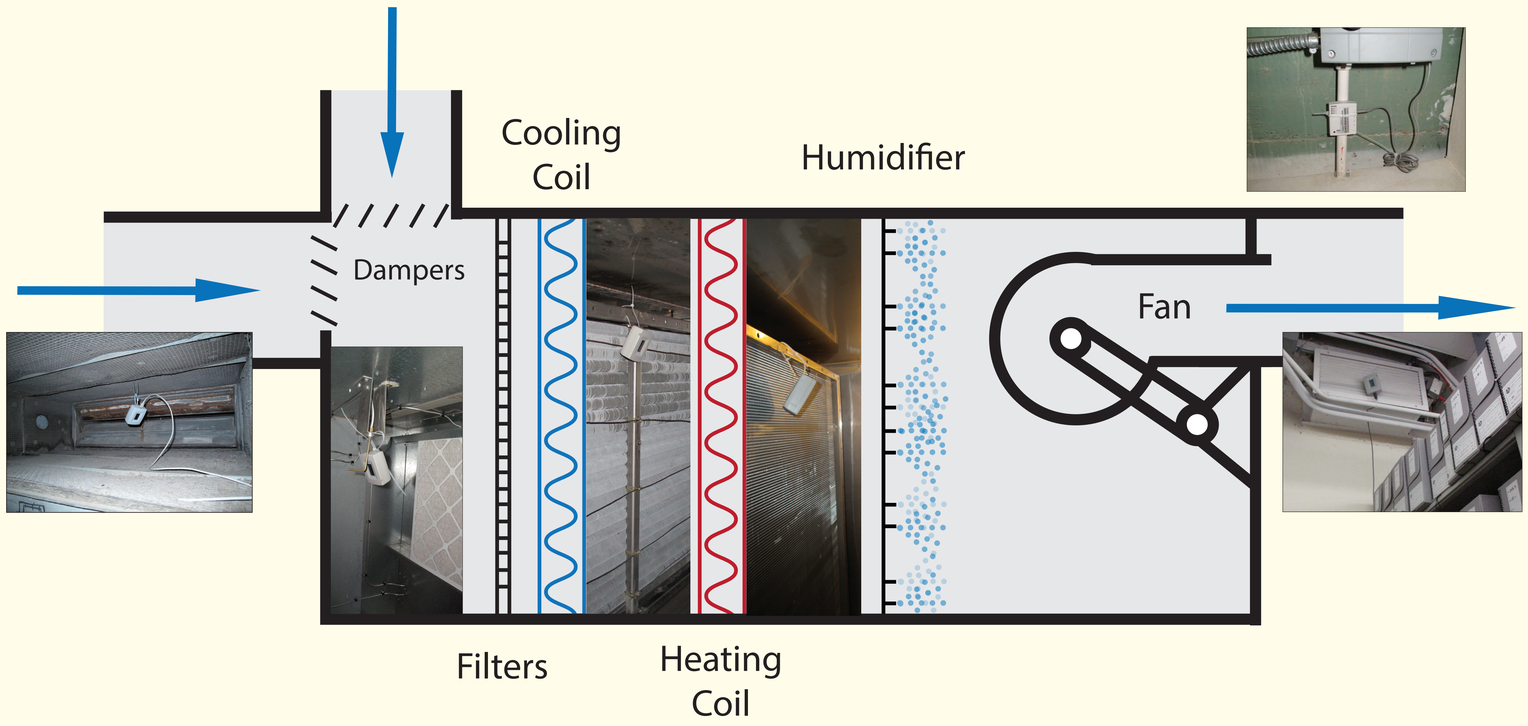
Sustainable Strategies for Mechanical System Operation in Collection Environments — *Christopher Cameron, Image Permanence Institute*

Abstract

Knowing how a facility's air handling system is operating is a crucial element of sustainable management of the collection storage environment. Even the most expensive systems, if not operating properly, can cause damage to collection materials. This type of damage can potentially go unnoticed and may result in significant loss or harm to the collection. A proper monitoring program can allow staff to follow the airflow and operation of their AHU. This will help identify any faults or inefficiencies within the system that can help to avert preservation issues such as accelerated chemical decay, mechanical damage from high or low moisture content, and the risk of mold outbreaks. This poster highlights proper AHU logging techniques and data analysis strategies to help the facility and collection care staff optimize system performance while providing a more stable environment and potentially saving on energy costs.

