

**2010 SACUBO BEST PRACTICES ENTRY:
WATER SYSTEM BEST MANAGEMENT PRACTICE GUIDELINE**

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Abstract

Florida State University is a comprehensive, national, graduate research university that puts research into action for the benefit of our students and society. As State appropriations have been considerably reduced in relation to the current economic conditions, additional pressures are placed on each cost center within the university to reduce expenses. With utility expenses being a major cost, additional focus has been given to explore where additional savings are available.

With a fundamental belief that true sustainability begins with conservation of natural resources, utility savings constitute not only financial benefits for the university, but also a reduction of its carbon footprint. Using good management practices for all utilities involves the analysis of data, communication with appropriate team members, and implementation. Florida State University strives to enable this type of behavior at all organizational levels. In many cases, savings generated require little or no capital, but have proven financial results.

As a result of this effort, the Florida State University Utilities Department generated over \$80,000 in proven, hard savings during the past 12 months. In addition, information collected is being used to develop a comprehensive water system management best practices guide to allow implementation campus wide. Future savings will be used to help the university meet its short and long term financial goals.

Introduction of the Organization

The Florida State University is a public, fully accredited, co-educational research institution located in Florida's capital city, Tallahassee. Established in 1851, it is located on the oldest continuous site of higher education in Florida. The total campus is 1,545.5 acres, including the downtown Tallahassee main campus of 452 acres.

With 15 colleges FSU offers more than 300 undergraduate, graduate, doctoral, professional and specialist degree programs, including medicine and law. The University faculty includes a Nobel Laureate, members of the National Academies of Science and Engineering, the American Academy of Arts and Sciences and Pulitzer Prize and Oscar winners. The average freshman carries a 4.0 high school grade point average and in the past four years, three students have been named Rhodes Scholars, placing Florida State in the top 10 universities in the nation for the number of students receiving this honor. The student population is diverse. They come from every county in Florida, all 50 states, and over 128 countries. Nearly 30% are minority, and 57% are women. Current enrollment is approximately 40,000.

FSU is home to the \$182 million dollar National High Magnetic Field Laboratory which features the world's most powerful magnets. It is also home to the Flying High Circus, the greatest collegiate show on Earth. The student run circus stages shows every spring under its own Big Top circus tent in the heart of campus. They also have performed in Europe, Canada, the Bahamas and the West Indies.

Statement of Problem / Initiative

The Florida State University Main Campus is located on 452 acres in downtown Tallahassee, Florida. The age of buildings on campus ranges from new to almost 100 years old. Due to changes in site needs, many buildings have different functions and utility requirements than originally designed. For example, a building that formerly housed a laundry may now only house offices or classrooms.

The City of Tallahassee provides Water & Sewer service to the Main Campus. Utility and service rates continue to rise as the City is facing rising costs and declining revenues. As with many universities, Florida State University is also experiencing a decreasing amount of funds available for operating the campus. The effect is that the University is faced with increasing cost precisely when funding is restricted.

Over the past 5 years, the Florida State University Utilities Department has made a tremendous effort to reduce water usage. Even so, water usage is only one factor regarding the total water utility expense to the university. Other factors such as the utility rate structure, meter sizing, and the link between water usage and sewer rates can contribute to cost.

The utility rate structure has changed significantly as the City of Tallahassee works to both increase revenue and reduce consumption. They employ a tiered rate structure that increases water cost per 1000 gallons by 17% for exceeding the monthly usage

allowance for general commercial potable water usage. In addition, the sewage cost is approximately 3.5 times the cost of water. For irrigation water (no sewer charge), the tiered rate structure has a 70% rate increase for usage above the monthly usage allowance.

Meter sizing impacts the minimum monthly charge from the utility. Each meter size has a monthly usage allowance based on the meter size. If the meter is undersized, the allowance will be exceeded, and the tiered utility rate for the cost of water applies. If a meter is oversized, the monthly minimum charge will be higher.

Selecting the appropriate meter classification for the type of water use is also important. For example, if irrigation application is tapped onto a line using a standard commercial meter, gallons used will be subject to a sewer charge. We use private wells to supply non-potable cooling water. If a condensing unit air compressor cooling heat exchanger is for any reason connected to the metered potable water supply, both water and sewer cost will be incurred.

To address these water management issues, the Florida State University Utilities Department embarked on revising its water system best management practice guideline. Given that the implementation does not require capital and offers significant potential savings, it was viewed as a win-win situation by university personnel.

