The CTI program includes an Owner/Operator Seminar (w/lunch) on Tuesday from 10:00a - 2:00p. All Owner/Operators (only) are invited. Be sure to mark it on your registration form so we'll have a close count.

The very popular Ask The Expert session will be held Tuesday from 2:00p - 4:30p. Come prepared with your questions for our panel of experts. We will have folks from all the standing committees ready to support your questions with good qualified answers.

Then on Wednesday from 8:00a - 12:00p will be the Education Program Session with four different topics. Information on this program is on page 3 of this newsletter.

The CTI Program Committee has put together a program that will offer the best opportunity to inform, educate and expand your knowledge about our industry. We hope you come prepared to take full advantage of everything we have to offer you. A great location, outstanding food, entertainment, and a conference that will give back to the membership what you want: “Information”.

Helen Cerra, the CTI Committee staff, and I invite and welcome you to the 2020 Annual Conference and meeting. We all look forward to seeing you in Houston, Texas.

Phil Kiser,
2020 CTI Program Chairman

And last, but certainly not least, this 2020 conference will mark the 70th anniversary of the CTI! A small group of individuals established CTI in 1950, and through the years, we have grown in scope and membership to become the leading international organization in cooling technology knowledge and cooling tower certification. We invite you to the 2020 conference to meet new friends, reminisce, and celebrate with the CTI!

Respectfully,

CTI President 2018 - 2019

From the President

New places, new faces! This past July, our 2019 Committee Workshop was held for the first time at the stately Peabody Hotel in Memphis, Tennessee. We welcomed many first-time attendees and all were warmly greeted by the resident Peabody ducks which march from their penthouse on the roof to the decorative fountain in the Lobby each day. Watching their procession provided an entertaining break during our productive committee work. The Peabody ducks are obviously a well-trained and dedicated team!

The ducks were not the only dedicated inhabitants at the hotel that week. We appreciate everyone who rose early to participate in the morning committee meetings, where your commitment maintains the success of the CTI’s mission. Thanks go out to Vicky, Angie, Kelli, and Andrew for organizing not only an overall successful workshop, but also a great evening of dinner and live music and dancing on the roof of the Peabody!

At the summer workshop, we advanced the development of two new test codes to address industry needs – a thermal performance test code for adiabatic cooling equipment and STD-204, sound certification. GDL-159, a Legionellosis Guideline specifically for evaporative heat rejection equipment, is headed to ad hoc review with hopes of publication in early 2020. The Products and Materials Certification program is also gaining traction as we are in the process of reviewing the testing lab proposals.

I want to take this opportunity to sincerely thank the three outgoing Board of Director members for their contributions to CTI: Peter Elliott, ChemTreat, Kent Martens, SPX, and Janet Stout, Special Pathogens Laboratory. We will soon be electing three new directors and a new president as my term also comes to an end at the Annual Conference in February. As I have stated above, the success of the CTI is dependent on our members’ commitment to doing the work necessary to keep the organization progressing into the future. If you have interest in getting more involved, please reach out to me, the committee chairs, or CTI staff.

I want to take this opportunity to express my deepest sympathy to the family of Nick Stich, who recently passed away. Nick, along with Tom Weast, founded Cooling Tower Test Associates in Kansas City. His thermal test work spanned many U.S. and international locations. Nick attended the summer workshop in Memphis and we will all miss Nick’s friendship as well as his contributions to the industry.

Please join us for the 2020 Annual Conference at the Westin Galleria in Houston February 9-12, 2020. Phil Kiser and the Program Committee have worked hard on a program which is very much Owner/Operator focused. In addition to the Owner/Operator luncheon on Tuesday, check out the Water Treating Panel Discussion and the Education Seminar. We still have some table tops available to reserve during the Exhibition session scheduled for Tuesday evening which is a great opportunity to promote your company’s products and services to the CTI community.

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* Thirty-six (36) month standard warranty applies, refer to standard T&C’s.
Session 1: Water Treatment and Water Chemistry
This topic includes water treatment chemicals, service, feed and monitoring equipment as well as other such equipment as cooling towers, sidestream filters and common replacement components such as fill and nozzles. It will be of interest to owners and operators of cooling towers who have to purchase chemicals, service and repair and replace their equipment, to suppliers who want to know how end users think about these issues, and to consultants who want to know how to serve their clients by providing this service.

Session 2: FM Approvals 4930 for Cooling Towers
FM Approvals 4930 standard states Approval requirements for cooling towers and cooling tower components. Cooling towers or cooling tower components that meet the requirements of this standard do not need automatic sprinkler protection. This standard sets the requirements for cooling towers constructed with combustible and non-combustible components. Typical combustible components may include, but are not limited to, structural carrying/support members, fill, drift eliminators, louvers, fan, fan deck, piping, enclosure walls or partition walls.

Session 3: CTI Certification Programs
STD-201: This Standard sets forth a program whereby the CTI will certify that all models of a line of evaporative heat rejection equipment offered for sale by a specific Manufacturer will perform thermally in accordance with the Manufacturer’s published ratings. It applies to Mechanical Draft Evaporative Heat Rejection Equipment such as Cooling Towers, Closed Circuit Coolers and Evaporative Refrigerant Condensers where the thermal capacity is selected from published ratings.

STD-202: It is CTI’s intent to foster and promote the benefits to the owner/operator of the equipment of thermal performance acceptance testing of water cooling towers to encourage custom tower capacity equal to or greater than 100%. This Standard sets forth a voluntary program wherein CTI will publish measurements of the thermal performance test history of participating tower manufacturers (PM) by utilizing field-testing of custom cooling towers within its licensed thermal testing program.

STD-204 (under development): This Standard sets forth a program whereby the CTI will certify that all models of a line of evaporative heat rejection equipment offered for sale by a specific Manufacturer, and thermally certified under the CTI STD-201 program, will have sound pressure levels that conform to the Manufacturer’s published sound pressure data.

Session 4: Overview of Technical Specifications to Purchase Evaporative Cooling Towers and Air-Cooled Steam Condensers
- Sources of information and assistance to develop a technical specification,
- Scope of work,
- Vendor qualification,
- Project timeline: bidding, selection of supplier, contract negotiations, deliverables, procurement, construction & installation, startup & commissioning, testing,
- Responsibilities during engineering, procurement, construction & installation, startup & commissioning, testing,
- Guarantees, corrective actions and/or penalties for non-conformance

Please attend the Cooling Technology Institute (CTI) Owner/Operator Session and Lunch at the 2020 CTI Annual Conference in Houston. The Council is comprised of owner/operators that are responsible for cooling towers, associated equipment as well as water treatment for the cooling systems at their facilities. This is an opportunity for owner/operators to hear an informative presentation from recognized experts in the industry and talk with their peers about issues they are having and share lessons learned as well as best practices developed through experience. All those with an Owner/Operator ribbon at the Conference are welcome and encouraged to attend.

