The Magazine for ENERGY EFFICIENCY and WATER CONSERVATION in Cooling Systems

CHILLER & COOLING BEST PRACTICES

coolingbestpractices.com

August 2020

COOLING TOWERS & CHILLERS

WATER TREATMENT & COOLING SYSTEM ASSESSMENTS

BEST PRACTICES

2020 ONLINE EVENT! SEPTEMBER 23-24

COMPRESSED AIR / VACUUM / COOLING

AGENDA AT A GLANCE

Wednesday, September 23

10:00AM: First Wave of Pre-Recorded Sessions

1:00PM: Live Keynote Presentations

Thursday, September 24

10:00AM: Second Wave of Pre-Recorded Sessions

1:00PM: Live Keynote Presentations

3:00PM: Live Discussion Forum

Note: All times listed are U.S. EST

BEST PRACTICES 2020 ONLINE EVENT!

The Best Practices 2020 ONLINE EVENT! will take place September 23-24. The event will produce LIVE Keynote Presentations and Forums plus hours of pre-recorded sessions featuring leading experts from around the world.

FREE for all to register at www.cabpexpo.com, this is a great opportunity for maintenance teams, energy managers, specifying engineers and sales engineers to receive training (and PDH hours)!

5 Event Tracks

Track 1: Compressed Air Technology Fundamentals & Maintenance

Track 2: Compressed Air System Energy Conservation

Track 3: Industrial Blower & Vacuum Fundamentals & System Optimization

Track 4: Aeration Blower Sizing & Specifications

Track 5: Chiller, Cooling Tower and Water Treatment Fundamentals & Specifications

SAVE THE DATES ON YOUR CALENDAR! Register for FREE at cabpexpo.com

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FEATURES

COOLING TOWER & CHILLER FEATURES

WATER TREATMENT & COOLING SYSTEM ASSESSMENT FEATURES

COLUMNS

FROM THE EDITOR

Summer is in full swing and we hope you are finding time to get outdoors. Our team here wishes all of our readers safety and sanity during this unique period in our lives. We are all working from home very productively and hope to look back upon this as a time when we actually improved some processes.

Cooling Tower & Chiller Features

When do you specify water-cooled vs. air-cooled central plant chillers? In her article, "The Impact of Water Utility Rates on Chiller Selection," Judith Peters from Daikin Applied Americas, examines traditional metrics like kW/ton and discusses other metrics used less often – like water treatment and wastewater costs associated with cooling towers.

A Midwest-based plastic extruder is growing, thanks to their high-performance polymers. Their ageing 250 ton air-cooled central chiller plant, critical to the quality and reliability of the extrusion lines, struggled to keep up with demand and became maintenance intensive. A new 345 ton air-cooled central chiller plant was installed, after an extensive analysis. Our own Mike Grennier had the opportunity to interview the team at CASCO USA, who did the system assessment and installation. The extrusion lines are now well-equipped to support more growth!

Water Treatment & Cooling System Assessment Features

U.S. Flue-Cured Tobacco Growers (USFCTG) operate out of Timberlake, North Carolina where they produce as many as eight billion cigarettes per year. Their air washer systems are critical to tobacco processing and are a significant user of cooling water. The cooling system consists of three chillers: a 1,250-ton Trane®, a 370-ton McQuay® and a 275-ton York® chiller and three SPX Cooling Technology Marley® evaporative cooling towers. Our story is about how USFCTG's focus on sustainability led them to replace their chemical water treatment program with an innovative all-natural solution using moss.

The proper maintenance of cooling towers is a huge factor for maintaining plant uptime and process quality. Jon Southworth, from Cambridge Water Screen Systems, has sent us an interesting article about the benefits, to reliability and uptime, of using traveling (vs. stationary) water screen systems.

Best Practices EXPO & Conference Announcements

Please consider reserving portions of September 23-24, 2020 for the Best Practices 2020 ONLINE EVENT! Free for all to register at www.cabpexpo.com, this is a great opportunity for maintenance teams, specifying engineers and sales engineers to receive training (and PDH hours)! We will offer LIVE Online Forums and Keynotes, plus hours of pre-recorded sessions.

We have announced the postponement of the Best Practices 2020 Expo & Conference to November 2-4, 2021. It will be held at the same venue – the Schaumburg Convention Center located in Chicago's convenient outskirts near O'Hare International Airport.

Thank you for investing your time and efforts into **Chiller & Cooling Best Practices.**

ROD SMITH
Editor, tel: 412-980-9901, rod@airbestpractices.com

2020 MEDIA PARTNERS

INDUSTRIAL COOLING SYSTEM NEWS

Best Practices 2020 EXPO & Conference Postponed Until 2021, ONLINE EVENT! Scheduled for September

The producer of the Best Practices 2020 EXPO & Conference has announced the event devoted exclusively to optimizing on-site utilities powering modern plant automation has been postponed until November 2-4, 2021. The event will take place at the same venue as the one planned for 2020 at the Renaissance Schaumburg Convention Center in Chicago, Illinois. Rod Smith, Producer and Publisher of Best Practices EXPO & Magazines, said the Best Practices 2020 EXPO & Conference was postponed due to continued uncertainty associated with the COVID-19 virus.

Smith said enthusiasm remains high citing organizations like the Compressed Air & Gas Institute (CAGI) and Compressed Air Challenge (CAC) who have confirmed their continued participation in the 2021 event, including on-site CAGI Compressed Air System Specialist examinations and CAC Level 1 and Level 2 Training Courses.

In a related announcement, the Best Practices 2020 ONLINE EVENT! will be held September 23-24, 2020. The online event will feature live keynote presentations, a discussion forum and hours of pre-recorded sessions from experts throughout the industry.

"The decision to postpone the 2020 Best Practices EXPO & Conference is in the best interest of all attendees who planned to attend our rapidly growing annual event," Smith said. "Our discussions with event sponsors have been very well received with the overwhelming majority signing up for a fantastic event in 2021. At the same time, we're excited to offer the Best Practices 2020 ONLINE EVENT! This is a great opportunity for maintenance teams, energy managers, specifying engineers and sales engineers to receive training (and PDH hours)! Registration is FREE to all!"

As with past in-person events, the Best Practices 2020 ONLINE EVENT! will include highly informative educational tracks dedicated to specific industry topics, including:

- Track 1: Compressed Air Technology Fundamentals & Maintenance
- Track 2: Compressed Air System Energy & Cooling Water Conservation
- Track 3: Industrial Blower & Vacuum Fundamentals & System Optimization
- Track 4: Aeration Blower Sizing & Specifications
- Track 5: Chiller, Cooling Tower and Water Treatment Fundamentals & Specifications

To learn about the full schedule of planned activities and register for the Best Practices 2020 ONLINE EVENT! visit www.cabpexpo.com /online-event/.

About Best Practices EXPO & Conference

The Best Practices EXPO & Conference is an event devoted exclusively to optimizing on-site utilities powering modern plant automation. The event hosts more than 100 exhibitors and a multi-track conference program featuring industry experts willing to share "Best Practices" in deploying leaders who have profitably deployed energy and water conservation measures. For more information on the Best Practices EXPO & Conference, please visit www.cabpexpo.com.

The Best Practices ONLINE EVENT! is scheduled for September 23-24, 2020.

Nidec Global Appliance Acquires Delta Compressors

Nidec Global Appliance, a division of Nidec Corporation, acquired the Delta production line from Secop Austria on June 1, after obtaining approval from the European Commission. The transaction, started in 2019, includes the operations related to the development, manufacturing and sales of Delta compressors, executed in the site of Fürstenfeld, Austria.

"The final approval of the acquisition is an important milestone to strengthen our compressors business globally. We are looking forward to taking the first steps to integrate Fürstenfeld into our global footprint," said Valter Taranzano, CEO of Nidec Global Appliance.

With headquarters in Italy and Brazil, Nidec Global Appliance combines the synergies between brands and products for the appliances industry worldwide. The incorporation of Delta line enhances the existing portfolio of fixed and variable speed compressors for home appliances.

INDUSTRIAL COOLING SYSTEM NEWS

Nidec Global Appliance acquired the Delta compressors manufacturing plant on June 1, 2020.

In this sense, Nidec Global Appliance aims to foster the synergies between Delta and other Embraco solutions. "It will enable us to evolve our innovation capabilities, which is key to anticipating future generation of products to our customers," said Taranzano. Through this agreement, the company will also reinforce its global footprint, which now counts on 12 manufacturing plants across 9 countries.

About Nidec Global Appliance

With over 17,000 employees across 9 countries, Nidec Global Appliance manufactures and commercializes Embraco and Delta cooling solutions for a variety of refrigeration applications, motors for dishwashers, washing machines and dryers, as well as air conditioning components. Its focus is to deliver a comprehensive portfolio capable of meeting customer needs through high standards of quality, competitiveness and energy efficiency. The division is part of Nidec Corporation, a global leader in motors and components, with headquarters in Japan. For more information, visit www.nidec.com.

2020 ASHRAE Handbook Focuses on Systems and Equipment

The newly published 2020 ASHRAE Handbook – *HVAC Systems and Equipment* includes updated information to help system designers and operators select and use equipment that is the best fit for a particular application or scenario.

The 2020 ASHRAE Handbook – *HVAC Systems and Equipment* discusses various systems and the equipment (components or assemblies) they comprise, and describes features and differences. Subject matter experts on ASHRAE Technical Committees in each

subject area have reviewed all chapters and revised them as needed for current technology and practice. A new feature of the Handbook is the annotatable PDF download. Users can highlight relevant text and add their own notes and comments.

The volume contains several new updates. Chapter 51, Dedicated Outdoor Air Systems, is entirely new and presents detailed information on DOAS. Chapter 9, Applied Heat Pump and Heat Recovery Systems, has new content on waste heat recovery, district applications, and industrial process heat pumps, while Chapter 24, Desiccant Dehumidification and Pressure Drying Equipment, has expanded content on applications, air filters, and liquid strainers, plus recommendations from ASHRAE research project RP-1339 on rating equipment at altitude.

Other updates that likely will impact many users include: Chapter 19, Duct Construction, extensive revisions on system leakage and air dispersion systems; Chapter 25, Mechanical Dehumidifiers and Related Components, new content on psychrometrics, outdoor air, controls, and industrial dehumidifiers; and Chapter 37, Solar Energy Equipment, new data on worldwide solar technology use, plus an expanded section on photovoltaic equipment.

Other revisions and additions include:

- Chapter 18, Variable Refrigerant Flow, has new sections on modeling and system commissioning, and an updated system design example.
- Chapter 20, Room Air Distribution Equipment, has updates for current technology, with new information on specialized components and air curtains.
- Chapter 26, Air-to-Air Energy Recovery Equipment, has new information on heat pipes and desiccant and heat wheel systems.
- Chapter 28, Unit Ventilators, Unit Heaters, and Makeup Air Units, has revisions on standards, controls, and fan selection for makeup air units.
- Chapter 29, Air Cleaners for Particulate Contaminants, has updates on standards and performance testing.
- Chapter 31, Automatic Fuel-Burning Systems, has added content on pneumatically and electronically linked gas/air ratio burner systems.

INDUSTRIAL COOLING SYSTEM NEWS

- Chapter 38, Compressors, has revisions on general theory; screw and scroll compressors; and bearings, including oil-free technologies.

- Chapter 44, Centrifugal Pumps, has new content on vertical, inline, split-coupled pumps; hydronic system pump selection; and differential pressure control.

- Chapter 46, Valves, has new content on control valve sizing; electronic actuators; and ball, butterfly, flow-limiting, and pressure-independent control valves.

- Chapter 49, Room Air Conditioners and Packaged Terminal Air Conditioners, has updates for efficiency standards.

ASHRAE has completed distribution of complimentary copies to members and is now offering this essential resource to the public. The volume is published as a bound print volume, as a downloadable PDF, and online, and in two editions: one using inch-pound (I-P) units of measurement, the other using the International System of Units (SI). The cost of the print bound volume is $230 in I-P or SI. Individual chapters may also be purchased as digital downloads in PDF format.

