack of understanding of responsibilities are common problems which can be fairly easily addressed by making sure that each party has a clear understanding of their responsibilities and by clearly defining correct escalation procedures.

A suitable management arrangement should establish:

- Who has overall responsibility for each system;
- Who reviews chemical and bacterial analysis results and recommendations;
- Who authorises corrective works;
- How system modifications are communicated;
- How water consumption and losses are recorded;
- What happens when results fall outside agreed parameters; and
- How completion of corrective actions is signed off and recorded.

Contracting out maintenance of the closed water systems does not remove the need for good oversight, building managers need visibility of findings and the chance to challenge findings and recommendations in an informed way, ultimately to confirm that required actions have been carried out.

4. Look beyond individual sample results

Water sampling is an important part of closed system management, but an individual result provides only a snapshot. Maintaining a record for trend analysis is essential to spot gradual changes that can indicate larger issues. It's also important that results are reviewed alongside previous sets of results to consider previous recommendations and any remedial work that has taken place since the last visit. The more information that is fed to the water treatment provider the better, they need to be aware of significant changes to the system, for example tenant connections, so they can adapt and adjust their advice accordingly.

A satisfactory set of results doesn't always demonstrate that the whole system is being effectively managed, equally, a poor result doesn't necessarily mean it isn't. It's important that results are reviewed and investigated in context of the system and the current goings on in the building before reacting. For example, a low inhibitor reading may be caused by tenant flushing works, but consistently low inhibitor readings following dosing could suggest a leak on the system. Understanding the context will help to prevent unnecessary remedial actions, repeated recommendations across multiple reports could indicate that the actions being taken are not fixing the underlying issue.

Records should allow the management team to follow the history of each system, there should be no ambiguity about what was recommended, the action that was taken, and the condition of the system both before and after it was carried out. This is where maintaining a good record of trends for each system can help, not only to spot issues early on, but also to demonstrate good control with data that can show it in a visual way for validation.

5. Control changes, water loss and system additions

Physical changes to a closed system are a classic area of vulnerability.

Maintenance or refurbishment work can require a system to be partially or fully drained and refilled, additionally, new pipework and terminal units can be connected to existing systems, adjusting what may be a stable system. Physical changes can alter system chemistry, introduce dissolved oxygen and debris, or dilute water treatment chemicals. If responsibilities are unclear, project works may be considered complete once the mechanical installation is operating, without thinking about the effect it will have on the water quality of the system it is connected to.

For every significant change, building and facilities managers should consider:

1. If the new components and materials are compatible with the existing system;
2. That new pipework has been appropriately cleaned before connection;
3. How much water has been removed and replaced;
4. If inhibitor levels need to be adjusted, or even if the inhibitor needs to be changed for new metals added;
5. If sampling regimes need to be amended; and
6. If drawings, system descriptions and maintenance instructions need updating.

Unexpected water consumption should also be investigated as the addition of fresh water can significantly alter system stability and water loss could indicate a leak in the new installation.

6. Action your findings

Water treatment reports can often be difficult to interpret alone, this is why it is so important that the water treatment contractor is communicating issues correctly and clearly. Busy building and facilities management teams need clear information to be able to make an informed decision and create a practical management plan.

Water treatment companies should display recommendations clearly, it should also be obvious who is responsible for carrying out any remedial actions, what the expected timeframe is, and each recommendation or action should be supported by evidence in the analysis report or from the wider trend analysis. Not every out of parameter result requires extensive cleaning or immediate replacement of equipment. Equally, a series of minor concerns should not be allowed to remain unresolved until a system failure occurs.

An independent review can help distinguish between routine improvements, issues requiring further investigation, and more significant concerns that may affect system reliability or asset life.