This year’s Council will feature one technical presentation followed by an owner/operator-only open forum discussion (no suppliers or manufacturers present). The presentation this year will illustrate the capabilities of the CTI Toolkit; a suite of cooling tower applications indispensable to anyone responsible for the peak performance of cooling towers. Our technical presentation will be presented by Rich Aull, Cooling Tower Consulting.

The CTI Toolkit
- Predicts off-design performance
- Evaluates cooling tower performance
- Produces performance curves from field test data

The open discussion following the presentation is a great opportunity for owner/operators to cultivate relationships amongst each other as well as to have a candid discussion about their ongoing operations, problems and solutions. Come prepared to share thoughts and experiences on topics ranging from performance monitoring, certifying cooling towers, water quality, plume abatement, and/or vibration issues. Be sure to sign up and come enjoy the benefits of being an active participant in this Council!

Owner/Operator Chair,
Ian Horne

Technical Session Presented by Rich Aull (Richard Aull Cooling Tower Consulting, LLC)

Richard J. Aull, PE is an expert in cooling tower thermal design, performance rating and analysis with 40 years experience in the industry.

Rich is active in the Cooling Technology Institute (CTI), having served as a board member and Vice Chair of the Performance & Technology (P&T) Committee and is currently serving as vice chair of the Software Task Group and vice chair of the Multi-Agency Testing Committee. In addition, he is a voting member of various P&T standards development task groups. He has published technical papers and conducted seminars on a variety of cooling tower topics for the Cooling Technology Institute, Electric Power Research Institute, International Water Conference, IAHR Conference on Cooling Towers and Air-Cooled Heat Exchangers, India’s NTPC’s India Power Station O&O-M Conference, NTPC’s Global Energy Summit, and the American Society of Mechanical Engineers.

Rich received his B.S. and M.S. degrees in mechanical engineering from the New Jersey Institute of Technology specializing in thermodynamics, fluid flow and heat transfer and is a registered Professional Engineer in the Commonwealth of Pennsylvania.
The Water Treating Committee has been working on a draft document (WTG-161) outlining best practices for water treatment performance in evaporative cooling water systems, and we are nearing ad hoc review of the document.

In order to get an end user perspective on the proposed guideline, we are pleased to host a panel discussion with prominent end user companies. The panelists will give their evaluation of the proposed best practices and offer recommendations for editing the document going forward. There will be plenty of open discussion from the audience as well during the panel discussion. Please join us for a most interesting panel discussion.

Best Regards,
Jack Bland, Moderator
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**CALL FOR PAPERS**

Be a part of next year’s program by submitting a paper to be presented at the 2021 CTI Annual Conference.

**New Orleans, LA**
**February 7-11, 2021.**

Abstract forms can be found online at [www.cti.org](http://www.cti.org) and submitted for approval by the program committee. A schedule of deadlines for authors as well as a speaker’s manual and other documentation will be available later in 2020.

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COMMITTEE AGENDAS

Below are the agendas of the CTI standing committees.

Performance & Technology


I. Call to Order/Announcements
II. Introduction of Attendees
III. Task Group Reports & Schedule Review
   • STD-202 Publication - Paul Lindahl
   • PFM-143 Airflow Testing – Sander Venema
   • ATC-140 Isokinetic Drift Measurement Test Code for Water Cooling Tower – Chris Lazenby
   • ATC-105 Acceptance Test Code Cooling Towers – Larry Burdick
   • ATC-105S Acceptance Test Code, Closed Circuit Coolers- Hussnain Yaser
   • Acceptance Test Code for Adiabatic Equipment – Jennifer Hamilton
   • ATC-128 Sound Test Code – Larry Burdick
   • Water Usage and Measurement Task Force – J. P. Libert
   • STD-146 Standard for Water Flow Measurement – David Wheeler
   • STD-204 Sound Certification Task Force – Doug Randall
   • STD-201 Thermal Certification - Jennifer Hamilton
   • ATC-150 Plume Abatement Test Code – Jared Medlen
   • Cooling Tower Manual Ch. – Intro to Thermal Design - J. P. Libert
   • Cooling Tower Manual Ch. 3 – Performance Variables – Rich Aull
IV. New Business
V. Adjourn

Engineering Standards & Maintenance


I. Minutes for Summer 2019 ES&M
II. Lead Task Group Chair Reports

Wood, Metal, and Concrete Materials Task Group [Bill Howard]
   • ESG-166 Recommended Guidelines for Fire Partitions - Tom Kline, In work. Updates will be incorporated.
   • The various wood standards are due to be reviewed and volunteers are needed.

Mechanical and Electrical Task Group [Craig Burris]
   • Chapter 11 – Electrical Components, James Blake - In work. Need outside electrical contractor involved on several items.
   • Chapter 10 Mechanical Components, Craig Burris – In work, may move some chapters to other documents. Fan section needs an update.
   • ESG-151 VFD Application Guidelines, Craig Burris – In work

FRP and Plastics Task Group [Jamie Bland]
   • 3STD-137 Fiberglass Pultruded Structural Products, Ken Mortensen, Bhyrav Mutnuri – revision to new ASCE Fiberglass Code.
   • STD-136 Thermoplastic Material for Fill, Chris Bowman and Ken Mortensen – Polymer properties in discussion.
   • ESG-152 Structural Design for FRP Components – Tom Toth, Moisture/ temp/immersion table will finalize.
   • ESG-164 on Thermoplastic Fill, Nina Woicke – Document divided into three parts: Mechanical, Fire, and UV, see 170, 171, and 172, below.
   • STD-170 UV Testing - Fill, Nina Woicke – In work on protocol.
   • STD-171 Mechanical Testing - Fill, Nina Woicke – In work on protocol. Looking for input on hanging and splash bar testing.
   • STD-172 Fire Testing – Fill, Nina Woicke – Agreed on protocol. Review and start with preliminary testing.
   • Information, R Seismic Factor, Bill Howard, Tom Toth– Update on the status of the new LRFD code. Anticipated LRFD approval first Quarter 2020. Looking into test facilities for shake table. Jim Harris at next Meeting. Need ideas for source of $300,000 to $500,000 cost.
   • New FRP Life Extension- adding this to Chapter 1.
   • STD-124 Fan Stack Material Standard, Tom Toth – In review.