About ASHRAE

Founded in 1894, ASHRAE is a global professional society committed to serve humanity by advancing the arts and sciences of heating ventilation, air conditioning, refrigeration and their allied fields. As an industry leader in research, standards, writing, publishing, certification and continuing education, ASHRAE and its members are dedicated to promoting a health and sustainable environment for all. For more information, visit ashrae.org.

Victaulic Adds Virtual Access to Continuing Education Program

Victaulic, the world's leading manufacturer of mechanical pipe-joining systems, is now offering free virtual courses from its accredited and award-winning Victaulic University program to construction professionals around the world. Growing demand for more versatile training options and shrinking access to traditional classes given the COVID-19 pandemic presented an opportune time for Victaulic to make its robust catalog of courses, many of which offer International Association for Continuing Education and Training (IACET) Continuing Education Units (CEUs), available to industry professionals such as owners, engineers, contractors, architects and designers online.

"The launch of Victaulic University's virtual platform is another successful result of collaborating with customers to help solve their challenges," said Eric Luftig, Vice President, at Victaulic. "We are pleased to introduce an innovative and convenient way to support the industry's need for high-quality education."

Victaulic has instructed 175 live sessions since March, attracting approximately 7,200 virtual learners from 99 countries. Attendance is growing rapidly as Victaulic adds new content and more users discover the program.

"The Victaulic education program presents valuable information in a well-organized and easily understood fashion," said Mike Stossel, Senior Design Manager at KNS Sprinkler Design and a recent Victaulic University participant. "The content is extremely insightful, and we look forward to participating in more courses in the future."

Victaulic's 45+ piping technology courses are available at no cost in two virtual formats: live, instructor-led webinars and self-paced courses, which are available on-demand at any time. Courses are taught in English, Spanish, and German, with new languages being added regularly, and cover several industries, including General Engineering/Construction, Plumbing, Heating and Air, Data Centers, Fire Protection, Virtual Design and Construction. CEUs or Professional Development Hours (PDHs), which are required for maintaining engineering certifications are immediately available upon completion of applicable courses.

"Between Victaulic's 100-year legacy and over 200 years of knowledge amongst the instructors, the global construction industry will undoubtedly benefit from Victaulic University," said Colin Phelps, Sales Training Manager at Victaulic. "So far, we've had more than 12,000 courses completed. With our robust content and a growing curriculum, there's something for everyone."

About Victaulic

Since 1919, Victaulic has been the originator and world's leading producer of mechanical pipe joining solutions. Victaulic has 14 manufacturing facilities and 29 branches worldwide with nearly 5,000 employees who speak 43 languages across the globe. Used in the most demanding markets, Victaulic innovative piping technologies and services put people to work faster while increasing safety, ensuring reliability and maximizing efficiency. With over 1,900 global patents, Victaulic solutions are at work in more than 140 countries across

diverse business lines including oil and gas, chemical, mining, power generation, water and wastewater treatment, military and marine, as well as commercial building and fire protection. For more information visit www.victaulic.com.

Frigel Launches Heat Rejection Systems Division

Frigel, a market leader in intelligent process cooling in plastic industries, announced the launch of its Heat Rejection Systems Division with the sole focus of business and product development for new industries and applications to enter. The main vehicle for this will be the new, larger and enhanced version of the adiabatic cooler range called Ecodry.

"Ecodry was the first true adiabatic cooler launched on the market," said Duccio Dorin, CEO of Frigel. "Since the first versions of the late 90s, there have been many product evolutions and even today, despite many competitors taking the field, including the strongest global manufacturers of evaporative towers, Frigel is still recognized as a technological and experience leader, strengthened by patents issued and pending in many countries."

"Our objective is to launch the larger version of the Ecodry adiabatic cooler by Q1 2021, in order to address the ever-increasing demand for larger scale cooling capacity across industries," said Gyula Szekeres, Board Member, responsible for Business Development. "The demand for adiabatic cooling solution is expected to be fueled not only by the business targets of our potential customers, but the increasing awareness of environmental and health challenges we face. The new Division is definitely going to contribute to some of the United Nations Sustainable Development Goals, like "Clean Water and Sanitation" as well as "Industry, Innovation and Infrastructure" just to highlight two of them."

"The existing version of Ecodry satisfies the requirements of our customers providing the performance of an evaporative system with the advantages of a dry cooler system. Our adiabatic coolers drastically

INDUSTRIAL COOLING SYSTEM NEWS

The Ecodry adiabatic cooler range from Frigel.

reduce water usage – by up to 95% vs. an open cooling tower and up to 60% vs. a closed cooling tower – all while maintaining premium energy efficiency. Now, we are about to stretch our limits, heading towards higher capacities," said Massimiliano Dall'Armellina, Product Manager.

"We know the convergence of technological innovation and environmental and health awareness is the right answer to the challenges our customers want to address. At Frigel, we invest in the expertise and experience to make this happen. This is just the start. Our existing and potential customers will be taking full advantage of our results," said Dorin.

About Frigel

Frigel has been a worldwide market leader in intelligent process cooling since the 1960s. Solutions include centralized cooling systems, machine-side cooling and temperature control units, and water- and air-cooled chillers, as well as advanced control technology. Foremost among Frigel's products is Ecodry, a unique, internationally patented, closed-loop intelligent cooling system that has been proven at more than 8,000 manufacturing installations worldwide. Ecodry, an environmentally friendly cooling solution, keeps cooling water clean, delivers substantial savings on water, chemicals, energy and maintenance. Frigel also manufactures and markets the unique, cycle-time improving Microgel combination chiller/temperature control units (TCUs), as well as Turbogel and Thermogel TCUs, Aquagel pumping and filtration equipment and water- and air-cooled central chillers. For more information, visit www.frigel.com.

Baltimore Aircoil Enhances Nexus Modular Hybrid Cooler

Baltimore Aircoil Company (BAC) announced enhancements to the revolutionary Nexus Modular Hybrid Cooler, the world's first intelligent, plug-and-play, modular hybrid fluid cooler for HVAC and light industrial applications. The Nexus Cooler, which already led the industry for lowest installation costs, lowest operating costs, lowest maintenance costs and maximum uptime now provides best water quality resulting from enhanced water management. An optional water disinfecting system as well as a product redesign now meet even the most stringent local building codes regarding fire safety and noise reduction.

The BAC Nexus Modular Hybrid Cooler was designed to minimize maintenance cost by reducing spray water volume by up to 60%, by allowing accessibility to all components at the front of the unit, and by operating dry when temperature and climate allow. What's more, it reduces water treatment costs with its DiamondClear Design, which prevents stagnant water in the system and minimizes scale build-up and biological growth. The new optional, compact and fully-integrated UV water disinfecting system rounds out the product's enhanced water management system. This UV disinfecting system further minimizes bacterial growth delivering best water quality and enhancing health and safety, all without changing the unit's footprint.

Corrosion-resistant, premium materials are standard on the Nexus Modular Hybrid Cooler. This reduces the need for maintenance, while fan and motor redundancy reduce unplanned downtime. There is no need for permanent ladders or elevated platforms to perform routine maintenance, making the Nexus Modular Hybrid Cooler safer overall than competing products. Additionally, new optional accessories are now available to further reduce sound levels and help comply with stringent fire codes and sound requirements.

The Nexus Cooler's simplified system design delivers a 15% reduction in system costs compared with traditional fluid coolers. The Nexus eliminates the need for a separate heat exchanger or controls, and it delivers reduced water treatment requirements, with no sweeper piping or side-stream filtration required. The system's compact design makes it ideal for constrained spaces, including indoors. This compact design also reduces installation costs, as modules can fit into a freight elevator, thus eliminating the need for cranes or helicopters.

This innovative hybrid cooler design also offers up to 50% water savings and 40% energy savings. The iPilot Control System automatically switches among three modes – fully evaporative, fully dry, or balanced Nexus mode – according to environmental conditions, operating priorities and cooling demands. The efficiency of the Nexus Cooler is unmatched, thanks to the patented hCore Heat Transfer Technology and a direct-drive, variable-speed EC Fan System.

About Baltimore Aircoil

With over 80 years of industry-leading innovation and experience, BAC creates cutting-edge cooling equipment for the HVAC, Industrial, and Refrigeration marketplaces. We solve customers' unique needs with our expertise and wide range of high-performance systems. BAC leverages the power of evaporative cooling by optimizing the balance of water and energy, but the true BAC difference lies in our absolute commitment to creating sustainable solutions and delivering value to our customers. For more information, www.BaltimoreAircoil.com.

Johnson Controls Introduces Envirco IsoClean Portable HEPA Filtration System

Johnson Controls has introduced the Envirco IsoClean filtration system designed to easily and economically create a negative pressure isolation room/environment that meets OSHA and CDC TB guidelines as the world navigates the COVID-19 pandemic. IsoClean can be used as a positive pressure clean air recirculating system in clinics, waiting rooms, hospital emergency rooms and other confined areas. The system can also be used as a partial or complete exhausting unit to construct a negative pressure isolation room space.

"The IsoClean is an easy and economical solution that is ideal for health care professionals looking to create a negative pressure, isolation patient room," said Mark Mattingly, vice president and general manager, Air Filtration Products. "The system can be easily rolled from one room to another and fits into areas with limited floor space. The portability and practical applications this solution offers is optimal for facilities looking for an economical investment."

INDUSTRIAL COOLING SYSTEM NEWS

"The IsoClean is an easy and economical solution that is ideal for health care professionals looking to create a negative pressure, isolation patient room," said Mattingly.

Simply roll the IsoClean into a standard room, connect flexible ducting to the 6 in (152 mm) collar on the top of the unit for partial exhaust or to the optional 8 in. (204 mm) flanged collar for total exhaust and vent the purified air to the exterior through a window or wall.

The versatile IsoClean can be used as a clean air recirculating unit, a negative pressure unit or as a split system to create both negative pressure and clean air recirculation by simultaneously exhausting some of the air out while recirculating the remainder back into the room.

About Johnson Controls

At Johnson Controls, we transform the environments where people live, work, learn and play. From optimizing building performance to improving safety and enhancing comfort, we drive the outcomes that matter most. We deliver our promise in industries such as healthcare, education, data centers and manufacturing. With a global team of 105,000 experts in more than 150 countries and over 130 years of innovation, we are the power behind our customers' mission. Our leading portfolio of building technology and solutions includes some of the most trusted names in the industry, such as Tyco, YORK, Metasys, Ruskin, Titus, Frick, Penn, Sabroe, Simplex, Ansul and Grinnell. For more information, visit www.johnsoncontrols.com.

Carrier Chooses R-32 Refrigerant for Commercial Scroll Chillers

As part of its commitment to provide customers with solutions that use the right refrigerant for each application, Carrier has selected R-32 refrigerant to replace R-410A refrigerant, a high global warming potential (GWP) refrigerant, in commercial chillers using scroll technology. R-32 was chosen for its lower environmental impact, high energy efficiency, wide availability and ease of use. In Europe, the refrigerant will be offered in some scroll chillers beginning in the first half of 2020. Introductions will follow in other regions and all will meet UN Montreal Protocol Kigali Amendment regulations taking effect in 2023. Carrier, a world leader in high-technology heating, air-conditioning and refrigeration solutions, is a part of Carrier Global Corporation, a leading global provider of innovative heating, ventilating and air-conditioning (HVAC), refrigeration, fire, security and building automation technologies.

"Carrier focuses the right refrigerant for each application in order to provide the very best solutions for our customers," said Chris Nelson, President, HVAC, Carrier. "After thorough evaluation of the options, Carrier selected R-32 for scroll chillers and heat pumps for its lower impact on the environment, reaffirming our continued commitment to sustainability."

Carrier's use of R-32 refrigerant and expert system design will reduce the refrigerant carbon footprint by 80% in commercial scroll chillers and heat pumps. This is due to the much lower GWP and a significant system refrigerant charge reduction compared to the previous generation using R-410A.

Carrier is continuously investing in long-term solutions to lead the industry and promote highly efficient products with lower impact on global warming. This announcement follows Carrier's 2018 selection of R-454B, known commercially as Puron Advance, as its primary lower GWP solution to replace R-410A in ducted residential and package unitary commercial products utilizing scroll compressors sold in North America. Carrier also previously announced commitments to move toward low GWP refrigerants with the selection of HFO R-1234ze(E) for screw chillers in Europe in 2015, the introduction of R-513A in multiple centrifugal and screw chillers in 2018 and finally the introduction of the award winning AquaEdge 19DV centrifugal chiller using HFO R-1233zd(E) in 2016.