It is believed that an effective water system best management practice guideline would have other intangible benefits such as increased awareness of water usage that can aid in additional water conservation, proactive involvement of maintenance to identify defective equipment, and a heightened knowledge of water use by university personnel.

Design

The primary focus of the water system best management practice guidelines were discussed within the Florida State University Utilities Department and included:

1. Enhanced effort to fully identify the “trigger” points for higher rate costs within the revised City of Tallahassee water and sewer rate structure.
2. Review of current building usage compared with the meter size in place.
3. Review of current utility bills to identify where costs appeared to be out of line with other similar buildings
4. Empowerment of Utilities employees to investigate and make recommendations.
5. Analysis of system design in order to identify potential causes of significant periodic water usage.

While there was an ongoing level of activity in all of these areas, it had never been pulled together into a comprehensive set of guidelines. As people move in and out of positions, knowledge is often not transferred. A water system best management practice policy allows information to be disseminated to both new and existing staff in an organized manner.

The first step in the process was to designate a champion for the water system. James Coleman, a Utilities Department maintenance technician, was selected as a champion of the water system because of his dedication to cost savings and his knowledge of Florida State University. The decision to use an internal resource was critical due to the fact that many of the saving opportunities required knowledge of current equipment within the facility.

The primary goal of the program was to validate practices that could be integrated into water system best management practice guidelines. The guidelines will minimize total campus water usage, promote water conservation for a more sustainable campus, and develop tools to insure ongoing adherence.

From the onset, the Florida State University Utilities Department would be responsible for the leadership of the program. With assistance from the Accounting Department, Utilities Department team members would provide Mr. Coleman with valuable data regarding current usage, current rate structure, and usage trends over time.

Mr. Coleman's directions were to compare the data with the physical arrangements in the field. Three buildings were selected based on usage and usage type to represent a typical "sample" of campus buildings. The field results would be used to validate key points considered for incorporation into a water system best management practices guideline.

Implementation

The primary focus for water analysis was determined by the Utilities team to be water used for system cooling that should be using non-potable water from the wells, but was connected to the City of Tallahassee potable water supply. These uses not only incur the normal water charges, but also a sewer usage charge.

The secondary focus would be to identify process issues that were the source of unplanned uses of potable City water. Since many of the systems use City water as a backup supply for the onsite plant non-potable water wells, certain unplanned conditions could cause systems to switch water sources.

In both cases, the utility bills were reviewed and used to quantify the results of the process. With the budget constraints in place, no additional dollars were available to increase staff. All aspects of the program would be completed using existing internal resources.

The three buildings selected for the test group were the Collins Nuclear, King Life Sciences, and Biology Building #1. All of these buildings contain classrooms or research facilities. Since the buildings represent a typical cross section of property types on campus, the savings should be applicable to many locations. All savings calculations were to include only verifiable "hard" savings as opposed to any intangible savings available.

Benefits

Analysis of the three buildings within the test set revealed several savings opportunities that could easily be incorporated into a water system best management practice guideline. For ease of understanding, we will list the savings by building.

Collins Nuclear Building

Description: The Collins Nuclear Building is a 62,933 square foot classroom and research building. It houses numerous mechanical systems including steam, compressed air, chilled water, and potable water.

Saving Opportunities Identified

After a review of the site, it was found that the helium compressors were using potable water for cooling rather than non-potable well water. Average monthly usages for the building (20 months) prior to the correction were as follows:

Water Usage: 1,544 MGL per month

Water Cost: \$2,134 per month

Associated Sewer Cost: \$2,554 per month

Solution: It is appropriate to use potable water for cooling in the event of a process water supply failure. The existing system was cumbersome to troubleshoot and had several cross connections where potable water could easily be substituted for process water. In order to simplify the system and eliminate the opportunity for a system being manually switched to potable water, a new piping and controls arrangement was installed. The new system monitors the pressure of the process water. If the process water pumps are unable to maintain adequate pressure, they are turned off and an automatic valve for the potable water line opens.

Rather than multiple connections, there is only one primary connection between potable and process water. When the fault is corrected, the system can resume normal operation.

After correction to the process the monthly usages for the past 4 months were as follows:

Water Usage: 11 MGL per month

Water Cost: \$69 per month

Associated Sewer Cost: \$58 per month

Total annualized savings for water and sewer were \$54,732.

Conclusion: Processes should be served by non-potable process water when possible to avoid both the water and the sewer cost.

King Life Sciences Building

Description: The King Life Sciences building is a 179,969 square foot classroom and research building. It has mechanical equipment such as humidifiers, cooling and heating coils, and potable water.

