Rec Center Pool Solutions

Benefits for People, Planet, and Profit

Campus Sustainability Planning Studio

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Fall 2012

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1.1 PROBLEM

The Wade King Recreation Center (WKRC) currently uses a standard pellet chlorine system to sanitize the lap pool and spa. The following issues arise with the use of chlorine in pool sanitation:

- Uncomfortable chemical conditions are expressed by users of the pool.
- Chloramines are produced when free-chlorine (residual chlorine in pool water) reacts with human-introduced chemicals (human waste products) such as sweat, skin, urine, etc.
- Chloramines produce hazardous air and water quality, and are the culprit for swimmer irritation and the traditional, fading of swim wear.
- Current exposure of chlorine is harsh on skin and lungs, especially when handled in concentration by the operations crew.
- Pellet chlorine is used to sanitize pool water.
- Super-chlorinating is a process of highly chlorinating the pool after hours to destroy chloramines and bacteria. This process is harsh on people exposed to the area and on the environment.
- Chlorine produces environmentally hazardous effects.

1.2 SOLUTION

After research and analysis of multiple pool sanitizing technologies; standard chlorine, saltwater, and a secondary system that involves UV sanitation, we propose that Medium-Pressure UV is the best fit technology for the Wade King Recreation Center's Swimming pool. As presented in the diagram in the evaluation section, our analysis uses a lens of sustainability to compare the economic, environmental, and human health of each technology. UV technology rated the highest in our analysis because it is added to our current system rather a saltwater system that requires a conversion, greater sanitizing potential, less regular and special maintenance than standard chlorine, lower ongoing chemical costs than standard chlorine, greater equipment life than saltwater, less damage to infrastructure than saltwater and standard chlorine, and greater user comfort than saltwater and standard chlorine. UV technology rated highest overall to saltwater and standard chlorine systems and overcame many of the challenges with each of these systems.

UV systems cause less irritation to the eyes, skin, and lungs because the chloramines that form in the pool from bather-introduced chemicals and chlorine are destroyed from exposure to UV. UV technology also plays a role in sanitation, which reduces the work of chlorine, thus reducing the amount of chlorine used. Super-chlorination is not commonly needed because the UV engages in this effort constantly. When the pool needs to be drained, which is a rare occasion, the waste water is more environmentally friendly since chloramines have been destroyed.

1.3 FUNDING REQUIREMENTS

Funding has yet to be determined. Three possible funding options are available for the project; the Wade King Recreation Center, the Student Green Energy Fee Program and additional grants or incentives. The Student Green Energy Fee application process begins in the spring. This project will be in the running to receive an allotment of the $300,000 available. Depending on the amount allotted to fund this project, the WKRC may be interested in investing in this project as long as the amount is within their preferred 5-8 year payback period. After the payback period, the WKRC would experience a reduction in chlorine and maintenance costs on a yearly basis; these savings could be used to cover electricity fees if necessary. Applying for additional funds and incentives can potentially supplement the WKRC and or the Green Energy Fee.

1.4 CASE STUDIES, INTERVIEWS, AND SCHOLAR JOUNALS

The multiple case studies for saltwater were valuable in our effort to get a stakeholder perspective as well as examples of projects very similar to our own. The few case studies we found for UV technology provided a strong case in support of using UV to sanitize swimming pools and spas. One insider interview for saltwater presented counter support for saltwater and even made the claim of planning to switch back to standard chlorine during the next remodel. Many Scholar journals were used in the research of UV technology, the science behind pool chemistry, and chlorine effects. See appendix for further inquiry.

2.0 STATEMENT OF NEED

The Wade King Recreation Center pool currently does not meet the needs of its users. According to data from The CSPS Solar Thermal Project, The WKRC pool has been used at least once by 91 percent of all students and averages around 2,200 people per day during the school year. With complaints of skin and eye irritation, damage to swimmer wear, along with high usage of harsh chemicals, improvements can be made. With a new technology the pool has the potential to be more comfortable for the users, less work for the maintenance crew, and lessen an economic burden on the WKRC. Our well-rounded approach to address each problem was researching multiple technologies and proposing the optimal system for our pool system.