About Carrier

Founded by the inventor of modern air conditioning, Carrier is a world leader in high-technology heating, air-conditioning and refrigeration solutions. Carrier experts provide sustainable solutions, integrating energy-efficient products, building controls and energy services for residential, commercial, retail, transport and food service customers. Carrier's HVAC business is a part of Carrier Global Corporation, a leading global provider of innovative HVAC, refrigeration, fire, security and building automation technologies. For more information, visit www.carrier.com.

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President, JenTech Inc.

Tom Taranto
Owner, Data Power Services

Chris Gordon
President & CEO, Blackhawk Equipment

JAN 23
Compressed Air Leak Management Best Practices
Presenter Ron Marshall, Chief Auditor, Marshall Compressed Air Consulting
January 23, 2020 – 2:00PM EST
Co-Sponsors: Trace Analytics and UE Systems

FEB 20
Verifying Blower System Energy with ASME PTC 13
Presenter Tom Jenkins, P.E., President, JenTech Inc.
February 20, 2020 – 2:00PM EST
Sponsor: Inovair

MAR 19
Designing Piping Systems for Low Pressure Drop
Presenter Tom Taranto, Owner, Data Power Services
March 19, 2020 – 2:00PM EST
Exclusive Sponsor: Kaeser Compressors

APR 16
How to Correctly Size Vacuum Pumps
Presenter Chris Gordon, President & CEO, Blackhawk Equipment
April 16, 2020 – 2:00PM EST
Exclusive Sponsor: Busch Vacuum Solutions

MAY 21
Air Compressor Master Controls to Prevent Control Gap
Presenter Tim Dugan, P.E., President and Principal Engineer, Compression Engineering Corporation
May 21, 2020 – 2:00PM EST
Co-Sponsors: BEKO Technologies and VPInstruments

JUN 18
VSD Air Compressor Installation Guidelines
Presenter Loran Circle, Senior Consultant, Compressed Air System Training & Consulting
June 18, 2020 – 2:00PM EST
Sponsor: Open

JUL 20
Where Does Blower Air Go? Process Fundamentals
Presenter Tom Jenkins, P.E., President, JenTech Inc.
July 20, 2020 – 2:00PM EST
Sponsor: Open

AUG 20
Calculating Storage for Demand Events
Presenter Tom Taranto, Owner, Data Power Services
August 20, 2020 – 2:00PM EST
Co-Sponsors: BEKO Technologies and Kaeser Compressors

OCT 15
Vacuum System Efficiency Projects
Presenter Chris Gordon, President & CEO, Blackhawk Equipment
October 15, 2020 – 2:00PM EST
Exclusive Sponsor: Busch Vacuum Solutions

NOV 12
Measuring KPI's: kW, Flow, Pressure, Dewpoint
Presenter Tim Dugan, P.E., President and Principal Engineer, Compression Engineering Corporation
November 12, 2020 – 2:00PM EST
Co-Sponsors: Kahn Instruments and VPInstruments

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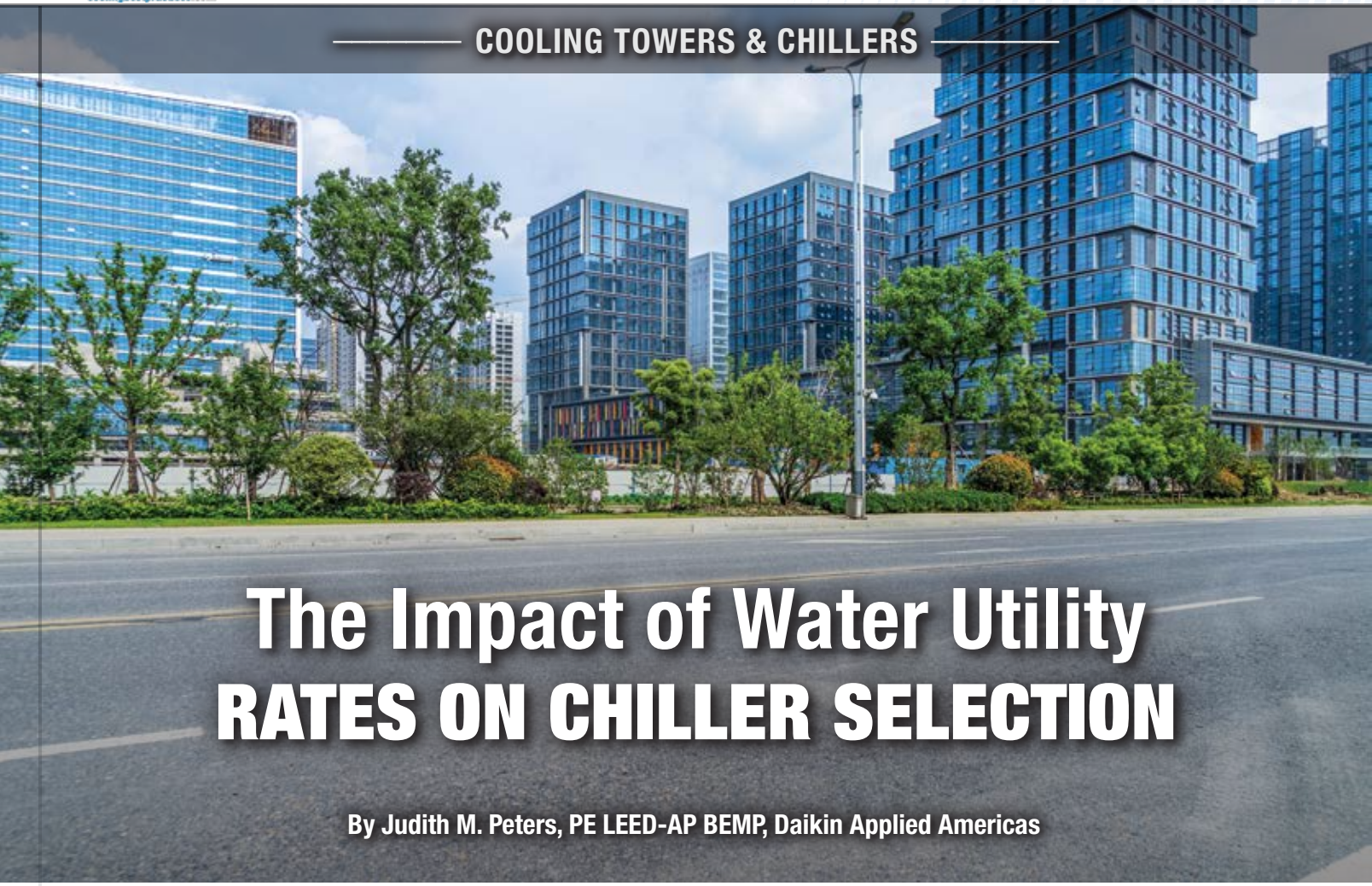
COOLING TOWERS & CHILLERS



The Impact of Water Utility RATES ON CHILLER SELECTION

By Judith M. Peters, PE LEED-AP BEMP, Daikin Applied Americas

Historically, the operation of a water-cooled chiller plant would deliver lower utility costs than a similar air-cooled chiller plant. A water-cooled chiller's superior efficiency in kW/ton more than made up for the energy consumed by condenser water pumps and cooling tower fans. However, over the past decade air-cooled and water-cooled chillers have experienced dramatic improvements in energy efficiency. At the same time electricity, water, and wastewater charges have experienced year-over-year increases.

Do water-cooled chiller plants still deliver lower utility bills? Today, many chiller plant energy analyses carefully account for energy costs, and even energy escalation rates – a factor that projects how fuel costs will increase over time, while ignoring water and wastewater costs associated with cooling towers. While highly effective at transferring heat, cooling towers consume millions of gallons of water each year through the process of evaporation, drift, and blowdown. With the rising cost of water and wastewater, this omission can result in an incomplete picture for the building owner.

In September 2017, the U.S. Department of Energy's (DOE's) Pacific Northwest National Laboratory (PNNL) produced a report on water and wastewater price escalation across the United States. Their findings showed that while energy prices tend to be driven by commodities; water and wastewater are driven by infrastructure projects leading to large variances in prices escalations across various

"While it's important to include accurate electricity costs and escalation rates, it's equally important to include water and wastewater charges and their corresponding escalation rates."

— Judith M. Peters, PE LEED-AP BEMP, Daikin Applied Americas

TABLE 1: ENERGY MODEL INFORMATION		
LOCATIONS	Major cities representing 8 ASHRAE Climate Zones	
BUILDING DESCRIPTION	Ten story 200,000 Feet^2 (18,580 Meters) Office Building	
AIR-SIDE SYSTEM	VAV AHU with cooling and heating coils and VAV electric reheat and air-side economizing	
SUPPLY AIR SYSTEM CONTROLS	Supply air temp 55˚F (13˚C) with reset to 60˚F (16˚C) when temperatures varies between 80˚F (27˚C) and 60˚F (16˚C)	
BUILDING PEAK LOAD	Varied by location: >300 ton; <600 tons	
CHILLER PLANT DESCRIPTION		
SEQUENCE OF OPERATION	Sequential; loading one chiller before bringing on another	
CHILLED WATER TEMPERATURES	44˚F (7˚C) minimum leaving water temperature with a 12˚F (7˚C) loop delta T	
PRIMARY CHILLED WATER PUMPS	1 pump per chiller; 9 W/gpm; 2 gpm/ton; 90% motor efficiency; constant speed; 15 feet of head pressure (45 kPa)	
SECONDARY CHILLED WATER PUMPS	1 pump at 13 W/gpm; 2 gpm/ton; 90% motor efficiency; variable speed; 45 feet of head pressure (134 kPa)	
CONDENSING TYPE	Water-Cooled	Air-Cooled
CHILLER TYPE	Two water-cooled centrifugal chillers with VFD ASHRAE 90.1-2016 compliant	Two air-cooled screw with VFD chillers ASHRAE 90.1-2016 compliant
CHILLER EFFICIENCY	0.635 kW/ton; 0.40 IPLV	9.7 EER FL; 16.10 IPLV (1.237 kW/ton; 0.745 IPLV)
COOLING TOWER	Two axial-fan cooling towers	N/A
COOLING TOWER MODELING STRATEGY	Cross-flow algorithm using 7˚F (4˚C) approach; 10˚F (6˚C) range; 6 cycles of concentration	N/A
COOLING TOWER FAN POWER AND CONTROL	Variable speed fan control with 60 gpm/hp efficiency	N/A
CONDENSER LEAVING WATER TEMPERATURES	85˚F (29˚C) with 10˚F (6˚C) Delta T	N/A
CONDENSER LOOP CONTROL	Maintain LWT between 70 and 85	N/A
CONDENSER PUMPS	Two pumps 19 w/gpm; 3 gpm/ton; 50 feet of head; 90% motor efficiency; constant speed	N/A

service providers.[1] They found on average annual escalation rates for water range from 0.6% in the West-Mountain region to 8.6% in the Northeast. Average annual wastewater escalation rates range from 1.3 to 5.1 percent. In comparison, the DOE's Energy Information Administration (EIA) energy escalation calculator[2] predicts average annual escalation rates from 0.35% in the Midwest to 1.78% in Northeast US.

With this degree of variability, a careful analysis of site-specific utility costs coupled with a detailed energy model is invaluable to an owner who is weighing chiller plant options.

Daikin Applied Americas recently conducted a study to compare the utility expense of operating an air-cooled chiller plant versus a water-cooled chiller plant across eight climatic zones as identified in ANSI/ASHRAE/IES Standard 90.1-2016.[3] The study focused on utility costs to the owner and the role of energy modeling in making the best possible selection. It did not address subjects such as total cost of ownership,[4] the water-energy nexus of heat

THE IMPACT OF WATER UTILITY RATES ON CHILLER SELECTION

rejection,[5] and associated cooling tower costs including water treatment, testing, Legionella's inspection, annual cleaning, and winterization.