AHU Logger Placment



Data Analysis Strategies

Identify System Capabilities and Operation

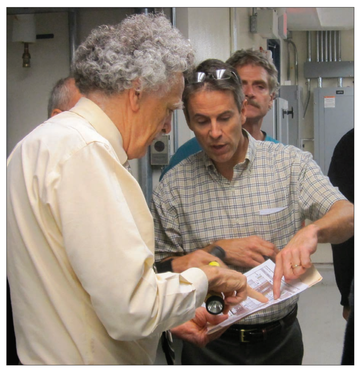
Data from properly placed data loggers can identify how much work the HVAC system is doing at each component, insight into what the system is capable of, and help determine if the system can produce better conditions for collection preservation. Data analysis can expose sub-optimal operation, indicate seasonal changes, or identify unnecessary energy consumption.

Identify Heat or Moisture Issues

Dampness and dryness are primary collection preservation concerns, leading to accelerated chemical decay, mechanical damage, corrosion, and the risk of mold growth. Analysis of mechanical system data can identify periods of humidification and dehumidification and expose inappropriate moisture conditions in a space that have an effect on collection preservation.

Review System Response to Extreme Weather Conditions

Extreme weather conditions are occurring more frequently. Understanding how your mechanical system responds to these events will help you evaluate disaster recovery, identify potential dangers to collections, and develop effective risk management plans. You may also find that the facility was safe and the environment stable during the event.



Weather-Related Case Studies

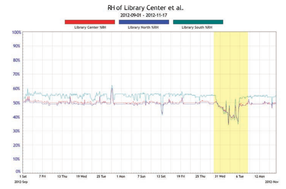
Hurricane Sandy, Mid-Atlantic Region

October 22-29, 2012 - $67.6 Billion in Damages

The storm brought extremely heavy winds and rains and a powerful coastal surge to northeastern New Jersey and Manhattan. Severe weather caused extensive flooding and widespread power outages, some of which were not resolved for up to seven weeks. Many cultural institutions dealt with building damage, and the lack of power to circulate air, condition collection spaces, or remove standing water. With the temporary loss of their BMS system data, some institutions relied on stand-alone loggers to capture data during the recovery.

Data showed a noticeable upward swing in temperature and RH for many locations. Often these swings lasted only a day or two before dropping back to normal or, due to the loss of HVAC function, below normal. RH levels as low as 30% lasted for only a few days before returning to pre-storm conditions. At worst, temperatures rose 5-6°F for a week after the storm in facilities without power. When power was restored spaces quickly returned to normal temperature. Overall the impact on collections due to high temperature or RH conditions was small. Often collection items stored in boxes or cabinets were buffered from T and RH swings.

Hoboken, New Jersey, USA - October 31, 2012: Man walking on the flooded street



Colorado Front Range Flood, Southwest Region

Sept. 9-16, 2013 - $1.5 Billion in Damages

The storm delivered over 15 inches of rain and caused extensive flooding in seventeen counties. The city of Boulder recorded up to 20 inches of rain over several days. Boulder Creek was flowing at 25 times its normal capacity and heavy rain damaged over 900 square miles, flooding streets, destroying bridges and overwhelming buildings.

Museums in the Boulder area worried about the effect of high water levels on buildings and collections. Review of available data showed that all monitored spaces did experience an upward shift in RH and a decline in temperature during the event. Most of the data showed an RH peak under 60%, with the worst case reaching around 65%. RH began climbing on Sept. 9, reached peak conditions over the next three days, and remained over 60% for four days before quickly returning to safe levels. The temperature drop seen in the data was indicative of the standard seasonal drop in temperature experienced during the shift from summer to winter operation.

At worst, the temperature drop was steady and only a few degrees below normal. This shift was unlikely to cause any damage to the collection. The RH climb was of greater concern, however the short exposure time that collections experienced was unlikely to spur a mold outbreak or cause any noticeable metal corrosion. In planning for future events, museums should consider raising the temperature of the supply air to help lower the RH during the period of concern.

Boulder, Colorado, USA- September 12, 2013: Flood waters with cars driving through a flooded intersection.

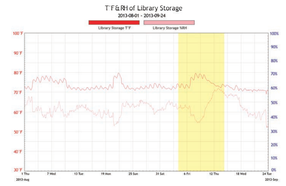


IMAGE PERMANENCE INSTITUTE R·I·T

The Image Permanence Institute, part of RIT's College of Imaging Arts and Sciences, is a non-profit preservation research lab devoted to the development and deployment of sustainable practices for the preservation of images and cultural property. Visit us online at: http://www.imagepermanenceinstitute.org.