2.1 PURPOSE OF PROJECT

We are proposing to improve the sustainability of the Wade King Recreation Center's swimming pool, and specifically, improve the sanitation of the water. The lens of sustainability is as follows:

People - Human Health: The proposed pool cleaning technologies would be softer for user's and operations crew's physical wellness. Health of users will improve by greater sanitation potential and effectively removing harmful irritants.

Planet - Ecological Sustainability: Reduce the abundance of harmful chemicals used and those dispersed into the environment.

Profit - Economic Sustainability: After conversion investment, cost for regular maintenance would be decreased and less chemical chlorine would be used. Product equipment has long lifetime, with minimal equipment replacement needs. UV will improve the impact on the pool and building infrastructure.

3.0 PROJECT DESCRIPTION

With approval from stakeholders and required funding, this project would install a Medium-Pressure UV system to the WKRC Pool. The contracted maintenance team, Aquatic Specialties, will lead the installation of this system. Aquatic Specialties will continue to maintain the WKRC Pool. Through educating users of the pool about chloramines creation and exposure, with catchy signs in the locker rooms, this project will encourage users to rinse off before entering the pool and to not pee in the pool.

3.1 METHODS

From our analysis, human health, economic sustainability and ecological sustainability will be improved from the installation of the UV technology.

The pool has an estimated 500-gallon per minute flow rate, and the spa has an estimated 300-gallon per minute flow rate. The flow rate is how much water is being cycled through for filtering and sanitation. These flow rates and the use of the pool would require Medium-pressure UV technology, which has a wider Ultra-Violet range and greater sanitizing abilities. The pool and spa are on separate filtration systems and would require separate UV equipment. The UV equipment would be attached to the current water cycle system. The water from the pool and spa is filtered and then would flow through a chamber, exposing the water to Ultra-Violet light. When exposed to this light, the chloramines, free-chlorine, and other bacteria in the water are broken up and destroyed. The water is then further sanitized with chlorine, but at slightly less amount than standard because the UV exposure assists in the sanitation process. The water entering back into the pool has been fully sanitized and the air and water irritants removed.

For implementation of this project, the WKRC will need to give approval. Following the approval, an application for the Student Green Energy Fee will be submitted. The procedure after application for the Student Green Energy Fee will require further research of products, installation and maintenance details. Once funding is available, a pool specialties company will be contracted to supply and install the new system.

3.2 STAFFING/ADMINISTRATION

The WKRC faculty and staff, Aquatic Specialties staff, the Green Energy Fee, and other Western staff members are key resources for this project.

Pete Lockhart, Assistant Director of the Wade King Recreation Center, described the pool water and sanitizing system, walked us through the maintenance room and has given details on the current system dynamics and chemical usage.

Dan Richards, President of Aquatic Specialties, a Seattle based company that maintains the WKRC pool, has given details regarding alternative sanitizing methods, their pros and cons, and his preference in the field.

Regan Clover, GEF Grant Program Coordinator, explained the Green Energy Fee application and implementation process

Stephen Morrow, campus plumber, is along for the ride! He is learning as we are and acts as a sounding board.

3.3 EVALUATION

This project is for the students, swim and water polo teams, faculty, staff, children of the Child Development Center of Western, as well as the general public. According to the previous CSPC Solar Thermal project, the WKRC pool has been used at least once by 91 percent of all students and averages around 2,200 people per day during the school year. This high visibility can provide an excellent educational tool for promoting sustainability through improved water and air quality, especially since the WKRC is a starting point for campus tours. Through the use of new and existing signage and informational boards, we can both inform and educate students, faculty and community members. Multiple majors including economics, environmental studies and science, chemistry and biology can use this project as a learning site, research piece, and even incorporate it into their curriculum. Western's Swim and Water Polo Teams can provide subjective feedback for the new water and air conditions of the pool.