Tower Operations Task Group [Phillip Poll]
   • Chapter 1, Cooling Tower Operations, Dave Staat and Brian Lesniak - in review.
   • ESG-138 Long-term Storage of Cooling Towers, John Ahern – Need some info from the gear box manufacturers to finalize.
   • Chapter 13 Inspection of Cooling Towers, Dave Staat, Ethan Chestnut – Sections are being added and reviewed.

Hazard & Environmental Protection Systems Task Group [James Blake]
   • GDL-159 Legionella, Ken Mortensen and others – To ADHOC.
   • ESG-162 Cleaning Cooling Towers, Phillip Poll and Ken Mortensen – reviewing.
   • ESG-121 Construction Safety, Phillip Poll and Ethan Chestnut – In work.
   • Field Erection – Tom Toth, Ken Pate - In work.

III. Old Business
IV. New Business
I. Call to Order
II. Introduction of Attendees/Announcements
III. Review and Approve the Minutes from the 2019 Summer Meeting
IV. Task Group Reports
   • WTG 126, Application of Non-Oxidizing Biocides, Brian Corbin (Chair), Dwight Emerich (Vice-Chair)
   • WTG 130B, Deposit Monitoring, Bob Cunningham (Chair), Dwight Emerich (Vice-Chair)
   • WTG 142, Galvanized/White Rust, John Zibrida (Chair), Dwight Emerich (Vice-Chair)
   • WTG 155, Cooling Water Reuse, Jim Kanuth (Chair), Bob Cunningham (Vice-Chair)
   • WTG 161, Best Practices Guidelines for Cooling Water Systems, Jack Bland (Chair), Bill Pearson (Vice-Chair)
   • WTG 168, External Reuse for Cooling Water Make-up, Ray Post (Chair)/Bob Cunningham, Tom Mastbaum, (Vice-Chairs)
   • GDL 159, Legionella, Bill Pearson (Chair)/Helen Cerra (Past Chair)
   • STD 149 Corrosion Testing Procedures, review Matt Wangarin
V. New Business
VI. Old Business
   • Status of Documents which were in Ad Hoc Review in 2019
   • WTB-147 Water Reuse Papers of Interest to Water Treaters, status change.
   • WTG-141 review to start in summer 2020, Review committee member solicitation.
   • WTG-122, Water Filtration document, review committee solicitation.
   • Liaison Reports
VII. Task Group Work
VIII. Closing Meeting
   • Recap Group Reports
   • Recap status of new and old business topics
IX. Adjourn

CTI CERTIFICATION PROGRAM:
STD-201 for THERMAL PERFORMANCE

As stated in its opening paragraph, CTI Standard 201 . . . "sets forth a program whereby the Cooling Technology Institute will certify that all models of a line of water cooling towers offered for sale by a specific Manufacturer will perform thermally in accordance with the Manufacturer’s published ratings . . ." By the purchase of a "certified" model, the User has assurance that the tower will perform as specified, provided that its circulating water is no more than acceptably contaminated-and that its air supply is ample and unobstructed. Either that model, or one of its close design family members, will have been thoroughly tested by the single CTI-licensed testing agency for Certification and found to perform as claimed by the Manufacturer.

CTI Certification under STD-201 is limited to thermal operating conditions with entering wet bulb temperatures between 12.8C and 32.2C (55F to 90F), a maximum process fluid temperature of 51.7C (125F), a cooling range of 2.2C (4F) or greater, and a cooling approach of 2.8C (5F) or greater. The manufacturer may set more restrictive limits if desired or publish less restrictive limits if the CTI limits are clearly defined and noted in the publication.

Those Manufacturers who have not yet chosen to certify their product lines are invited to do so at the earliest opportunity. You can contact Virginia A. Manser, Cooling Technology Institute at 281.583.4087, or vmanser.cti.org or PO Box 681807, Houston, TX 77268 for further information.
LICENSED THERMAL CERTIFICATION TESTING AGENCIES

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Sound testing provides standard test procedures for measuring the near-field airborne sound from water-cooling towers with reproducible and consistent results per CTI ATC-128.

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Join the Community!
November 1, 2019 - The Cooling Technology Institute announces its annual invitation for interested drift testing agencies to apply for potential licensing as CTI Drift Testing Agencies. CTI provides an independent third party drift testing program to service the industry. Interested agencies are required to declare their interest by July 1, 2020 to the CTI office via email at the address listed below:

Cooling Technology Institute
vmanser@cti.org
Subject: Multi-Agency Testing
**Monday Morning Sessions**

**February 10**

**8:30 - 9:00 (ES&M and P&T)**
**TP20-01: Vibration Monitoring and Instrument Control in Cooling Towers**

Frank Fang (Metrix Instrument)

Frank is currently the product manager at Metrix Instrument Company, and formerly served as principle engineer focusing on Digital Proximity System technology innovation. Frank has more than 15 years of experience in instrument control, automation, machinery condition monitoring & diagnostics.

Cooling towers are commonly used in petroleum refineries, power generation plants, and many other industrial processing facilities. The rotating equipment, such as cooling fan, gearbox and driving motor, are critical devices in cooling tower facilities. Thus, monitoring the machinery condition and properly controlling its operation bring enormous benefits for preventive and predictive maintenance, reducing unprepared downtime and protecting production assets.

Vibration is one of the key parameters that indicate rotating machinery health condition. In this paper, the minimal vibration monitoring and controlling requirements in cooling tower will be discussed, and then the optimal implementation of each requirement will be deliberated specifically.

**8:30 - 9:00 (Water Treatment)**
**TP20-02: Flue Gas Injection and Antiscaling Treatment for Cooling Water Circuit**

Christophe Vanschepdael (Engie Laborelec)

Christophe Vanschepdael is Project Engineer in water treatment including boiler and cooling water treatment at ENGIE Laborelec. He received his bachelor's degree in Chemistry and Environment from the 'Haute Ecole Louvain en Hainaut' in 2006. Since then, he works at Laborelec as expert for power plant worldwide. He has participated at different seminars, workshops, presenting several papers. He received also a ‘Grand Prix’ at the GDFSUEZ Innovation Trophy in 2014 working on: ‘Implementation of an innovative, cost effective and safer anti-scalant for cooling water circuits’.