Study Description and Assumptions

This study is comprised of two sets of comparisons:

1. The first set compares two ASHRAE 90.1-2016 (Path B) compliant chillers plants: an air-cooled plant versus a water-cooled plant.

2. The second set makes the same comparison but with higher efficiency chillers.

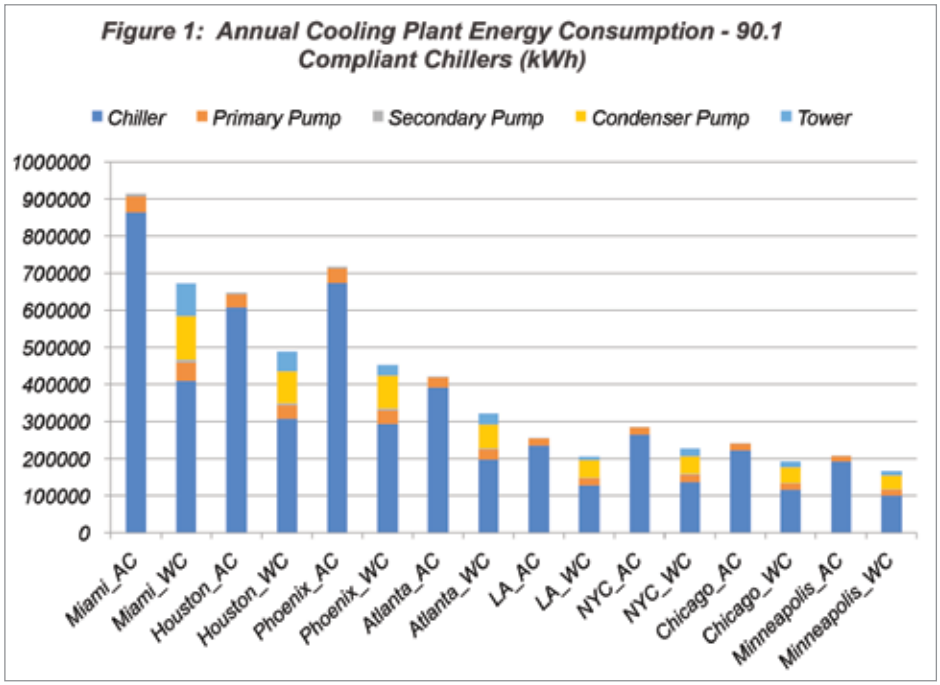


Figure 1: Annual Cooling Plant Energy Consumption - 90.1 Compliant Chillers (kWh)

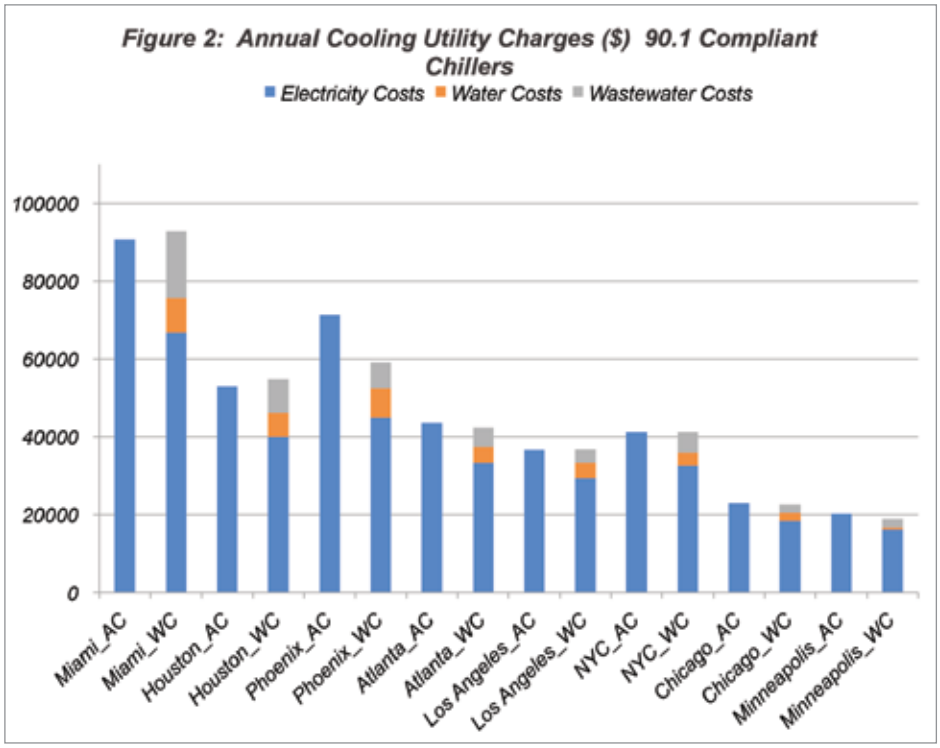


Figure 2: Annual Cooling Utility Charges ($) 90.1 Compliant Chillers

The DOE's EnergyPlus whole building energy simulation software (version 8.5) was used to model a mid-size, 200,000-square-foot (18,580 square meters) 10-story office building located in eight climate zones. The building size was selected for three reasons: it typifies numerous buildings across the United States, it is small enough to have fairly simple HVAC operations, yet is large enough to demonstrate a measurable energy cost savings between cooling plant designs. The building envelope, lighting power densities, occupancy, and operating schedules follow ASHRAE standards and methods outlined in ASHRAE 90.1 User Manual.

Each of the modeled locations has two chillers within the 150-300 ton range. Design day calculations were used to determine building load and corresponding chiller capacities, peak power, and flow rates.

Table 1 outlines the HVAC specifications associated with the model. (See sidebar article for discussion of the cooling tower's cycles of concentration.)

Study Objectives and Points of Interest

The following objectives were addressed:

(a) How does the energy consumption of an air-cooled chiller compare with that of a water-cooled chiller when taking into account pumping energy (chilled

water and condenser) and cooling tower energy?

(b) How does annual utility expense differ between an air-cooled and a water-cooled chiller plant? Is there a turning point where it is actually less expensive to operate an air-cooled chiller versus a water-cooled chiller? Does chiller efficiency affect this turning point?

Eight weather files from ASHRAE climate zones 1A, 2A, 2B, 3A, 3B, 4A, 5A, and 6A were used in the study. Locations were selected to provide a variation in climate as well as utility costs. Published commercial utility rates for each city were used in place of statewide average prices from the DOE's Energy Information Administration (EIA) in order to account for demand charges. Air-cooled chillers have higher peak loads and therefore a higher blended rate than their water-cooled counterparts.

TABLE 2: ANNUAL WATER CONSUMPTION AND WATER AND WASTEWATER CHARGES

	COOLING TOWER WATER CONSUMPTION	COOLING TOWER WATER AND WASTEWATER CHARGES	COOLING TOWER CHARGES PER KGAL	COOLING TOWER WATER CONSUMPTION PER TON (DESIGN)
	KGAL/YEAR	$/YEAR	$/KGAL	KGAL/TON
Miami	2010	26,027	$12.9	3.9
Houston	1438	14,931	$10.4	3.0
Phoenix	1790	14,110	$7.9	4.1
Atlanta	959	9,027	$9.4	2.2
Los Angeles	525	7,309	$13.9	1.7
New York	654	8,620	$13.2	1.6
Chicago	549	4,257	$7.8	1.2
Minneapolis	472	4,466	$9.5	1.1

Study Results – Part One: ASHRAE 90.1 Compliant Chillers Comparison

Results from this study indicate water-cooled chillers consume 46 to 57 percent less electricity than an air-cooled counterpart.

THE IMPACT OF WATER UTILITY RATES ON CHILLER SELECTION

After adding pumping and cooling tower energy, the energy savings is 20 to 37 percent depending upon climate. Figure 1 summarizes this relationship.

Noteworthy is Phoenix, Arizona, an arid climate with an extensive cooling season, provides the largest overall electric energy consumption savings at 37%.

In this study, the air-cooled chiller plants' chillers used 93% of total cooling plant energy; primary pumps used 6% and secondary pumps 1%. The water-cooled chiller plants' chillers used 61% of total cooling plant energy; condenser pumps used 21%; cooling towers used 9%; primary pumps used 8%; and secondary pumps used 1%.

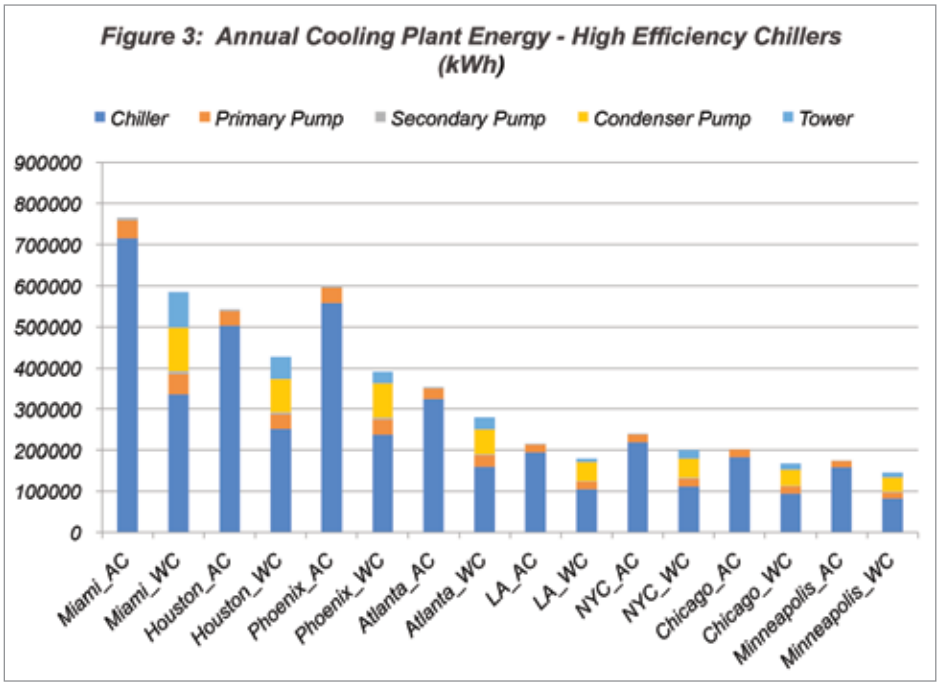
Utility Costs: This study uses electricity rates from DOE's EIA for commercial building customers (January, 2018)[6]; one of two options allowed by ASHRAE 90.1 2016 Normative Appendix G – Performance Rating Method.[7] The other option is to use actual electrical rates which have the advantage of including demand charges which are higher for air-cooled chillers. However, with the study based on hypothetical buildings, choosing a rate structure for each city becomes an arbitrary process that is difficult for the reader to reproduce; in contrast to EIA rates which are easily verified by the reader. Water and wastewater rates were taken directly from municipalities' published information since there is no corresponding centralized data base for water utility rates.

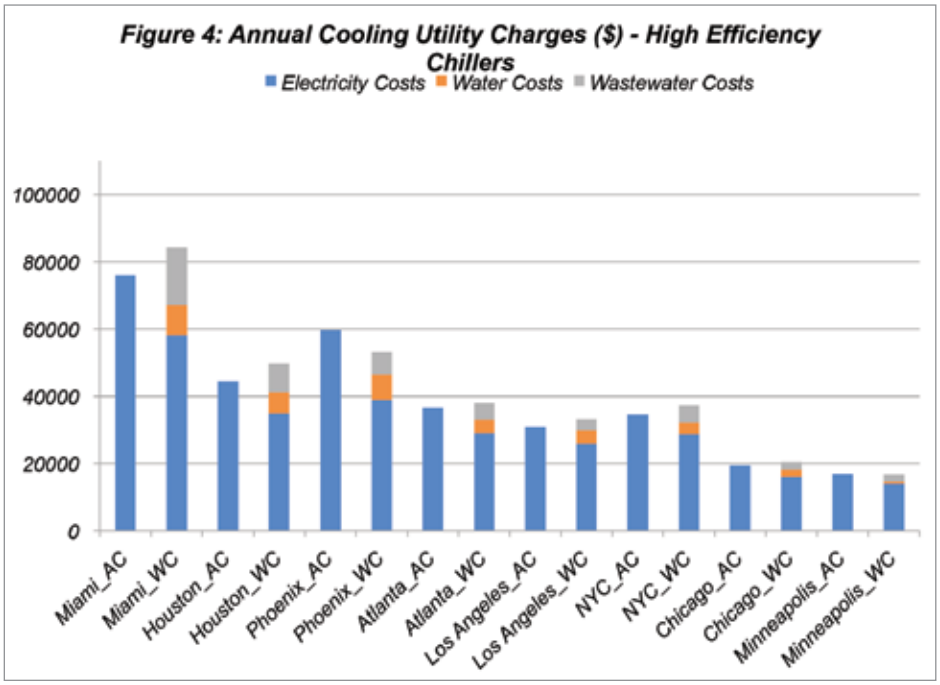
Figure 2 summarizes annual utility operating costs of electricity, water, and wastewater for each location.