Sanitation Technology Analysis Chart is on the top of the next page:

Sanitation Technology Analysis Chart (Larger scale in Appendix 3.0A)

	Initial Investment	Ongoing Cost	Lifetime	Maintenance	Sanitizing effectiveness	Chemical Use	Air Water Quality	User Comfort	
Saltwater Sanitation	-~$40,000 initial cost -replace current sanitizing system **3**	-$ for salt -$ for replacing infrastructure -replacing plates **2**	-replace plates every few of yrs -warranties voided when on salt systems -damages develop from poor maintenance **2**	-issues if not well maintained -demanding maintenance **3**	**5**	-Chlorine is produced from salt -chloramines develop from poor maintenance **3**	-slight buoyancy affecting swim training **4**	-salty flavor **4**	**28**
Medium Pressure UV Sanitation	-~$40,000 initial cost **4**	-$ for chemicals -replacing bulbs **3**	-bulb lifetime = ~4,000 hours, ~every two yrs **4**	-handling of harmful chemicals **4**	**5**	-chlorine still needed -mercury is used in the making of the UV bulbs **3**	-minor chloramines develop with high levels of free chlorine **4**	**5**	**32**
Chlorine	**5**	-cost of chemicals -$ for equipment replacements -$ for replacing infrastructure **2**	**5**	-handling of harmful chemicals **4**	-inability to remove chloramines and/or free chlorine w/o super chlorination **4**	-abundance of harmful chemicals -chlorine is toxic to environment -super chlorination is used for deep sanitizing -free chlorine mixed with human excrements creates chloramines **1**	-chloramines in the air cause respiratory issues -harsh on in pool and out of pool equipment -skin and eye irritation **2**	-Irritation due to chloramines -Prolonged exposure damaging to skin, lungs, eyes, hair, etc. **3**	**27**
	Profit: The economic value created after deducting the cost of all inputs, including the cost of the capital tied up.				**Planet:** The factors and practices that contribute to the quality of the environment on a long-term basis.		**People:** Conditions that impact the health of people in all aspects.		**Totals**

Rating: Each segment begins with the rating of 5 and loses value for detrimental issues. Higher rating = higher overall benefit.

3.4 SUSTAINABILITY

The WWU Sustainability Committee definition of sustainability at WWU is used as a model to express how this project improves the sustainability of the Wade King Recreation Center pool.

People - Protects the health of its users: Removal of the common irritants of chlorine pools (eg. chloramines). Improved water sanitation and improved air and water quality of the pool room.

Planet - Protects local and global ecology: Using technology to further reduce the chemical use and its impact on the environment. Medium-Pressure UV technology eliminates the need to super-chlorinate the pool and reduces the chemical irritants existing in waste water.

Profit - Creates economic vitality: Reduced chemical costs. Improve the lifetime of the pool equipment by removing corrosive chemicals. Reduce maintenance requirements.

Social: Upholds social development: With the approval and further research of our project we will add an educational piece, by means of posters in the locker rooms, to inform users the importance of washing pre-entry to the pool and not peeing in the pool.

4.0 BUDGET

Preliminary contact with the UV sanitation company Honovia, has given us an estimate for the initial investment to be somewhere around $40,000 - $50,000. An estimate from Dan Richards from Aquatic Specialties for Hanovia products confirms this investment. This estimate is without the bidding between companies that would result from further research with the Green Energy Fee and approval from The Wade King Recreation Center.

5.0 FUTURE WORKS

We propose an educational aspect for this project, with signage, teaching about the pool, giving WWU yet another defining feature for being an environmentally aware university.

One improvement, on the pool does not make it complete. Ideally, the WKRC pool, would not involve harsh chemicals at all. This could be achieved by future improvements made to the chlorine system and Medium-Pressure UV technology, by converting the pool into a saltwater system with Medium-Pressure UV technology as additional support, or by something not yet on the market. For now this project is proposing the best technology on the market.