The use of CO₂ is a proven antiscalting treatment for the cooling water circuit and is applied in several plants in Europe. As an alternative to pure commercial CO₂, Laborelec has tested the use of (concentrated) power plant flue gases as a source of CO₂. The challenge is to determine the minimal CO₂ concentration within the flue gas for an efficient antiscalting treatment.

Laborelec has used its MERADES pilot installation to setup an antiscalting treatment based on the use of power plant flue gases. MERADES is a mobile installation simulating semi-open cooling circuits, made of two parallel and independent circuits allowing the comparison between different treatments under the same conditions. Each circuit is a miniaturized cooling circuit with one simulated heat exchanger and a forced-draft cooling tower. The topic of this presentation is to present the result of the pilot testing.
The first installation of routing the discharge from a wet flue gas desulphurization (FGD) system retrofit into a natural draft cooling tower in the US was completed at the 630MW supercritical coal fired Unit 3 at AEP/Buckeye Power’s Cardinal Plant in Brilliant, Ohio in 2012. The Cooling Tower was also converted at the time from a crossflow to a counterflow configuration with a fiberglass fill support structure (FRP). The paper will describe the process for determining the scope of the retrofits, highlight construction challenges and successful operation of the FDG and the Cooling Tower conversion.

Microbiological (MB) growth management in cooling systems requires an integrated approach to control both heterotrophic and sessile bacteria (biofilm) through proper chemical treatment and monitoring. Technologies are now moving toward in-situ monitoring of microbial growth in the cooling system. This paper reviews an advanced technology to monitor and, ultimately, optimize the chemical usage for MB control. The core of the integrated MB control solution is based on a real-time monitoring device that employs both an ultrasonic thickness and a thermal resistance sensor to detect biofilm growth. Evaluation was conducted under both laboratory and field conditions. Results indicate that not only the biofilm can be detected in the early stage, but also the instantaneous biofilm thickness measurement was responsive to different MB treatment programs. Case studies of successful MB growth management when applying the technology in power, refinery, and chemical production industries will also be discussed in the paper.

The results of measurements carried out on several fans on the new 38 feet CT-like test rig at Cofimco facility in Italy are presented. The paper covers both stress and performance measurements. Strain gages measurements versus fan speed and static pressure are shown and potentially critical speeds effects highlighted. Similarly, conventional flow rate measurements using Pitot tubes and vane anemometers are compared highlighting pros and drawbacks of both methods.

Scale formation and deposition are a fundamental problem in cooling water systems. Scale interferes with heat transfer by forming an insulting barrier on heat exchange surfaces. Scale also promotes localized corrosion and restricts water flow. As a consequence, scale formation and deposition may result to huge economic loss due to its impact on heat exchanger operation, mitigation measures and unscheduled equipment shutdown. This paper discusses the use of a non-phosphorous corrosion inhibitor program in alkaline conditions. Eliminating one of the sources of phosphate allows for better heat exchanger tubes performance as evidenced by lower approach temperatures. In addition, utilizing a non-phosphorous corrosion treatment program extended the exchangers’ cycle on turnaround even for heat exchangers that are run with lower water velocity.
10:00 - 10:30 (Water Treatment)

TP20-08: Rapid Microbial Detection, Qualification, and Control
Mark Reed (Buckman)

Mark Reed has a background in molecular biology and microbiology and has completed his BSc at the University of York, and a PhD at the University of Leeds. He has led the Biotechnologies group at Buckman for 4 years where the focus of his team’s research has been on enzymatic technologies and biocide development. Mark has a passion for commercializing new technologies that can optimize systems and bring significant ROI to the user, with data-driven biocide delivery being one of the most recent efforts.

Microbial control continues to be a major topic in cooling water applications, with changes in physical conditions and inflow rapidly impacting the ability of a biocide regimen to adequately control the populations of microbes. ATP and petri-films have long been the standard for microbial detection, but these technologies either fail to provide specificity regarding the microbes being measured or do not provide data in a duration that allows for adjustment of the control regimen. In identifying a rapid molecular measurement for bioburden and digitally coupling this near real-time measurement with delivery of proven biocidal technologies (such as monochloramine), there exists an exciting opportunity to monitor the fluctuations in bioburden that can impact cooling water applications, be alerted digitally when these changes occur and more readily address bioburden in a timely fashion.

10:30 - 11:00 (ES&M and P&T)

TP20-07: Numerical Calculation on Heat Exchanger Tube Thermal Fatigue Life in Cold Environments
DH Han (Research Institute of Engineering and Technology)

Dr. Han holds a Ph.D. in mechanical engineering.

A series of numerical analyses are conducted with the assistance of coupled computational fluid dynamics (CFD) and structural analysis to estimate the air-cooled steam condensing heat exchanger tube life expectancy in extremely cold ambient conditions. The temperature profile of a heat exchanger tube from CFD is used as boundary conditions for stress-strain analysis. The effect of ambient air temperature, air velocity, steam pressure, steam velocity, tube material, tube wall thickness, non-condensable stagnation zone length, and tube ends supporting configuration are considered. The fatigue life expectancy of the tube is calculated using the Goodman fatigue equation. It is found that minimizing the temperature difference between the tube internal and external temperatures is key to heat exchanger tube protection in cold environments.

10:30 - 11:00 (Water Treatment)

TP20-10: Sustainable Water Treatment for Cooling Towers Using Next Generation Electrooxidation Reactor
Sanjeev Jakhete (Aqua Pulsar LLC)

Mr. Sanjeev Jakhete is the President of Aqua Pulsar LLC with over 25 years of engineering experience. Mr. Jakhete has developed proprietary, chemical free water treatment technologies for processing the most challenging water streams using simply electricity. Under his leadership, Clear Water Plasma has successfully launched the AP72, a standalone hyper oxidation water treatment system for the Oil and Gas industry and various other water industries. Mr. Jakhete holds a Bachelor of Mechanical Engineer and Class I Chief Engineer Certification. Mr. Jakhete has received numerous US and International patents and patent pending rights on the core proprietary technologies.

Advances in electronics and metallurgy have enabled in designing a powerful electro- oxidation/ precipitation process which significantly improving water treatment performance, safety, and enabling dramatic treating cost reductions. Technology and field results are presented demonstrating in-situ generation of multiple oxidants using simply electricity and Cooling tower water without addition of hazardous reagents or chemicals. These oxidants are shown to be extremely effective biocides for bacteria disinfection, precipitation of scale causing minerals, and oxidation of heavy metals of treated cooling water.