Table 2 provides water consumption and water and wastewater charges associated with operating the cooling tower.

A key question is, how does water and wastewater charges change utility costs?

The water-cooled chiller saved between $4,000 and $26,400 per year in electricity over the air-cooled chiller. However, inclusion of water and wastewater charges resulted in the water-cooled plant having equal or slightly higher utility costs in four cities: Miami, Houston, Los Angeles and New York. Phoenix, Atlanta, Chicago, and Minneapolis maintained savings for the water-cooled chiller ranging from $400 to $12,200.





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Chiller & Cooling Best Practices is a technical magazine dedicated to discovering Energy and Water Savings in industrial and commercial HVAC and process cooling systems. Our editorial focus is on case studies and technical articles focused on optimizing cooling towers, central plant chillers and process chillers. We also focus on building knowledge on refrigeration compressors and circuits.

How Can Mechanical Contractors and Owners Design Systems Using Reduced Cooling Water and kW?

Our goal is to share the "Best Practices" already available and used in the field today. Our readers embrace Sustainability as a profitable business opportunity-and the right thing to do. We believe the industrial process cooling and HVAC installed base to be at a tipping point – one where "energy and water retrofits" will fuel a new era of market growth. Our case study editorial focus teaches Mechanical Contractors and Owners how to use less kW and cooling water by understanding "the constituents of demand" and exploring alternative cooling options.

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- Improve water treatment strategy to reduce water consumption
- Deploy VSD compressor technology to reduce chiller kW consumption
- Reduce demand by replacing water-cooled air compressors with air-cooled
- Identify waste heat sources
- Measure and challenge flow and temperature specifications

"The new chiller has multiple cycling scroll compressors providing 30% energy savings, zero down-time in production and remote monitoring for all KPI's."

— Derrick Gough, Coppertail Brewing Co. (feature article in March 2019 Issue)

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— Dustin Cohick and Josh Boehner, EVAPCO (feature article in May 2019 Issue)

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— Rajesh Dixit, Johnson Controls
(feature article in August 2019 Issue)

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THE IMPACT OF WATER UTILITY RATES ON CHILLER SELECTION

To save on wastewater expense, facility managers and owners can request credit for evaporative losses by metering the total make-up water quantity and subtracting the metered blowdown. At three cycles of concentration evaporation makes up 67% of make-up water. At six cycles of concentration, evaporation makes up 83% of make-up water consumption resulting in a substantial savings to the owner.

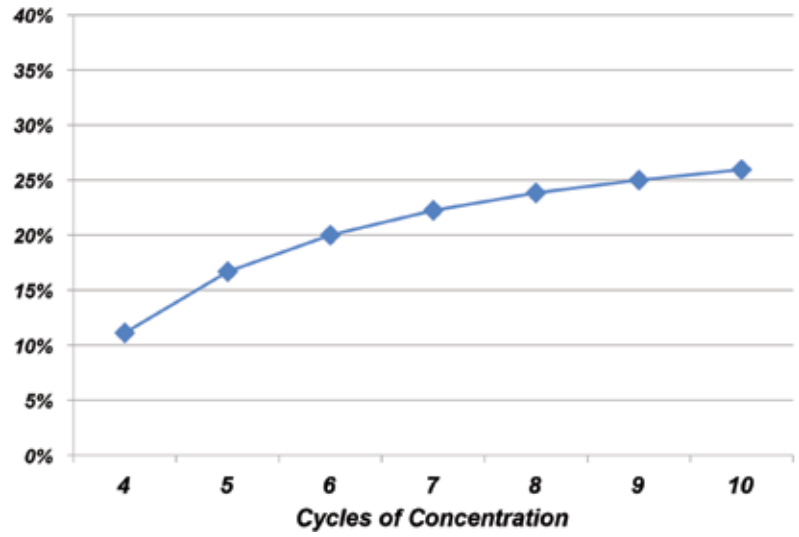
Study Results – Part Two: High Efficiency Water-Cooled Chillers versus High Efficiency Air-Cooled Chillers

If we make the same comparison using high efficiency chillers in place of ASHRAE 90.1 compliant chillers, do the results change? Is the increase in chiller efficiency enough to mitigate the impact of water and wastewater charges?

Cooling towers consume large quantities of water (makeup water) to replace losses due to evaporation and blowdown. Blowdown is water bled from the system in order to remove high levels of soluble and semi-soluble solids which can lead to corrosion and scaling. Cycles of concentration (COCs) are defined as the ratio of blowdown conductivity divided by makeup water conductivity. Increasing COCs means water is recirculated longer before being blown down, reducing the amount of required makeup water.

ASHRAE GreenGuide[8] notes that while many systems today operate at two to four cycles of concentration, it is possible to increase to six or even eight COCs for locations with high quality make-up water (low levels of minerals) or through chemical-free technology. Increasing COCs from three to six reduces cooling tower make-up water by 20% and cooling tower blowdown by 50%.[9] Figure 5 shows the relationship between COCs and percent reduction in make-up water as calculated for this study using the EnergyPlus software.

Figure 5: Makeup Water Savings (%) Due to Increased Cycles of Concentration (Baseline is 3 COC)



Part two of this increases each chiller by approximately 20%:

1. Water-cooled chillers will now have a full load efficiency of 0.53 kW/ton and 0.33 Integrated Part Load Value (IPLV);

2. Air-cooled chillers will now have a full load efficiency of 11.7 EER and 19.5 IPLV.

The simulation was re-run with these efficiencies. Figure 3 summarizes the energy consumption and Figure 4 summarizes the utility charges.

Electric energy savings from water-cooled chiller plants ranged from 16 to 35 percent and saved between $2,900 and $21,000 per year in electricity. After adding water and wastewater charges, all water-cooled plants showed an increase in utility charges over their air-cooled counterparts ranging from $1,000 to $8,200 with the exception of Phoenix and Minneapolis, which showed annual utility cost savings of $6,700 and $200, respectively.

Upgrading from ASHRAE 90.1 base chillers to higher efficiency chillers resulted in lower comparative utility costs for air-cooled chillers versus water-cooled chillers over a range of climates and utility rate structure.

Summary

The improved efficiency of chillers, coupled with rising electricity, water, and wastewater rates, is changing the landscape of chiller plant utility costs. While it's important to include accurate electricity costs and escalation rates, it's equally important to include water and wastewater charges and their corresponding escalation rates. In addition, climate and equipment selection play a critical role in arriving at the best equipment. Undoubtedly,

energy modeling will play an increasingly important role in future analyses.

Going forward: A subsequent phase of this study would include different building types particularly those with extended hours and higher loads such as hospital and retail settings. Moreover, the study could expand to include a lifecycle costs analysis with updated energy and water and wastewater escalation rates. BP

About the Author

Judith M Peters, PE, is an energy modeling engineer at Daikin Applied Americas.

All images courtesy of Daikin Applied Americas.

Editor's note: This is an edited version of an article previously published by the same author in the June 2018 issue of ASHRAE Journal.

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Daikin Applied Americas, a member of Daikin Industries, Ltd., designs and manufactures technologically advanced commercial HVAC systems for customers around the world. Customers turn to Daikin with confidence that they will experience outstanding performance, reliability and energy efficiency. Daikin Applied equipment, solutions and services are sold through a global network of dedicated sales, service, and parts offices. For more information or the name of your local Daikin Applied representative, call 800-432-1342 or visit www.DaikinApplied.com.

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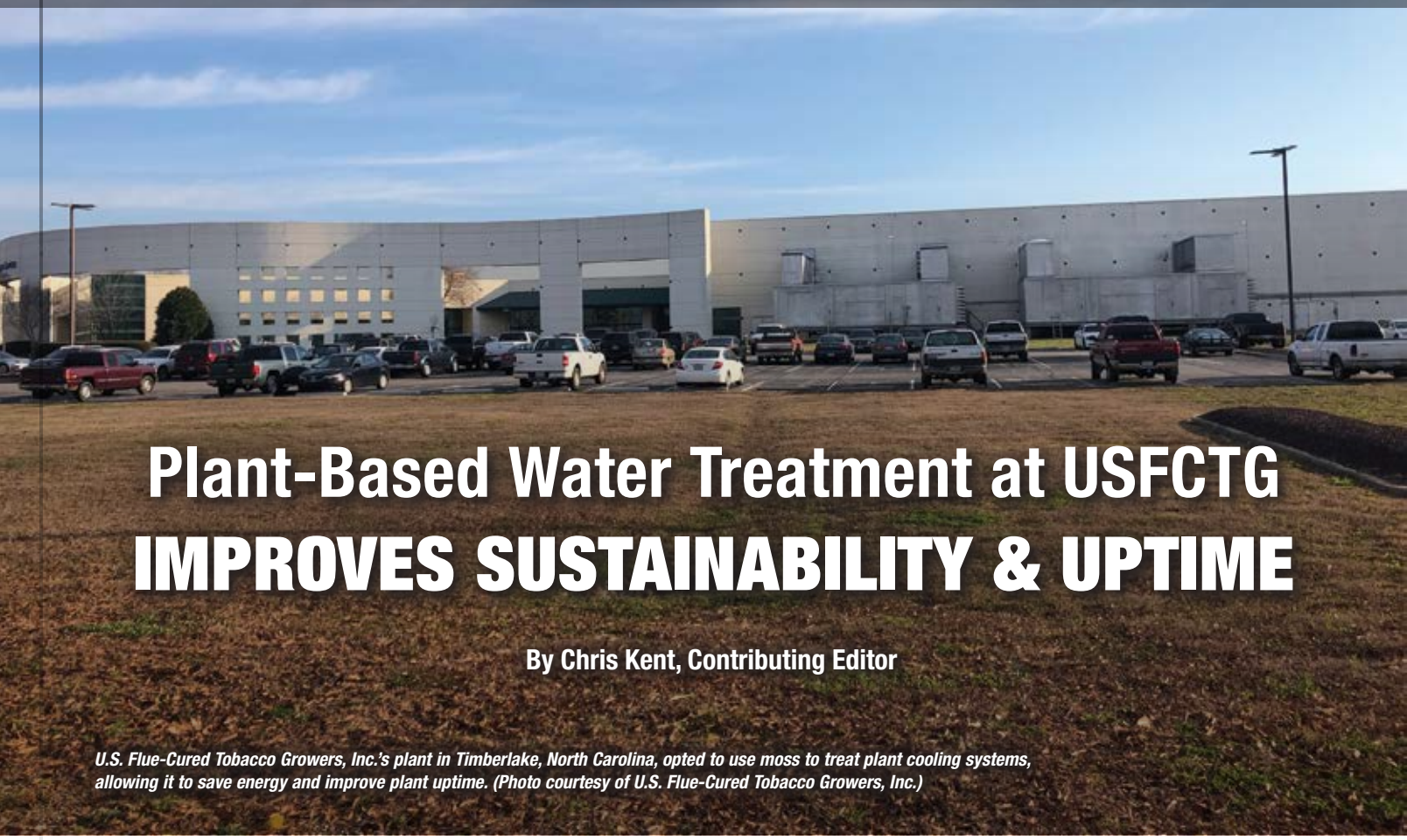
WATER TREATMENT & COOLING SYSTEM ASSESSMENTS



Plant-Based Water Treatment at USFCTG IMPROVES SUSTAINABILITY & UPTIME

By Chris Kent, Contributing Editor

U.S. Flue-Cured Tobacco Growers, Inc.'s plant in Timberlake, North Carolina, opted to use moss to treat plant cooling systems, allowing it to save energy and improve plant uptime. (Photo courtesy of U.S. Flue-Cured Tobacco Growers, Inc.)

