Case Study:
Cooling System Failure

Industry:
Senior Living

Employee Count:
700-800

Senior Housing Case Study - Cooling System Failure

The Customer

A national provider of senior housing and services faced an enormous cooling system failure issue at one of their properties. This national provider has over 300 communities in 25 states throughout the United States. A longtime customer of IWC Innovations referred us to this customer as the best firm to come in to solve the problem.

The Facility

The building, a historic, 14-floor, century old hotel, was converted to businesses on the first floor and apartments on the remaining floors.

The Problem

The single cooling tower of this 14-floor building failed and was replaced on three separate occasions within a two-year timespan. If each of those cooling towers had been properly treated, they should have *each* had a 15-year lifespan. Instead, money was "*thrown down the drain*" on equipment that should have lasted a total of 30 years. This investment was destroyed through a lack of understanding of proper cooling system chemistry, control, diligence, and upkeep plays in the overall life of the equipment. Subsequently, these failures started a chain reaction of breakdowns throughout the entire cooling system.

Analysis

The approximately 150-ton cooling tower located on the ground floor failed. Partial collapse and bundle clogging, in combination with age, and lack of proper treatment started the system malfunction. Sustained erosion from both calcium hardness and loss of passivation directly tied to full system failure.

The untimely and systemic loss of proper treatment led to intense pipe erosion throughout all systems. Non-copper pipes showed intense clogging and degradation due to chemical and biological attack against iron and galvanized surfaces. The situation was compounded by a general loss of glycol freeze protectant in the tower tube bundles.

During the summer of 2018, IWC Innovations performed a full water analysis. The results of this analysis are noted in the chart below.

Test	City	Make-Up	Cooling Tower	Cycles	Closed Loop
Conductivity (mhos)	815	815	0	0	842
pH	7.6	7.6	0	0	8.2
Copper	0	0	0	0	0.30
Iron	0.16	0.16	0	0	9.75
Total Hardness	70	78	0	0	70
Sodium Nitrite			0	0	0
Molybdate	0	0	0	0	0
Phosphonate	0	0	0	0	0

At the time of analysis, the building was being cooled by a temporary cooling tower and plate exchanger. The cooling system was given no chemical treatments of any kind. This directly led to the clogging of both sides of the plate exchanger.

Within the internal closed-loop portion of the system, no de-scalant or inhibitor was detected. Nitrate was tested down to 1ppm, and azole was tested down to 0.01ppm.

As indicated in the water analysis report, the iron levels in the loop were extremely high and quickly increasing. They were tested at 9.75 ppm and should have been below 1 ppm. Before IWC Innovations' intervention, two managers at the property performed extensive strainer and loop flushes. This only provided the loop with fresh air and water supply which only accelerated the pipe erosion. Excessive amounts of contaminants were caught with inline filters and bypass filtration. Black pipe cannot withstand this type of degradation for long, and systemic failure developed. In this, as in many other similar situations, the black pipe erosion was only half of the problem. The internal pipe erosion led to the piping area to be greatly reduced. This restricted flow in the loop and caused the pumps to work even harder to maintain flow, and pressure. This extra exertion caused excessive wear and load which led to premature pump failure.

In addition, all electrical control panels were in dissatisfactory condition due to the direct and indirect moisture exposure, over currenting. The phase controllers had issues that directly led to feedback burnouts.

Moreover, the loop lines outside of the mechanical room were mainly Schedule 40 PVC. They exhibited excessive heading and expansion and were damaged beyond repair. The loop lines that were made of L type copper were noted to be in fair shape with reasonable service life remaining, as long as only soft water and proper chemical treatments were utilized from that point forward. No equipment was salvageable with the exception of the copper piping. Only with proper care, would the copper piping survive.

The Solution

IWC Innovations developed a cohesive plan to address all of the existing problems found at this property. The customer received a green light from corporate to go ahead with the strategic plan developed by IWC's engineers.

IWC first added Variable Frequency Drives to all new internal pumps. This allowed the pumps to keep up with increasing demands and back off as the load diminished. In the long run this saved on overall operating costs and prolonged the life of the pump motors. A backup generation system was implemented and interfaced with the new pumps and controllers.

The Schedule 40 PVC throughout the closed loop and the cooling tower piping was replaced with Schedule 80 PVC piping. This led to cost savings and put a stop to mass iron contaminations. Valves and horizontal water distribution lines were added to each floor of the building. This addition allowed for isolation of repair locations and minimal loss of water, drain times, refill times and off times.

A type 316 stainless steel cooling tower was installed on the property. This cooling tower features forced draft and counterflow technology and water retaining louvers for superior operating advantages. This has allowed for a longer service life, and a decrease in chemical use. Tonnage was increased ever so slightly to offset the glycol efficiency losses.

All piping outside of the mechanical room was replaced in stages. This staged replacement helped control cost and outages of the system while it was being updated. An automated chemical feed controller was added to the cooling tower to prevent future equipment failures and greatly extend the life of the system. An automated controller was also added to the closed loop system to reapply the loss of chemical treatment. Finally, pressure gauges and thermometers were installed as well as bypass valves throughout the mechanical room. These components serve as the first line of defense when potential system errors occur.

Conclusion

This detailed plan was developed for this particular building structure and needs. Forecasts were presented to the customer throughout the entire process, so that there were no unforeseen expenditures. Predictions were presented on the lifespan on all machinery investments. The plan was implemented and executed as planned, saving the property thousands in water, electric, service calls and chemical expenditures. The need for external mechanical contractors to repair malfunctioning equipment each week is no longer needed and an extra savings. The property no longer deals with monetary losses in terms of insurance costs and claims that existed before the new system was implemented. IWC Innovations has continued to monitor this facility and is always available for assistance and consultation when needed. IWC Innovations engineers take pride in the relationships they have developed, the success of their meticulous plan, and continue to be an advocate for this customer in all of their water treatment endeavors.

IWC Innovations is here to help. Call us and speak with a water treatment specialist who will answer any questions you might have. 1-877-492-7526 Ext: 702

Or

Fill out THIS form online and someone will get back to you asap.