Electro-Oxidation technology also based on a mobile platform, can be deployed rapidly to treat complicated cooling tower water source and offer a clean, bacteria free, Non-scaling effluent, at high flow rate. Recycle and reuse of cooling water using Electro-oxidation process offers tremendous cost savings to an operator without compromising the performance on cooling towers.

11:00 - 11:30 (ES&M and P&T)

TP20-09: Air Flow Modifications for Optimization of Natural Draft Cooling Towers
Christian Wawzesyk (Framatone GmbH)

Design engineer for cooling water and heat sink systems for 10 years. Working for several new built and installed base nuclear power stations worldwide.

Many operating cooling towers have a sharp-edged concrete shell, support columns or basin edge. The air flow entering the tower passes these zones and easily becomes swirled, restricting the free air inlet area and reducing the overall air inflow. Improving these inflow conditions allows an increase in the overall air intake of the tower and thereby improves its re-cooling capability.

The two nuclear power plants of NPP Leibstadt and NPP Goesgen developed such improvements by adding spoilers to the tower shell and if necessary the support columns. On the American market an air flow optimization is currently under way working with a major US nuclear utility. Preliminary investigations estimate a potential temperature reduction of approx. 0.6°C (1.1 F) of the cold water leaving the tower. As next steps measurements of the air flow profile inside the tower and the related tower performance are foreseen for July 2019.

WE'RE CELEBRATING SEVENTY YEARS!
PH is a common critical parameter in water treatment and therefore solubilities, include temperature and the partial pressure of carbon dioxide (pCO₂).

This paper provides a framework for answering questions such as: Why do calcite saturation ratio (and inclusive saturation indices) increase with temperature and then decrease above a certain temperature? Why isn’t the pH of cooling water at 1.0 cycles increase with temperature and then decrease above a certain temperature? Are acid requirements different for a closed versus open system with respect to CO2 exchange?

Concrete cooling towers experience various levels of concrete deterioration due to exposure to atmospheric conditions, cooling water chemistry, and demands to extend their service life. Despite being a critical asset, many cooling tower structures are inspected on an ad-hoc basis after problem conditions are discovered, often leading to more extensive repair conditions. This paper defines a standardized process and procedures for conducting inspections and condition assessments of concrete cooling towers. Inspection procedure recommendations are provided to aid a qualified team leader in carrying out the planning, observation, classification, and documentation of the physical condition of concrete cooling towers. Condition assessment procedures are then discussed to determine the need and priority of maintenance, repair, or rehabilitation actions based on information obtained from the structural inspection. The intent is to provide a systematic and proactive program for managing and maintaining cooling tower assets.

Monitoring and control of cooling water chemistry has improved considerably over the past few decades. Initially, chemicals were metered into the cooling water in proportion to blowdown water flow. The blowdown flow was either measured directly or, more typically, imputed from a makeup water flow meter. The concentration of water treatment chemical was controlled by manually adjusting the delivery rate of a metering pump by timing the drawdown using a calibration cylinder valved into the pump suction. Samples of the cooling water were collected, generally once per shift and trekked to a chemistry lab where a trained operator performed a wet chemistry analysis for one or more of the treatment chemical components. Based on the results of the wet chemistry tests, the operator would then make adjustments to the metering pump using stopwatch and drawdown cylinder.
Value means a product you can rely on, a team of experts available when you need them, and a partnership beyond the sale.

Invest in a supplier who invests in you.
Jim Baker brings a unique marketing diversification to the Industry through his 39 years of involvement throughout the Cooling Tower Industry. Mr. Baker worked from 1980 through 1992 for Phillips 66 as their Cooling Tower Specialist. This role enabled him to acquire experience on the Owner and Operations side of the business. From 1992 through 2013, Mr. Baker worked for Marley Cooling Tower Company, SPX Cooling Technologies, Composite Cooling Solutions, and Texas Air Systems. In his various managerial roles he marketed everything from HVAC Cooling Tower products to the large Petro-Chemical and Power Industrial Products. Since 2013 he has worked as an Independent Consultant and presently for Galebreaker Industrial.

The subject cooling tower was a 3-cell counter-flow located in the Chicago area. The subject tower was first inspected in February of 2018 and excessive icing was present. The customer attempted to install tarp's to keep the heat in the tower and the ice melted. This was a temporary fix, and not a very good one that had to be removed and reinstalled on a yearly basis. In December of 2018, a permanent solution was designed and installed. The solution was retractable winterization screens which could be deployed in the winter and retracted back up in the summer. The customer was extremely satisfied with the finished product. The icing accumulations on the interior were eliminated during the sub-zero temperatures in January of 2019.

Billy Childers has been part of the cooling tower industry for the past 29 years and is currently the Manager of Aggreko Cooling Tower Services. Responsibilities over the past 29 years have included R&D, thermal performance testing, cooling tower design, CTI STD-201 certification, business development, and business management. His work in designing projects for rental cooling tower applications includes thermal performance, cooling tower selection, pumps, piping, and electrical distribution. Billy has authored and presented several technical papers on rental cooling towers at national conferences including Cooling Technology Institute, Electric Power Research Institute, and Edison Electric Institute.

The thermal performance of a cooling tower can be regulated by varying fan power. Typically it is possible to lower fan power significantly while only having a minimal impact on the thermal capacity of a cooling tower. Since most cooling towers are designed to achieve the specified cooling capacity at the highest ambient wet bulb temperature for the region that only occur 1% to 2% of the time. It is for this reason means of reducing fan power (98% to 99% of the time) can offer large energy savings for cooling tower owners/operators. The paper will compare thermal performance test results of two multi fan rental cooling towers of similar rated capacity with one tower equipped with means of cycling AC direct drive fan motors off and on and another tower equipped with variable speed EC fan motors.

Reinforced Concrete Cooling Towers are a mainstay of industries that require the cooling of systems and process water. The environment these cooling towers see varies widely from forced air cooling towers for mineral water to natural draft cooling towers for brackish water. All these environments can have a detrimental effect on the condition and longevity of the reinforced concrete. This presentation will look at options for repairing and extending the life of these reinforced concrete cooling towers. The topic will be explored using case studies including two International Concrete Repair Institute (ICRI) award winning projects; Coal Creek Station in North Dakota using structural concrete repair, waterproofing, beam replacement, and protective coatings; and at the Chalk Point Generating Station with a variety of impressed current and galvanic cathodic protection systems. Each extending the life of the cooling tower in excess of 25 years.
By changing the data acquisition mode of the wet cooling tower collecting basin liquid mode, study the water loss law of cooling tower. The water loss of cooling tower was measured by U - tube liquidometer, real-time and accurate water loss data were obtained. When the liquid level of collecting basin drops 1mm, the water loss of one cooling tower was 1.39 m3. In reposeful engineering application operation and under different environmental and climatic conditions, the water loss was between 82-144 m3 h-1. Through the accurate measurement of water loss, the hypothesis of Michael model is proved that the air in the tower is saturated air. The testing and theoretical analysis of water loss by the application of the test device will be widely used in the design and other related engineering fields, such as the control and research of water loss of cooling tower and the drift recovery.