For U.S. Flue-Cured Tobacco Growers, Inc. (USFCTG) sustainability is a guiding practice for tobacco production from seed to delivery. So when traditional chemical water treatment had proven problematic in air washers at its plant in Timberlake, North Carolina, the company thought outside the box for solutions to address a variety of issues while also supporting its sustainability goals.

The thinking led to a trial of ProMoss™, a unique-plant based material that has shown to be effective for water treatment in industrial process cooling systems. Conducted by Southeastern Laboratories, Inc. (SEL), the trial in an air washer demonstrated the natural product would serve as a better method for treating cooling water at the plant. As a result, USFCTG opted to use ProMoss instead of chemicals in all air washers at the plant, allowing it to save 41,500 gallons of water per year. Additionally, the alternative water treatment program improves air washer and plant uptime while reducing energy consumption.

Taking Pride in Sustainability

USFCTG's Timberlake operation processes tobacco and manufactures as much as eight billion cigarettes per year. The grower-owned cooperative and manufacturing subsidiary of U.S. Tobacco Cooperative Inc. (https://www.usleaf.com) is a Sustainable Tobacco Production program member that takes pride in balancing its range of tobacco production with soil and water conservation and appropriate use of agrochemicals.

"When you consider that it eliminates the need for chemicals for water treatment, conserves water and energy – and reduces utility costs – it's all we could have hoped for."

— Scotty Young, Facilities/Maintenance Manager, USFCTG

The plant in Timberlake spans 340,000 square feet, with an adjoining 150,000-square-foot warehouse. During the high season for production, which typically runs from late-August to late-January, 300 employees are involved in 24-hour production that runs three eight-hour shifts, and in lower periods running in two ten-hour shifts, four days a week employing 80-100 employees. The primary blending and cigarette operation runs year-round.

Flue-cured tobacco derives its name from a curing process introduced centuries ago in which tobacco sticks are hung from tier-poles in curing barns. The barns had flues that ran from externally fed fireboxes to heat-cure the tobacco without exposing it to smoke. Today, the curing process is carried out through fuel-generated heat to dry the product. While the plant primarily produces flue-cured tobacco, it also processes other forms of tobacco in its primary blending and cigarette department.

Air Washer Performance Critical to Product Quality

Key to production at the Timberlake operation are three air washer systems used to keep temperatures and humidity consistent throughout at the plant while removing particulates from the air.

"Air washers are used in different types of manufacturing operations, but they are particularly useful for our plant where scrubbing the air of particulates and managing humidity and temperature is extremely important to maintaining product quality," said Scotty Young, Facilities/ Maintenance Manager, USFCTG.

An air washer system operates by passing air returning from plant production areas through a dry filter media, and then through a wall of water created by a series of spray nozzles. The process captures particulate and gaseous impurities generated within the manufacturing process. Fine water droplets and excess atmospheric humidity are also captured and removed from the airflow within a series of eliminator blades as the air exits the washer water spray area. Conditioned air is then returned to production areas via a series of fans and ducts. Controls are used to adjust the level of spray to accurately control temperatures and maintain 60% Relative Humidity (RH) where used.

The air washers each incorporate individual water reservoirs and secondary heat exchangers and operate independently to serve different areas within the plant. The AC Corporation Model Z-92000 air washers include Unit No. 1, which is rated to supply 80,000 cubic feet per minute (cfm) of conditioned air to the primary blending storage. Units No. 2 and No. 4 are each rated to provide 130,000 cfm of conditioned air to the cigarette production department.

Three water-cooled chillers are used in conjunction with the air washers for comfort cooling, depending upon seasonal demands. They include a 1,250-ton Trane® chiller, along with a 370-ton McQuay unit and a 275-ton York® chiller. Three Marley® evaporative cooling towers supply the plant with process cooling water. Two towers are rated at 498-tons each, while the third is a 949-ton unit.

Chemical Water Treatment in Air Washers Falls Short

Though chemical treatment is a standard practice for treating air washers in the tobacco industry, it proved problematic for the plant. Challenges with chemical water treatment systems is not uncommon for air washer systems in tobacco and textile plants given the high level of organic particulates.

Until recently, USFCTG had used a mixture of oxidizing and non-oxidizing biocides, dispersants, and corrosion inhibitors in large amounts to effectively treat its air washers. The chemicals are used to keep bacteria levels in control, ensure clean surfaces, and provide corrosion protection.

Shown are three AC Corporation Model Z-92000 air washers at the tobacco plant. (Photo courtesy of U.S. Flue-Cured Tobacco Growers, Inc.)

PLANT-BASED WATER TREATMENT AT USFCTG IMPROVES SUSTAINABILITY & UPTIME

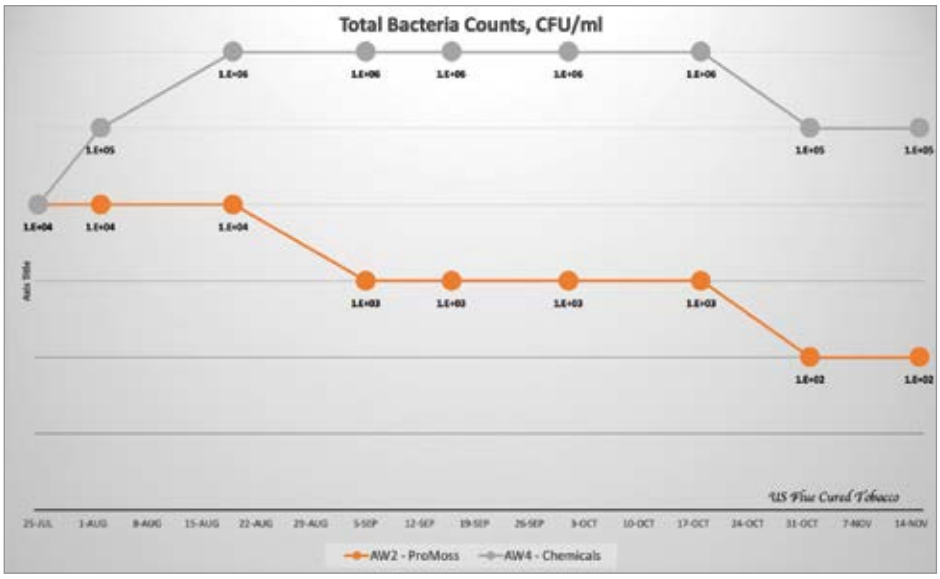
Process cooling water treatment is particularly challenging with tobacco production, however, due to elevated nitrogen levels and accelerated bacterial activity. Build-up of bio-slime masses on process cooling surfaces adversely affects the heat-transfer capabilities of the air washers – in addition to clogging spray nozzles.

While the use of chemicals proved somewhat effective at maintaining acceptable heat transfer within the air washers, it created a high level of air washer downtime and adversely impacted production. The problem stemmed from the need to use high biocide dosages to tame bacteria levels. Additionally, the plant needed to use a variety of organic dispersants to effectively break up slime masses. The use of high doses of chemicals, however, can create odor issues and lead to unworkable conditions for employees. The plant, in turn, needed to shut down the air washers with regularity for cleaning and maintenance.

The need to address odor issues often drove the need for the plant to halt production until the problem was resolved. Frequent cleaning of the air washers also required more consumption of water than normally needed, which also came with higher costs for electrical power and sewer water treatment. Additionally, the plant could not resume production until the air washers were reset and temperatures and humidity levels reached tier target setpoints.

All-Natural Water Treatment Solution Recommended

To address the issues with the air washers, the plant explored a number of water treatment options with SEL (https://www.selaboratories.com/), based in Goldsboro, North Carolina. SEL provides water treatment services, including all-natural water treatments and products, to a wide range of industrial, commercial, governmental, and institutional users.



Total bacterial counts were measured in the process cooling water of the air washers at the tobacco plant during the trial to compare the effectiveness of ProMoss (orange line) and chemical treatment (gray line) as measured in Colony-forming Units per Milliliter (CFU/ml). As shown, bacteria counts were consistently lower in the moss-treated air washer. (Chart courtesy of Southeastern Laboratories, Inc.)

SEL recommended a trial of ProMoss at the plant. ProMoss, manufactured by Creative Water Solutions (https://cwsnaturally.com/), Plymouth, Minnesota, is a plant-based alternative to chemical water treatment. It leverages unique biological properties of sphagnum moss, which is a plant that grows naturally in bogs in New Zealand and along the U.S.-Canada border. The moss has shown to be an effective method for inhibiting and removing organic contamination, as well as scaling and corrosion, in a wide range of process cooling applications.

SEL's Vice President of Field Operations Steve Chewning said the moss is well-suited to applications involving stressed air washer systems, such as the units at the USFCTG Timberlake plant.

"It's a natural solution that takes advantage of nature's chemistry, which makes it a viable green solution in systems like air washers that experience a high level of organic contamination," Chewning said.

Trial of Sphagnum Moss Proves Effective

SEL began a 90-day trial of the moss product in July 2019 in one of two air washers used to serve the plant's cigarette production department. It included a monthly dosage of four, 150-gram bags of ProMoss, followed by testing every two weeks to assess bacterial counts. The trial also measured water turbidity levels.

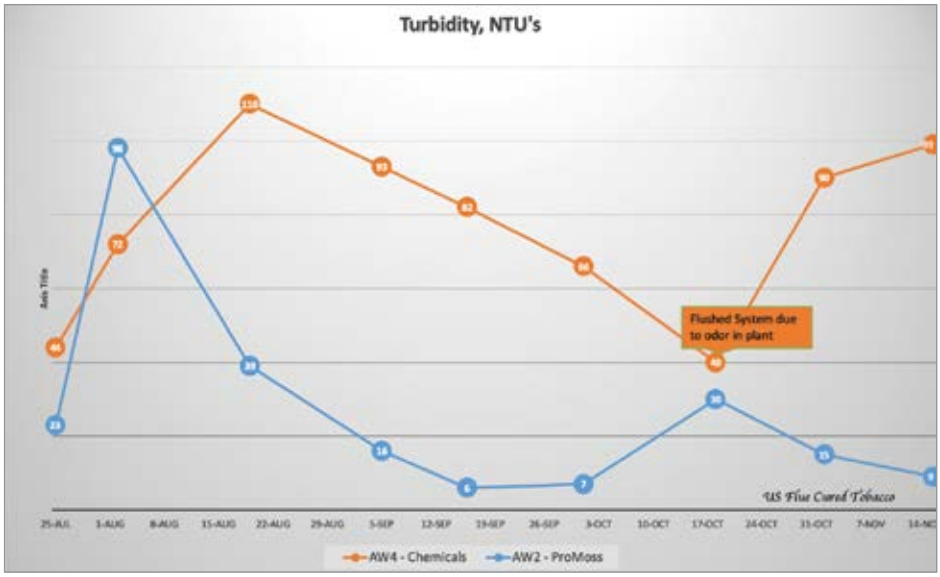
With the use of moss, the trial showed a bacteria counts were 100 to 1,000 times lower in the air washer process cooling water when compared with chemical treatment. Lower counts as well as visual observations indicated

that the moss was actively working to reduce organic contamination, which in turn, reduces biofouling of pipes and underwater surfaces.

The trial also showed the moss removed a higher level of suspended particulates when compared with the chemical treatment program, which resulted in much lower turbidity levels. Turbidity measurement is significant because water with higher turbidity increases biofouling of heat-exchange surfaces and promotes bacteria growth since suspended particulates feed bacteria. Turbidity levels in the trial washer were reduced by about 90% compared with the chemically treated washer.

The impact of ProMoss on the air washer was evident within one week of the first application, said Young.

"You could see noticeable improvement in water clarity immediately and within weeks you could actually see the bottom of the air washer sump," he said.