Saving Opportunities Identified

During the past 15 months, water and sewer usage were consistent. After a review of the data, significant elevation in usage was indicated for Feb-April of 2009. Subsequent investigation revealed that the original system design incorporated a pressure switch that changed the water source from non-potable well water to potable City water when water pressure was too low. The system is not designed to return to the non-potable water source when the low pressure condition is resolved.

Solution: The problem was caused by an equipment failure in one of the water booster stations and was corrected. The booster system was repaired and the system was restored to the normal condition. Plans are to install a pressure sensor to tie into the site Siemens Apogee system to alert the Utilities Department of any future failures.

Excess Water Usage due to Excursion: 347 MGL

Excess Water Cost due to Excursion: \$1,645

Excess Sewer Cost due to Excursion: \$5,390

Total savings: \$7,035

Water usage has now returned to normal ranges.

Conclusion: Mechanical systems for buildings should be reviewed for "trigger" points that can create usage greatly in excess of normal levels. When possible, information should be gathered by the data collection system so that problems can be addressed in near real time. In many cases, process excursions cause and increase in usage and increase the usage threshold above monthly allowances at the lower usage rate.

Biology Building Unit 1

Description: The Biology Building, Unit 1 is an 80,609 square foot classroom and research building. It houses numerous mechanical systems including steam, compressed air, chilled water, and potable water.

Saving Opportunities Identified

Solution: After investigation, it was found that some ½" and ¾" solenoids serving as a quench to cool the autoclave discharge drains were failed in the open position. With

a City water pressure of over 100 psi, the valves allowed a large amount of water to pass through the machine. The normal process is for the valves to open long enough to cool the drain and hot discharge from the autoclave.

Water Usage July 2007-Jun 2008: 9,859 MGL

Water Cost July 2007-Jun 2008: \$13,758

Sewer Cost July 2007-Jun 2008: \$40,246

Total Cost for Period: \$54,004

Water Usage July 2008-Jun 2009: 5,588 MGL

Water Cost July 2008-Jun 2009: \$7,684

Sewer Cost July 2008-Jun 2009: \$27,263

Total Cost for Period: \$34,967

Total savings: \$19,037

Conclusion: Solenoid valves are on many pieces of equipment to control the flow of air or water. In general, they are reliable, but have no feedback to a Building Automation System. Additional inspections of solenoid valves are often overlooked.

Closer inspection of these types of equipment, which are often part of a machine, can yield savings.

Other Notable Findings

As many municipalities are trying to find new ways to increase revenues, miscellaneous charges are being added to utility bills. One charge that impacts Florida State University is a \$175 fire protection charge per fire hydrant for maintenance. Previously this cost was included as a part of the total utility bill. Customers can choose to pay the fee or test and maintain their own fire hydrants. Florida State University has 117 fire hydrants on campus. Internal testing and maintenance cost of these hydrants is approximately \$100 per hydrant. **Total annual savings are expected to be \$8,775.**

Retrospect

Water and sewer charges are a significant cost, but frequently given less review time than larger utility cost centers such as electricity and natural gas. Often, the primary resource is a dedicated, high skilled maintenance employee. While very effective in solving the problems, documentation of what exactly was done to correct a problem can be difficult to find.

In addition, process piping and potable water piping are often linked for system reliability. Many times, these connections are added at a later date and for a specific

problem. By taking more time in the design phase to consider the reliability of the system requiring process water and the need for automatic control, systems can be both reliable and easy to diagnose when there is a problem.

Internal resources are always limited, particularly in times of financial crisis. On the surface, it may appear easier, though often extremely expensive, to use an outside resource to assist in the development of energy savings plans. Our experience with this project has found that on site employees generally possess superior knowledge of the equipment in use, existing problems, and potential solutions. The challenge is in the creation of appropriate guidelines, verification of savings, and documentation of techniques used to improve the process. Integration of these concepts into a comprehensive water system best practices guideline is considered to be extremely valuable.

Finally, sustainability is directly related to how wisely we use available resources. The most effective way to directly minimize the carbon footprint of an organization is to focus on conservation of all utilities. When sustainability is viewed in these terms, it is easily explainable and can be quantified in a direct way that can be understood by all. At Florida State University, we are striving to be a leader in sustainability efforts through an aggressive program to conserve all of our utilities. Part of that responsibility is to look at both the large utility costs such as electricity and the smaller utility costs

such as water usage. What we are finding is that when the entire organization adopts a conservation mindset, more people participate in the process.