6.0 CONCLUSION

Investing in Medium-Pressure UV technology will improve water and air quality, will save the WKRC money spent on chemicals, maintenance and will extend equipment life. The implementation of this technology will expand the sustainable image of Western and the LEED certified recreation building. This project will serve as an education piece for users of the pool and could serve students in various scientific studies on campus. This project will reduce chloramines irritants in the pool and spa, making a softer and cleaner environment for all users.

APPENDIX:

1.0A CASE STUDIES

Southern Illinois University Edwardsville

1. Who was the institution of implementation? Who orchestrated the project?
   Southern Illinois University Edwardsville. Facilities Management.
2. What was the title and start date of the project?
   Name N/A, Approx 2009
3. What was the project purpose or mission?
   Reduce chemical usage, improve user comfort.
4. What was the size, cost, and timeline of the project?
   Total cost was about $8,000 and was accomplished in about a week.
5. Who were the stakeholders?
   Facilities Management was the main stakeholder. Users of the pool were secondary.
6. What was the perception/reception of the stakeholders?
   Most users of the pool were not aware of the change. A significant minority commented the water was less harsh. The operations crew appreciated not having to deal with the toxic chemicals.
7. What were the biggest challenges?
   Balancing the water chemistry.
8. What are the results?
   Payback on reduced chemical usage about 3 years. Payback on reduced building corrosion impossible to measure.
9. Were there any related future projects?
   No.
10. Were there unintended consequences?
    We found the pool controller was not able to maintain the pool chemistry at the lowest safe level. We chose to replace it at an additional cost of about $2500.

Follow up questions:

1. What are specs on the pool at SIUE, i.e. size of pool, previous filtration system, etc. (for comparison with our own current setup)?
   a. It is a fairly standard 25 yard pool, six lanes, with a 12'deep end. I think it is sand filtration but I'll need to verify that. The filtration system is not affected by a salt water conversion.

b A few things helped pave the way for our project. Our local YMCA had recently converted both of their pools with good success, and both the Assistant Director Utilities who oversees the pool and I are swimmers. The main driver was eliminating the potential exposure of our operators to the chemicals, improving swimmer comfort, and reducing the corrosive effects of the chlorine on the building structure itself.

2 Was there a hot tub converted as well? If so, how did this fit into project?
We do not have a hot tub. I am not aware of the use of saltwater for hot tubs.

"You can't find the pool by following the chlorine smell anymore."
Robert Washburn
RETIRED - Director Facilities Management
Southern Illinois University Edwardsville

Seattle Pacific University

1 How large is the pool at Alaska Pacific?
90,000 gallon pool
2 Why has Alaska Pacific chosen to have a saltwater pool?
Safety, overhead cost and ease of care.
3 Was it originally a chlorine pool?
Yes
4 If not, what was the initial cost of transitioning the pool to a salt water pool?
Cost of transitioning the pool from liquid chlorine to saline was approximately $35,000
5 What was the timeline of this transition?
It took about three weeks but they were also redoing their liner and deck
6 Who were the stakeholders involved?
APU and General Public
7 How was the idea of a salt water pool received?
Research after a liquid chlorine accident
8 What were the biggest challenges of the transition?
Plumbing but they were "pretty minor"
9 Are there any challenges today associated with a saltwater pool?
No
10 What are the benefits of this type of pool?
"Our patrons love it, and our CPO and maintenance staff have a lot less work to do in keeping the pool operating"
11 If you could do this transition again, what would you do differently?

Yes

12 Any other information?

They just upgraded to a new and improved system from TMI Salt Pure, which they highly enjoy

Marc Phillips
Facilities Director
Alaska Pacific University
marcp@alaskapacific.edu

Texas A&M University

1 What UV installed when the pool was installed or a conversion project? Were they all done at the same time? Who orchestrated the use of UV? When was this done?