8:00 - 8:30 (ES&M and P&T)
TP20-19: Impact of Water Surface Tension on Drift Eliminators
Vincent Ganzitti (Hamon Thermal Europe)

Vincent Ganzitti graduated as an electro-mechanical engineer in 2001. In 2017, he completed a master in management at Solvay Brussels School. For the last 18 years, he worked at several positions within Hamon Thermal Europe including thermal software development, technical design, on field testing and mainly R&D. He is now Key Product Manager for wet cooling towers.

More and more cooling towers are experiencing higher drift rates than the design values. While the first root cause is often an installation problem with the drift eliminators, some cases remain unexplained. This is especially the case in re-used water applications. This paper explores the impacts of the water surface tension on the performance of drift eliminators.

8:00 - 8:30 (Water Treatment)
TP20-18: Online Robotics: Cleaning and Inspecting Tanks and Basins while Remaining Operational
Steven Rydarowski (Scantron Robotics USA, Inc.)

By placing a robot into the water instead of draining and putting abrasive blasters inside, functionality is maintained. These robots utilize the water, pulling debris out, meaning operation does not have to be halted for services.

Online Robotics are reshaping the field of water tank maintenance.

8:30 - 9:00 (ES&M and P&T)
TP20-20: Case Study of a New Oxidizing Biocide in Two Large Power Plant Cooling Towers
Justin Shim (Justeq LLC)


Two large, natural gas-fired power plants, producing 800 and 500 megawatts, use recycled water with high ammonia contamination for cooling water make-up. Both plants conducted a trial with a new stabilized halogen biocide. The plants were using continuous chlorination, sodium bromide feeds, and isothiazolone. In addition, one of the plants shock dosed with a 4,000-5,000 gallon tanker truck of bleach every one to two weeks, but the plant still struggled with biocontrol. The new treatment method completely cleaned the cooling systems, and saves the plants about 30% in biocide costs.
**9:00 - 9:30 (Water Treatment)**

TP20-22: Survey of Laboratory and Field Test Methods for Legionella  
Loraine Huchler (MarTech Systems)

Loraine Huchler, PE, CMC has served as president of MarTech Systems, Inc., a consulting firm specializing in risk management in utility water systems in industrial plants and large-scale commercial facilities, for over 20 years. She previously worked as an internal consultant at Betz. She earned a Bachelor of Science in Chemical Engineering from the University of Rochester, Rochester, NY and holds a professional engineering license (NJ). She has published numerous technical paper, authored the “Water Management” column (Hydrocarbon Processing) for a decade, and has published “Operating Practices for Industrial Water Management, Influent Water Systems,” Gulf Publishing, Inc.

The Centers for Disease Control (CDC) requires a spread-plate culture legionella test for risk assessments of water systems. While owners of cooling towers are concerned about managing their legal liability, they also must manage their operating risks. The culture method is a poor fit for routine assessment of operating risk of legionella in cooling water systems because operators cannot make timely decisions about corrective actions.

This paper discusses the selection criteria for field test methods (sensitivity, specificity, time, and legal defensibility (accreditation) and reviews the commercially-available field test methods and test kits, including the level of skill required for the test method, the accuracy of the test results, and the proper interpretation of test results.

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**9:30 - 10:00 (ES&M and P&T)**

TP20-25: A Detailed Thermal Analysis and Optimization of an Existing Field Erected Cooling Tower  
Philip Poll (OBR Cooling Towers)

**Philip Poll** is a Field Engineer with OBR Cooling Towers, Inc. Philip started his career in the cooling tower industry as a field repair technician in 2001. He attended Ohio University receiving a B.S. in Mechanical Engineering, where he participated in both the independent study and Co-op programs focusing on thermal systems. His experience includes project management, product design, equipment inspection and water treatment for both field erected and packaged cooling towers. Prior to joining OBR, Philip was employed as a District Representative for The Nalco Company, where he completed Nalco’s technical sales engineering training program.

This paper addresses a project involving the detailed analysis, upgrade and optimization of a field erected cooling tower at a district cooling facility located in the Midwestern United States. Examination and evaluation of the existing equipment will be explained in detail along with the optimization of the tower by upgrading the air moving system and water distribution. Observed and measured performance results are presented demonstrating the effectiveness of the project.

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**9:30 - 10:00 (Water Treatment)**

TP20-24: Constructing Non-P Passivation Films for Cooling Applications Surface Science Perspective  
Paul Frail (Suez Water Technologies)

Paul R. Frail is a Senior Engineer with Suez Water Technologies & Solutions with 9 years’ experience in the Cooling division. Prior to working with Suez, he completed a post-doctorate fellowship and PhD degree at the University of Pennsylvania in the Materials Science and Electrical Engineering Departments and Chemistry departments respectively. In the Cooling division, he has focused on deposit control and corrosion control. He has developed expertise understanding the relationship between surface chemistry, corrosion rate, chemical treatments, and water characteristics. Paul has authored and co-authored 20 peer reviewed publications, 4 patent applications, and belongs to the ACS and NACE.

To comply with environmental regulations or to ameliorate an existing calcium phosphate fouling issue, more customers are looking for non-P cooling corrosion control programs. Simply transitioning from a calcium phosphate to a non-P corrosion control program is relatively seamless due to the slow dissolution of the existing calcium phosphate passivation film to the new non-P passivation film. A more difficult transition is when the surface is neat due to a freshly cleaned surface or a re-tubing of a heat exchange bundle. Utilizing surface analysis techniques coupled with traditional corrosion monitoring for cooling applications the necessary means to construct effective passivation films will be discussed while exploring the various options available: (i) use of metal additives such as Al, Zn, Sn, etc.; (ii) non-P polyacrylic acid derivatives; and (iii) potential new approaches.

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**10:00 - 10:30 (ES&M and P&T)**

Dave Wheeler (CleanAir Engineering)

Mr. Wheeler did his first cooling tower test in 1978. Since that time, he has led more than one hundred cooling tower thermal performance tests. Since 2006, Mr. Wheeler has been a Technical Leader for CleanAir Engineering, a CTI Licensed Test Agent for thermal performance, drift and noise. He is a past chairman and current member of the task group assigned to revising the CTI ATC 105 test code. Mr. Wheeler is a licensed professional engineer in the state of Tennessee.