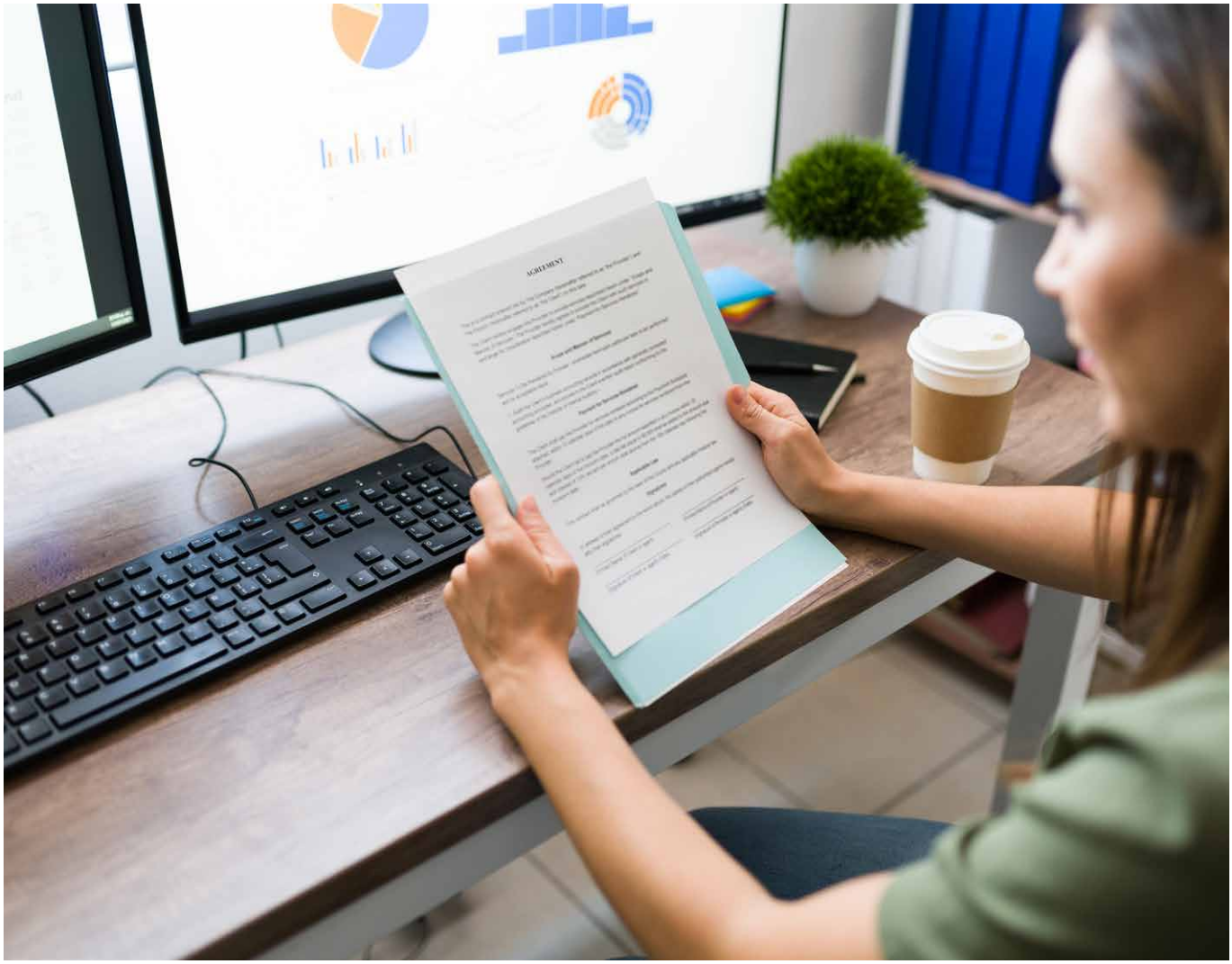
7. What does a closed water system management review provide?

A Closed Water System Management Review brings documentation review, system assessment and performance auditing together in one report. It is intended to provide a clear picture of how each system is currently operating, monitored and managed.

The review can consider:

- The quality of available system information and how correct it is;
- The existing management procedures and responsibilities;
- Water treatment regimens and historic monitoring records;
- Trends, recurring findings and outstanding recommendations;
- How the current management and regimen compare with the guidance;
- Physical observations made during a site inspection;
- The management of tenant connections or project works; and
- Opportunities to improve the current controls in place.

The output is a plain English report containing an executive summary, building and system descriptions, an overview of the information reviewed, findings from the site inspection and a prioritised action plan. This can be particularly valuable when taking responsibility for a new building, changing maintenance providers, reviewing long-standing arrangements, preparing an asset management strategy or investigating recurring heating and cooling problems.



8. Questions to ask

Closed water systems are important assets, even though they often operate in the background. Their condition can influence building performance, maintenance expenditure, occupant comfort and the life expectancy of expensive plant and pipework.

Building and facilities managers should ask:

- Do we have an accurate description of our closed systems?
- Are roles, responsibilities and communication pathways clearly defined?
- Do we conduct trend analysis on our chemical and bacterial analysis for the closed water systems?
- Are we monitoring system consumption and are water losses investigated?
- Are system alterations being communicated to our water treatment provider?
- Can we demonstrate that recommendations have been completed?
- Is our closed system aligned with current industry guidance?

If the answers are unclear, an independent closed water system management review can provide the evidence needed to identify strengths, close management gaps and highlight potential improvements.

How confident are you that your closed water systems are being actively managed, rather than simply maintained?