Turbidity levels were measured in the process cooling water of the air washers at the tobacco plant during the trial to compare the effectiveness of ProMoss (blue line) and chemical treatment (orange line) in removing suspended particulates. Measured as Nephelometric Turbidity Units (NTU's), the chart indicates turbidity decreased from levels near 100 NTU's to less than 10 NTU's in the moss-treated washer during the course of the trial, about ten times lower than the chemically treated air washer. (Chart courtesy of Southeastern Laboratories, Inc.)

Improved Water Consumption, Costs and Uptime

Based on the successful trial, the plant began using the moss on all three air washers in December of 2019. Doing so has allowed the plant to:

- Lower water consumption associated with cleaning and maintenance of air washers by 66% from 63,000 to 21,500 gallons annually.
- Eliminate the need for biocides and corrosion inhibitors to treat the process cooling water used in air washers.
- Reduce downtime for air washer cleaning and maintenance units by 75%. Now, air washers are cleaned every 12-16 weeks, instead of weekly.
- Reduce energy costs associated with the air washers by approximately 10% per year since it no longer needs to power chemical supply pumps.
- Save as much as $14,000 per year in water utility and sewer treatment costs.

In addition to using moss for its air washers, USFCTG recently decided to use it to treat water in its cooling towers – once again – replacing the use of chemicals.

"When I first learned about the use of moss for water treatment, I thought it sounded too good to be true," Young said. "However, it's proven to be effective in its ability to keep our air washers up and running, while also supporting our sustainability goals. When you consider that it eliminates the need for chemicals for water treatment, conserves water and energy – and reduces utility costs – it's all we could have hoped for."

Young added that employee safety and the work environment were also key factors in making the switch over to ProMoss. USFCTG is proud of the result of cleaner, odorless air and the chemical free environment – fostering a safer and more enjoyable environment. BP

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COOLING TOWERS & CHILLERS

CENTRAL CHILLER PLANT UPGRADE Helps Plastics Extruder Grow

By Mike Grennier, Chiller & Cooling Best Practices Magazine

To keep pace with continued growth and eliminate maintenance issues with existing chillers nearing their end of life, a plastics extruder in the Midwest upgraded its central chiller plant with chillers from Chase Cooling Systems.

➤ Over decades, a well-known plastics extruder in the Midwest built a solid reputation for delivering high quality, high-performance polymers – which in turn – allowed its customers to produce products on time and on budget. The company's reputation is based not only on a proven track record, but in making sound investments in plant operations, such as the decision to overhaul its process cooling system when the time was right.

By replacing chillers nearing their end of life with chillers from Chase Cooling Systems, the company has kept pace with increased production and a growing list of satisfied customers.

A Leader in High-performance Polymers

At the company's production plant employees manufacture a complete range of engineered, high-performance polymers. At the heart of the operation are numerous extrusion lines and related equipment that operate 24 hours a day, five days per week to produce and

"The installation of the new chiller system went smoothly and allowed the plastics extruder to maintain production at all times – and all issues with chiller maintenance are ancient history."

ship as much as five million pounds of high-performance polymer pellets each month.

The process of producing pellets begins when the rotating screw on each extruder accepts a carefully calibrated mix of thermoplastic materials, as well as additives, from a hopper and pushes the mixture into the extruder's barrel. Inside the barrel, material is heated and cooled to the proper melt temperature, which ranges from 400 to 500˚F depending on the materials involved. The screw then forces the material through a die to create a continuous strand of plastic resin, which is then cooled as it travels through a water bath. At the opposite end of the extrusion line, the strands of resin are dried and cut into pellets for shipment.

Cooling Temperatures Vital to Extrusion Process

Chilled water supplied to the extrusion lines is vital to production and product quality goals. Yet the aging central chiller plant was unable to keep pace with demand for chilled water and experienced maintenance issues, which led to plans for a chiller system upgrade.

The original chiller plant system featured four air-cooled chillers used to supply chilled water at 45˚F to the extruders and other production equipment. Three of the original chillers, with a cooling capacity of 30 tons each, were located outside the facility. The system also included a fourth chiller, rated to provide 160 tons of cooling. The fourth unit is a split-system with the evaporator installed inside the plant and the condensing unit, which includes the compressor, condenser, and fans, located outside the building. In all, the original chiller plant system provided approximately 250 tons of cooling capacity.

Shown are three Chase Cooling Systems CWB Chillers recently installed at an extrusion plant in the Midwest. Each air-cooled chiller provides 115 tons of cooling.

The chiller system also features a cold- and warm-water tank, each of which has a capacity of 3,000 gallons. The system's two Variable Speed Drive (VFD) pumps feed warm water from the warm water tank to the chillers at 700 gallons per minute (gpm) and 30 pounds per square inch (psi). The system also includes two separate process pumps to supply chilled water from the cold water tank to production areas at 1,500 gpm and 40 psi.

During production, chilled water cools the barrel of each extruder to keep the melt temperature of base materials and additives at precise temperatures. The melt temperature must be maintained within 10 to 20 degrees to ensure the integrity of the extruded material. Chilled water is also used for each extruder's water bath.

The plant's goal is to avoid adding any extra heat to the heat sensitive materials as soon as they reach the melt point in the extruder barrel. If the temperature gets outside the targeted melt temperature even a little bit it can start to negatively impact the physical properties of the material. The need to carefully control the melt point places a premium on reliable chilled water.

Growth Outpaces Existing Chiller Capacity

As the plant continued to grow, the need for more chilled water to meet increased production goals outpaced the capacity of the original chillers installed at the plant years ago. Additionally, one or more of the aging 30-ton chillers needed to be taken offline all too frequently for routine maintenance and repairs.

The situation led to scheduling issues with production. As an example, chillers weren't able to deliver the volume of chilled water at the required temperature during peak production. Additionally the operation experienced unplanned repairs. As a result, the plant need to make adjustments to production, such as slowing the pounds per hour of material extruded – or if that wasn't possible – shutting down an extrusion line to

CENTRAL CHILLER PLANT UPGRADE HELPS PLASTICS EXTRUDER GROW

Customer Relationships, Expertise Fuel CASCO USA's Success

CASCO USA is a distributor and service provider of air compressors, industrial chillers, pumps, blowers, and vacuum products. Headquartered in Washington, Pennsylvania, about 25 miles south of Pittsburgh, CASCO USA has additional offices in Cleveland, Ohio; Erie, Pennsylvania; Williamsport, Pennsylvania; and Detroit, Michigan. The offices serve customers across Michigan, Ohio, West Virginia, Pennsylvania, and southern New York.

In business since 1991, CASCO USA established a strong presence in the region with a reputation for delivering quality products and services. Whether designing a compressed air system, creating a process cooling system, or performing system maintenance, CASCO USA has the knowledge businesses need to improve their processes. Instead of simply shipping a piece of equipment and moving on, CASCO USA strives to build ongoing relationships with customers that continue years after the initial installation.

Another way CASCO USA differentiates itself is with its technical expertise. With a full fifth of the company having engineering degrees and backgrounds, precision of details is a clear strength. Solutions offered are carefully examined and calculated to meet specifications, ensuring it supports the required system demand. Additionally, the company's employees regularly attend industry events and factory trainings to stay up to date on the most recent engineering information and industry best practices.

Knowledge is a core tenant at CASCO USA. Everything from the simplest parts request to the most complex system design is thoroughly vetted. Before providing any solution to a customer, employees verify it is a truly workable solution. Taking a little extra time and care up front ensures the task is done right is a philosophy that has become a key component of the company's success. At the same time, maintenance and troubleshooting service is available for almost all brands and makes of compressors and chillers.

The in-house sales team can ship a wide selection of parts from many manufacturers almost anywhere. The most common parts are even stocked for quick turnaround time. When it comes to solutions, CASCO USA offers a wide variety of brands, such as Chase Chillers, Kaeser Compressors, Champion, Yamada Pumps, Sauer Compressors, and more.

For more information, visit https://cascousa.com/.

The team at CASCO USA offers air compressors, industrial chillers, pumps, blowers, and vacuum products, along with strong technical expertise and quality service.

keep the others operating at the proper melt temperatures.

The aging chillers also became maintenance-intensive, which took time away from a small maintenance staff with other responsibilities. During the warmest summer months, there were also times when a chiller would trip off because it reached its cooling capacity limit.

Knowing it needed to upgrade its central chiller system, the company set out to replace the aging chillers with a solution that would allow it to meet production and quality goals, as well as plans for continued growth.

CASCO USA Upgrades Plant Chillers

After evaluating a variety of process cooling solutions, the extruder chose to work closely with CASCO USA to upgrade its central plant chiller system with three air-cooled CWB chillers from Chase Cooling Systems. The company has a long-standing relationship with CASCO USA, which is a supplier of process cooling equipment, as well as air compressors and blower and vacuum systems. (See sidebar article about CASCO USA.)

The team at CASCO USA installed the CWB chillers in 2019 in place of the two aging, 30-ton chillers located outside the production facility. The installation also included new Crane-Deming 350 gpm pumps. The new chillers were installed without the need to replace water tanks, or the need to retrofit piping.

Each CWB chiller at the plant is rated to deliver 115 tons of chilled water for a total of 345 tons of cooling capacity. Each CWB chiller includes a variable speed condenser fan; tandem, hermetic scroll refrigeration compressors; and stainless steel brazed plate evaporators. In addition, each chiller is designed with a microprocessor controller

with a user interface that features multi-line display to clearly indicate operating pressures and alarms. The units also use environmentally friendly R-410A refrigerant, which eliminates the use of outdated R-22 refrigerant in the original 30-ton chillers.

To maintain production throughout the upgrade project, the CASCO USA team took the first 30-ton chiller offline and replaced it with one of the new chillers. Later, it shut down the remaining 30-ton chiller and 90-ton chiller and installed the two remaining Chase Chillers.

During normal production today, the three new chillers operate in parallel at 50 to 60 percent capacity each to meet the needs of all eight extrusion lines, as well as other production equipment that includes a 75-horsepower (hp) water-cooled, rotary screw air compressor. The water-cooled air compressor serves as a backup to a newly installed 100-hp air cooled rotary screw air compressor that CASCO USA also supplied and installed. The plant also uses its existing 160-ton split-system chiller as a backup chiller, providing additional redundancy for cooling water if needed.

Focusing on Optimal Production, Growth

The installation of the new chiller system went smoothly and allowed the plastics extruder to maintain production at all times – and all issues with chiller maintenance are ancient history. Most importantly, the upgraded central chiller system provides more than enough cooling capacity. As such, the company is able to focus on meeting production goals – and not on adapting its production schedule based on the limitations of the original chiller system. BP

All photos courtesy of CASCO USA.

To read similar ***Chiller Technology*** articles, visit https://coolingbestpractices.com /technology/chillers.

WATER TREATMENT & COOLING SYSTEM ASSESSMENTS

Water Screen Maintenance Improves COOLING TOWER EFFICIENCY

By Jon Southworth, Cambridge Water Screen Systems

Field-erected evaporative "wet" cooling towers, combined with heat exchangers, are an economical and efficient method to dissipate large heat loads at oil and gas refineries and chemical processing plants – as long as they're free of harmful debris. Yet many cooling towers at these facilities are highly susceptible to poor performance and costly downtime due to problems associated with debris buildup and potential for debris to pass by traditional stationary water screens during the cleaning process, clogging heat exchangers.

Fortunately, traveling water screens systems used in place of stationary water screens give plants the ability to more efficiently and safely remove debris, often saving the operation hundreds of thousands of dollars in lost production and maintenance costs.

The Importance of Cooling Tower Efficiency

Evaporative cooling towers encountering issues with debris and found at chemical plants and refineries include counterflow and crossflow configurations, as well as natural-draft, induced-draft, and forced-draft towers.

A wet cooling tower uses an evaporation process in combination with shell-and-tube heat exchangers to provide cooling water to processes within the plant. The tower also typically includes one or more water screens installed in the cold-water basin at the bottom of the tower. The screens filter out large debris, in turn, protecting pumps, heat exchangers and downstream systems

"By replacing the stationary screen system with the traveling water screen system, the plant estimated it saved over $800,00 during a five-year period by simply reducing the number of required maintenance outages."

— Jon Southworth, Cambridge Water Screen Systems

by filtering out debris that finds its way into the cold-water basin.