The Cooling Technology Institute’s (CTI) Acceptance Test Code, ATC-105, addresses the determination of thermal capability of evaporative water cooling towers. The code describes the instrumentation, data reduction, operational and environmental conditions for accurate cooling tower evaluations. The CTI ATC-105 test code is the most frequently cited document produced by Performance and Technology Committee of the Cooling Technology Institute. In April 2019, CTI issued a revised version of the code, the first since 2000, incorporating changes to almost every section of the document. This paper describes the new version of CTI ATC-105 emphasizing the differences between the 2000 and 2019 versions of the test code.
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10:00 - 10:30 (Water Treatment)
TP20-26: Preventing Severe Corrosion in Large Commercial/Institutional Buildings
Bob Cunningham (Chemsis, Inc.)

Bob Cunningham is a Principal with International Water Consultants. He has 53 years of water treatment experience across a broad range of applications and industries and served as President of the Cooling Technology Institute and on the Board of the Association of Water Technologies. Bob is a sought after speaker, consultant and expert witness. He has served as a testifying expert in Legionella related fatalities across the country and consulted clients on Legionella related issues across the globe.

Over the last 15 years there has been a disturbing increase in the number of very high cost litigations as a result of severe corrosion in mid-high and high-rise building HVAC plumbing systems. A common problem emerging from a review of these instances is the lack of comprehensive water treatment specifications. In the absence of such specifications critical omissions of necessary tasks relating to water treatment are condemning the building HVAC piping to severe corrosion very early in the life of the assets. These instances are being exacerbated by the confluence of rising labor/material costs, the availability of inexpensive poor quality off-shore piping, and the legacy of environmental restrictions on the available corrosion inhibiting chemistry. Tight adherence to well prepared specifications will reverse this trend. In this document we offer recommendations for specifications to help minimize these instances.
**WED**

**February 12**

- **7:00 - 10:00**
  - Coffee Service

- **7:00 - 5:00**
  - Registration and Sales

- **8:00 - 12:00**
  - Educational Seminar

- **12:00 - 5:00**
  - Technical Committee Meetings
    - Engineering Standards & Maintenance
    - Performance & Technology
    - Water Treating

- **5:00 - 8:00**
  - Hospitality Suite

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**THU**

**February 13**

- **7:30 - 8:15**
  - Board of Directors’ Breakfast w/ Committee Chairs

- **8:30 - 2:00**
  - Board of Directors’ Meeting w/ Committee Chairs

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**CHRIS LAZENBY (SOUTHERN COMPANY)**

Chris is a Principal Engineer with Southern Company, working as part of the company’s Technical & Project Solutions organization in Birmingham, AL. He has close to twenty-five years of experience in the utility industry, the vast majority of that in the area of power plant cooling systems and equipment. In his current role he provides guidance and input for design, operation, maintenance, and retrofit of cooling system equipment for Southern Company’s existing coal, natural gas, and nuclear generating fleet.

Chris has co-authored papers and made technical presentations at various organizations including the Cooling Technology Institute (CTI) and the Electric Power Research Institute (EPRI). He has also served on multiple CTI, EPRI, and ASME task groups and code committees related to condensers, cooling towers, and other cooling system equipment and testing. Chris has also chaired the Owner/Operator group at CTI as well as been a member of the Board of Directors.

Chris holds a Bachelor of Mechanical Engineering from Auburn University and a MA in English from the University of Alabama-Birmingham. He is a registered Professional Engineer in the states of Alabama and Minnesota.

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I. Task Group Meeting Summaries. All fourteen of the active task groups met during this meeting.

ATC-105 Thermal Performance Acceptance Test Code (Larry Burdick, Chair)
- Major revisions were approved by the board in February.
- Section 6 contains a reference to Session 4 of the 2018 Educational Seminar providing instructions for the performance curve technique. This was sent to the board for approval, was approved, and is now accessible on the “new” website under More/Free Downloads.
- Future discussion topics include correction of minor errors, and aligning ATC-105 and ATC-140 regarding the allowable window for an acceptance test.
- A draft will be created to begin capturing revisions going forward from the February 2019 version. Historical revision documentation should be considered for all CTI documents.

ATC-105S Test Code for Closed Circuit Coolers (Hussnain Yaser, Chair)
- Main body of document approved
- Appendices A (Performance Curve Evaluation IP units; B (same for SI units); and C (Examples of makeup water correction) were approved with minor corrections
- Need to compare with ATC-105DS for compliance, consistent terminology, and for minor corrections
- The goal is to get all changes ready for approval by February 2020 conference.

STD-204 Sound Certification Task Force (Doug Randall, Chair)
- Scott Nevins will edit the 204OM document to address qualification test requirements and consequences of test failures.
- Discussion on the requirements for initial certification testing to be more rigorous than subsequent annual tests.
- Doug Randall will edit 204RS to include definitions for qualification testing and sound rateras.
- Teleconference is planned for August.

STD-202 Publication of Custom Tower Performance Test Results (Paul Lindahl, Chair)
- Discussed the need to expand test conditions limitations
- Change made to increase constancy requirement allowance from 5 to 10%
- Ad-hoc review now needed.

Adiabatic Acceptance Test Code (Jennifer Hamilton)
- Reviewed first draft, established the name as “ATC-105 Adiabatic”
- Established task group (Nick Mascarhenas, is co-chair)
- Draft document is based on evaporative pad technology. Discussion on need and challenges of adding spray-based technology requirements
- Teleconference planned for August 6th

STD-146 Water Flow Measurement Standard (Dave Wheeler)
- Replaced two inactive members of task group
- Restarted review of Appendix C (needed due to pitot tube changes)
- Approved Appendix D (alternate measurement methods)
- Two more meetings planned before 2020 Annual Meeting; should have a draft ready for ad-hoc review by that time

PFM-143 Airflow Testing (Sander Venema)
- Discussion on yaw angle correction, power measurement locations and wind speed measurement locations.
• Added table for typical measurement uncertainties. A more detailed analy-
is will be undertaken to create an Appendix for this information.
• A draft document was completed for fans installed in an induced draft
tower. Updates are needed on placeholders for several figures/drawings.
IP units must be added.
• Online meetings are planned before 2020 Annual conference; hope to
have ready for board approval at that time

**ATC-140  Isookinetic Drift Measurement Test Code for Water Cooling Tower**

(Chris Lazenby, Chair)

• Addressed a formula error discovered due to a question raised by Ask the
Expert link.
• Reached consensus based on testing results that the DeNuoy ring is supe-
rior to potentiometers for surface tension measurement.
• Completed draft of an appendix dealing with conductivity measurement
as an alternate evaluation method
• Assignments made for review of various sections; goal to have ready for
ad-hoc approval before the winter meeting.