*Conversion project *Yes, all at same time *REC Sports Department made the decision to install the UV System. *I have been here 3 ½ years and these systems where installed before I got here but roughly 5 years ago?

2 What was the project purpose or mission?

*Better water quality which leads to better air quality. Now UV will not make this happen overnight by just installing this system. Other protocols MUST be in place for the UV to operate in the most efficient manner. Meaning, keeping proper chemical levels in the pools, constant testing during the day to monitor, have trained/qualified personnel to test, analyze and control the chemicals plus the balance of the water, backwashing, etc…… If these protocols are in place, then the UV system will work like it is supposed to.

3 What was the estimated cost of equipment and installation? How did this compare to previous costs? Have there been economic benefits of using UV?

*This information I don't know since it was all done before I took over this position. *N/A *Slight decrease in chlorine but if the waters are kept in constant balance and minimize over/under feeding, then the UV will help keep chlorine use down a little bit.

4 What was the perception/reception of the stakeholders? Is the water and air conditions noticeably different as in effect on irritation?

*They all know we needed to put these systems in place. *yes, but again UV will only do so much to kill bad stuff in the water. You need good water chemistry AND another important component is having an air system (POOL Paks, Desert Air, etc….) that is operating properly to get the chloramines that are still at the surface of the water and in the air out of the swimming area.

5 What were the biggest challenges? Were there unintended consequences? Do you know of a restart scenario or projects in the works?

*getting a service agreement in place that works for our needs here at TAMU. Had a middleman (company) that we had a service contract with when I got here to TAMU. This company and Siemen's (UV maker) were in arguments about parts, questioning the service company about their service on the UV machines, etc…. So I eliminated the middleman (mutual agreement by all parties) and set up a service agreement with Siemen's directly. MUCH BETTER! *I would ask some of the vendors themselves for recommendations for projects that were restart/renovation installation of the UV system.

Christopher J. Budvitis
Director of Aquatics
Department of Recreational Sports
Texas A&M University
cbudvitis@rec.tamu.edu

Elon University

The below information is from Elon's Plumbing Department Supervisor, Jimmy Curiazza:

http://prezi.com/gh3brkmdx10-/ beck-pool-chlorine-generator/

"To date the conversion exceeded my expectation and the bathers prefer the salt over harsh chlorine hands down."

Elaine R. Durr, LEED AP BD+C
Director of Sustainability
Elon University
www.elon.edu/sustainability

2.0A INSIDER INTERVIEWS

Interviewer: Daniel Soloff
Interviewee: Scott Muir
Position: Aquatics Director
Institution: Furman University
Contact: scott.murr@furman.edu
Date: Oct 9th 2012

Main Points taken from interview:

- Original chlorine pool built in '72, 100,000 gallon heated lap pool, stick chlorine system. Their drawback was handling chemicals and piping from stock to pool, cheap and easy.
- 2002 switched to liquid chlorine, quicker and easier, cost same, risk of handling, swimmers didn't notice change.
- 2006 building renovation, but not pool plumbing. Switched to saltwater system, softer on bathing suits and user skin, safer to handle, salt is cheaper than chlorine.
- Equipment to change salt into chlorine is expensive. Have not broken even due to replacement of 'wrong' chlorine generators (brand: eco-systems).
- Patrons like it.
- 100,000gallon kept at 81 degrees. needed two saltwater generators because company installed residential generators rather than commercial.
- Plumbing has become problematic.
- "Start over thesis" stick w/ chlorine system
- Therapy pool used for rehab, 92 degrees. 45,000 gallons, saltwater, may not affect health. injured athletes, seniors, etc.
- Scott was behind the conversion
- Took longer than expected due to complexities with renovation
- Scott will not give it justice. Stakeholders like it though.
- Deck, lighting, locker rooms as considerations
- Maintenance similar, planned for no inventory of chlorine before the conversion.
- Goal for another complete renovation

3.0A SANITATION TECHNOLOGY ANALYSIS CHART (LARGER SCALE)

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