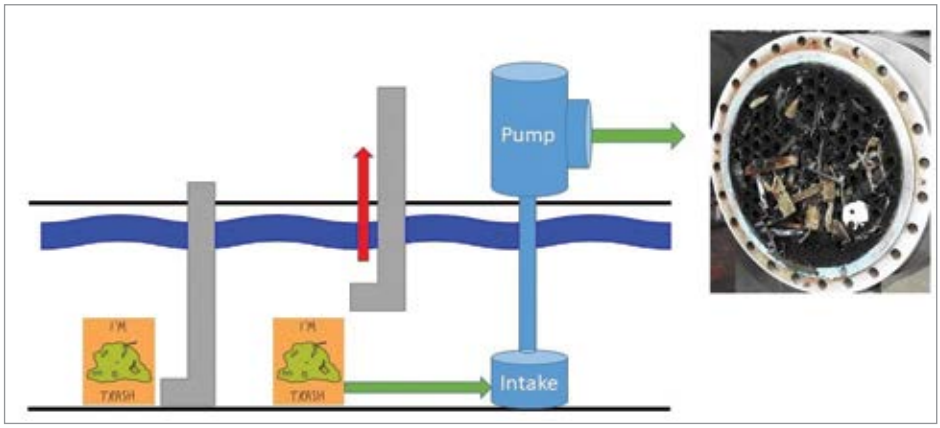
The efficiency of cooling towers is critical to maintaining production given the large-scale heat transfer necessary to provide cooling water to the plant. Of the utmost importance is optimal performance of the cooling process within the heat exchanger since it plays a vital role in the overall tower cooling cycle.

Problems Add up with Clogged Heat Exchangers

With a shell and tube heat exchanger, cold water flows through a set of metal tubes while a second heat transfer fluid passes through a sealed shell surrounding them, allowing heat to pass from one fluid to another. If the cooling water from the cold-water basin contains debris that is larger in diameter than the diameter of the heat exchanger tubes used for cooling water circulation, the debris can obstruct the flow of the cooling water and diminish the device's ability to transfer heat. The volume and type of debris in the water will determine the severity of the problem. As debris continues to build up and obstruct the flow rate of cooling water through the heat exchangers, the more severe the problem.

The volume and type of debris entering a cooling tower basin is directly impacted by the age and condition of the cooling tower. Towers with the highest risk are aging towers that are 15 or more years old, as well as damaged towers. In aging or damaged cooling towers, larger fragments of wood, plastic or other material are more prone to come loose and fall into the cold-water basin.

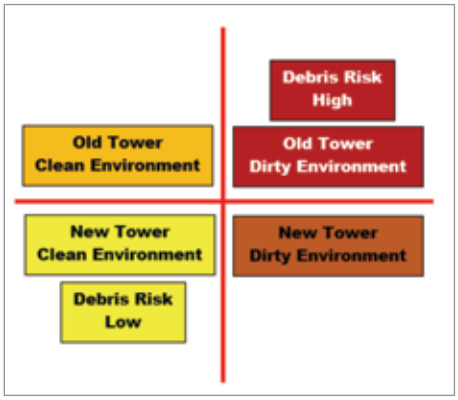
Also impacting the severity of the debris problem is the environment around the tower. Debris problems are the result of a variety of debris sources, such as cotton wood tree fuzz, leaves, bugs, and pieces of trash. It's not uncommon for natural debris to be pulled into the cold-water basin by the force of the fans located at the top of induced- and forced-draft towers. New towers operating in clean environments are less likely to encounter problems with debris.



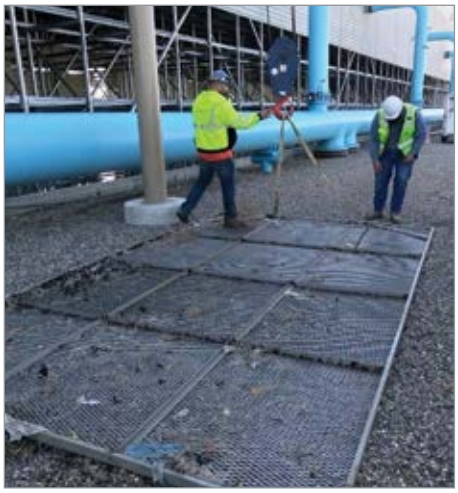
When cleaning stationary water screens on cooling towers, debris is commonly pulled into the tower's recycling pump and on to the tower's heat exchanger.

Whether the source of debris is from the tower or the environment, the severity of the problem impacts the speed in which the efficiency of the cooling system degrades. In turn, the faster cooling system efficiency degrades the more the problems associated with manufacturing processes accelerate. Problems can range from higher cooling tower power usage to compensate for reduced flow rate to the need to slow production to account for a "problem" in processing. In extreme cases, debris can lead to shut the tower down to clean the heat exchangers.

The costs associated with these problems at refineries and chemical processing plants can range from tens of thousands to hundreds of thousands of dollars per day, depending on the type of facility involved and the processes being cooled.



The risk posed by debris in cooling towers varies based on the age of the cooling tower and the cleanliness of environment in which it operates.



The task of cleaning stationary water screens in cooling towers requires a maintenance crew and lift equipment.

WATER SCREEN MAINTENANCE IMPROVES COOLING TOWER EFFICIENCY

Cleaning: A Disadvantage of Stationary Water Screens

For decades, plants have used stationary water screens to filter debris from cooling tower water. However, these types of screens are not without disadvantages – all of which are tied to the need to periodically clean the screens and the cleaning process itself. The disadvantages can easily offset the presumed lower upfront cost for the stationary screens.

A key disadvantage of stationary water screens is their ability to effectively capture and remove harmful debris during the cleaning process. As the screens are lifted out of the water, large pieces of debris that had been held to the screen by the force of the water running through it typically drop off the screen due to gravity. Additionally, as the debris gathers at the bottom of the cold-water basin it will be pulled back toward the recycling pump due to the undertow effect that occurs as a result of the screens being lifted. A two-screen system, along with debris baskets installed on the bottom of the screens, can help reduce the amount of debris that passes by the screens. However, harmful debris often slips through to the recycling pumps and on to the heat exchanger in a heavy-debris environment.

As the volume of larger debris continues to pass under the stationary screens during cleaning, it will continue to obstruct the cold-water tubes and therefore the cooling water flow rate through the heat exchangers. As the cooling water flow rate decreases, so will the efficiency of the cooling system.

Stationary water screens also present a challenging maintenance task. Each time debris builds up on the screens, they must be lifted out of the water and moved to an area to be cleaned. Depending on the number and size of the water screens installed, the cleaning process can be resource-intensive since it requires a crew of people and equipment to lift the screens. It's also not without risk of personal injury since the screens are cumbersome and heavy and the process typically involves the use of a crane or other lifting devices. Stationary screens can range in size from three feet by three feet on the small end to over 15 feet wide and over 25 feet tall on the large end. The size and number of screens used in any given tower varies by application.

There is also a direct correlation between the volume of debris in the water to maintenance costs associated with removing and cleaning the stationary screens. The higher the volume of debris, the more frequently the screens need to be cleaned, which in turn, increases the use of resources and maintenance costs.

Traveling Water Screens Mechanize the Cleaning Process

An alternative to a stationary water screen is traveling water screen, which essentially acts as a conveyor to mechanically remove debris from the cooling tower's cold-water basin without the need for a crew to perform this essential task. Traveling water screens can be used as a replacement for stationary screens on existing towers, if not specified on new towers.

As shown in Figure 1, the basic components of a self-contained traveling water screen include a rotating vertical mesh belt (or screen), spray bar, debris trough, gearbox, and an electric motor or manual device, such as an electric drill on the gearbox or a hand crank, to rotate the screen. The system can be installed using the same guide channels anchored or embedded to the walls of the basin used to install and remove the stationary screens. The rotating belt extends to the bottom of the cold-water basin while the remaining components remain above the water inside the basin. There is little, and often no need, to modify the cold-water basin structure when replacing stationary screens with a traveling screen as long as it is a "belt-style" system as described in this article. "Basket-style" traveling screens, which are typically found on natural waterways, may not be a practical option due to their large installation profile.

If using an electric motor, there are several options ranging from an on/off switch to a timer to a system that uses a differential sensor that will automatically turn on the system once debris builds up on the screen and produces a pre-determined amount of head-loss.

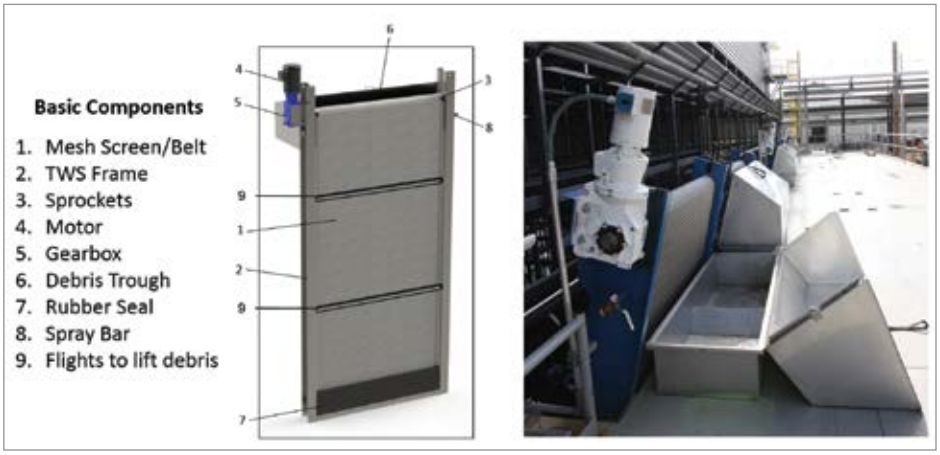


Figure 1.

As the traveling screen's mesh belt rotates, a series of horizontal flights built into the mesh belt, lift debris from the cold-water basin to the trough at the top of the device. There, a series of nozzles on the spray bar spray water on the belt, washing off debris and depositing it into the trough. The spray water is regularly filtered back into the cold-water basin through a drain. Debris is then periodically scooped out of the trough.

Once installed, a traveling water screen requires one person to operate the device and clean out the debris trough – eliminating the need to tie up a crew and lifting equipment.

When factoring in the costs associated with stationary screens, including man hours and the cost for a crane, or a chain block and tackle hoist, there is often little difference between the cost for a stationary screen and a traveling water screen. Decision-makers must also factor in the safety risks of cleaning large stationary screens.

Another crucial factor is the impact of cooling on production and the return on investment for a traveling water screen system. As an example, due to a large volume of debris passing by their stationary waster screens, debris obstructed numerous heat exchangers at geothermal plant resulting in a 7% decline in power generation in less than twelve months. In addition, the plant planned for maintenance outages every two years. However, the debris problem forced the facility into an annual outage which costs the plant over $300,000 in lost production and maintenance costs for a vendor to clean the debris from the heat exchangers.

By replacing the stationary screen system with the traveling water screen system, the plant estimated it saved over $800,00 during a five-year period by simply reducing the number of required maintenance outages.

The Goal: Cost-effective and Efficient Process Cooling

When used as part of an ongoing program to ensure cooling water is properly filtered and free of debris, traveling water screens are worth consideration when the goal is to ensure cooling towers cost-effectively and efficiently deliver process cooling needed at all times. BP

About the Author

Jon Southworth is the Business Development Manager for Cambridge Water Screen Systems and oversees U.S. and international sales and marketing for the water screen system market. A former United States Army officer, he has over 25 years of experience in the industrial, waste management and recycling and software industries. Email: jsouthworth@cambridge-intl.com.

About Cambridge Water Screen Systems

Located in Maryland, Cambridge Water Screen Systems is a Rexnord brand. We are a trusted leader in Professional Engineer (PE) certified design and United States manufacturing of new and replacement water screen systems for industrial, municipal and agricultural applications. We offer a wide range of custom traveling water screens, stationary water screens, trash racks, bar screens and stop logs for manmade (i.e., cooling towers) and natural (i.e. river, lakes, etc.) water sources. To learn more about Cambridge Water Screen Systems, visit https://cambridge-es.com/water-screen-systems.

All photos courtesy of Cambridge Water Screen Systems.

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