**STD-201 Certification** (Jennifer Hamilton, chair; Frank Michell, Nick Ma-
sacrenhas, Co-chairs)

• Most recent versions of 201-OM & RS have been approved and are now
available on the CTI website.
• After discussion, the task group recommended no changes be made to
the certification label. Adding the revision number to nameplates was
determined to be impractical and unnecessary since the revision number
is on the label.
• Open discussion on the merits of introducing factory audits into the pro-
gram, as Eurovent does. A separate task group was established to report
back to the main TG on 1) if audits are recommended, 2) audit structure,
including frequency, location and cost estimates, and 3) propose addi-
tional language for the code.

**ATC-150 Plume Abatement Test Code** (Jared Medlen, Chair)

• Reviewed comments on eight previously identified items, and added two
new items. (Quantity and location of inlet condition measuring devices)
• Resolved conflicts with ATC-105 regarding anemometers and dealing with
negative airflow zones.
• Revised definitions of Level 1 & 2 plume conditions.
• Need to make consistent with other CTI test codes
• Teleconferences planned to accelerate schedule
• Target completion of Winter 2020 for completion of draft document;
Summer 2020 for board approval.

**Water Usage Committee** (J.P. Libert, Chair)

• Reviewed Vincent's calculation spreadsheet to validate assumptions pre-
sented in JP's technical paper
• Reviewed evaporation on basis of constant hot and cold water tempera-
tures and range; determined all methods yield very similar results
• Compared calculation results from hourly, daily, monthly and annual
weather data points; results indicate good correlation. Monthly data can
be used as basis of calculations
• L/G ratio is a significant variable; will study from 0.75 to 2 and be able to
integrate from average evaporation data.
• Discussed possibility of incorporating results into ToolKit, or as a stand-
alone module to be made available on the CTI website
• J.P. will draft document revisions. A conference call will be held in the fall
• Need to assign a number to this standard m. Cooling Tower Manual

**Chapter 3 (Rich Aull, Chair)**

• Updates needed to align language with ToolKit, versus current references
to obsolete Kelly Book. Expectation that revision and marketing/pub-
lishing of this document will increase interest in sales of ToolKit.
• General review of existing document, including work performed by Mike
McCarrell to format the 40 year old document into a working version.
• 27 performance variables have been identified in Table 1; discussed the
need to keep all (or exclude some). Volunteers were recruited for word-
smithing each section. These revisions will be discussed at the winter
meeting.
• Discussion for board: Should free ToolKit versions be made available to
the reviewers? It appears all but one volunteer have a current version.
• J.P. Libert led a discussion on Chapter 2 (Intro to Thermal Performance).
It is agreed that Chapters 2 & 3 should be updated in parallel.
WTG 158, Physical Water Treatment (Mark Winter, Chair)
- This document went through the Ad Hoc review process and is ready for board approval. Document should be completed by winter CTI Meeting.

GDL 159, Legionella (Bill Pearson, Chair, Helen Cerra, Past Chair)
- Significant progress has been made to the document and is now ready for the Ad Hoc review process.

II. New Business
We have several documents that were considered for review due to the time passed since the last review.

- **WTG-141** Application of Oxidizing Biocides: this was considered for "review" in order to incorporate information about ‘newer oxidizing biocides’; The review is actually due in 2021, so we will start the review process in the Summer of 2020.

- **STD-149** Corrosion Testing Procedures: this was due in 2005 but was delayed because the procedure that it covers has not changed. Our evaluation at this time is that we see it as accurate, but with some poor quality images and possibly needing some minor language edits. Matt Wangarin took the responsibility to review and make the edits, with the potential to have it ready for the Spring 2020 meeting.

- **WTG-122** Water Filtration: This document is due for review. The filtration specialist that chaired this task group has retired from the Water Treatment Committee. We identified some filtration experts to invite to the next meeting, potentially to help review this paper, and potentially to join the Water Treatment Committee.

- **WTB-147** Water Reuse Papers of Interest to Water Treaters: This is a bibliography of papers which is in the category ‘Referenced’. It is not required to review this document. The status needs to be changed in the price list to reflect that the review is not needed.

- **Chapter 6 and Chapter 7 of the CTI Manual**: These are out of date and may not have been updated since the 1990’s. Further action is being considered.

III. Liaison Reports:
- Association of Water Technologies. The 2019 Annual Convention and Exposition will be held September 11-14, 2019, in Palm Springs, California. Conference is growing with 180 exhibitor spots this year.
- ASHRAE 12-2000, Guidance on Reducing the Risk of Legionella has been updated and will be sent out for public review this fall.
- International Water Conference will be held in Orlando, Florida, November 10-14. Conference is well attended and offers excellent training opportunities.
IN MEMORIAM
Nicholas Stitch
March 15, 1948 - October 26, 2019

Nicholas M. “Nick” Stich, 71, passed away Saturday, October 26, 2019 at Lexington Park in Topeka.

He was born March 15, 1948 at Brownsville, TX. the son of Albert J. and Babette A. Cox Stich. Nick graduated from Hayden High School and Rockhurst University in Kansas City. He lived nearly all of his life in Topeka.

He owned a Tom’s Franchise in Salina. Nick worked for Midwest Research Institute in Kansas City for 5 years and was a consultant for them for 17 years before founding Cooling Tower Test Associates with Thomas Weast. Their company tests cooling towers domestically and internationally. In his younger years Nick was a pilot. He enjoyed traveling throughout the world for both business and pleasure. He was a member of Kloudbusters Rocket Club at Argonia, Kansas.

He was preceded in death by his father, Albert Stich; his mother Babette Johnson and his step-father, Claude “Jack” Johnson.

Survivors include his brother, John (Connie) Stich, Topeka; two nieces, Sherri (Tim) Stewart and Kelli Stich, all of Meriden; four great-nieces and two great-nephews.

Funeral services were held Friday, November 1, 2019 at Piper Funeral Home with interment at Valley View Cemetery, St. Marys. Memorial contributions may be made to the donor’s choice.
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* Compared to other single-cell, crossflow cooling towers.