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Cooling Technology Institute
PO Box 681807
Houston, Texas 77268
USA

Phone: 281.583.4087
Fax: 281.537.1721

vmanser@cti.org

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THE 2018 CTI ANNUAL CONFERENCE PROGRAM

The Technical Sessions will run simultaneously between two separate Ballrooms.

While every effort has been made to insure the accuracy of the program, CTI is not responsible for cancellations, changes, errors or omissions after the posting of the program.

Sunday, February 4, 2018

3:00p - 5:00p - Board of Directors Meeting, ***Salon 1***

4:00p - 8:00p - Registration, ***Atrium***

5:00p - Midnight - Hospitality Suite, ***Raphael Ballrooms A&B - "Super Bowl Party"***

6:00p - 8:00p - Speaker Ready Room, ***Raphael Ballroom C***

Monday, February 5, 2018

7:00a - 10:00a - Service, ***Atrium***

7:00a - 5:00p - Registration and Paper Sales, ***Atrium***

7:00a - 5:00p - Speakers' Breakfast, ***Salon 1***

7:30a - 8:30a - Presidential Address, ***Raphael Ballroom A&B***

Long Range Planning

Multi Agencies Report

Certification Report

Monday, February 5 2018

7:00a - 10:00a - Service, ***Atrium***

7:00a - 5:00p - Registration and Paper Sales, ***Atrium***

7:00a - 5:00p - Speakers' Breakfast, ***Salon 1***

7:30a - 8:30a - Presidential Address, ***Raphael Ballroom A&B***

Long Range Planning

Multi Agencies Report

Certification Report

Raphael Ballrooms A&B (ES&M and P&T Sessions)

8:30a - 9:00a

TP18-01

Biofilm Removal Considerations and Protocol.....1

Edward T. Ott, Sr., ProMinent Fluid Controls, Inc.

Edward T. Ott Sr. is a Senior Technical Consultant for ProMinent Fluid Controls, Inc., a major global instrumentation and control water treatment equipment company. He is based in the Pittsburgh, Pennsylvania American headquarters and has provided technical support expertise in the chemical metering and monitoring field for the past 37 years.

Most of us understand that a Biofilm could have several layers with a protective film or slime between each layer. When we are treating a biofilm different bacteria and viruses might be uncovered as each layer gets exposed. This could become a Pandora's box if we are not careful. In this paper, we will look at the various methods: of treating a process that contains a biofilm, methods of addition and control of the chemistries used and what might happen if the biofilm is removed too quickly.

Donatello Room (Water Treating Sessions)

8:30a - 9:00a

TP18-02

Efficient Water Use to Boost the Air-Cooled Condenser Performance.....6

Luc De Backer, ENEXIO

Since Sep 2015, Dr. Luc De Backer has been Vice President of Technology with GEA, now known as ENEXIO. In 2011, Luc founded his own consultancy company, mainly to set up a new Air Cooled Condenser product line for LACC, Inc. Between 2004 and 2011, he was employed by GEA with a technical management role in wet & dry cooling, and by Bechtel Power as technical specialist for power plant cooling systems. Dr. De Backer started his professional career with Hamon after obtaining a PhD in Chemistry & Chemical Engineering from the Free University of Brussels.

During hot ambient conditions, it is often desirable to boost the performance of an ACC (Air-Cooled Condenser) to avoid a steam turbine trip under full load conditions. A Simple way to accomplish this is to spray water into the ACC air inlet (evaporative cooling). But this approach has many drawbacks and does not work under certain operating conditions. A more efficient way is to use the water in a small wet section add-on. The water consumption and performance improvement of both ACC performance boosting methods will be compared and the advantages and disadvantages will be discussed.

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The Technical Sessions will run simultaneously between two separate Ballrooms.

Raphael Ballrooms A&B (ES&M and P&T Sessions)

9:00a - 9:30a

TP18-03

Thermal Performance of Cooling Tower Fills – Experimental Investigation.....21

Jacques De Plessis & Daniel Roux, Stellenbosch University; Ockert Augustyn & Francois Du Preez, Eskom Soc Ltd

Jacques du Plessis is a laboratory engineer in the thermofluid department at Stellenbosch University, South Africa. He received his M.Eng (Cum laude) degree in mechanical engineering from Stellenbosch University in 2014 with the main focus was on the development of a counter flow water collection system for a hybrid cooling system. He is currently responsible for heat exchanger testing as well as cooling tower fill material testing in the heat transfer labs. His responsibilities a laboratory engineer include designing, manufacturing, commissioning and overseeing various experimental work such as characterization and performance testing of industrial cooling components for R&D as well as commercial projects. Jacques also co-found Thermasoft consulting with Daniel Roux in 2015. With its core focus on the performance modelling software as well as online monitoring of industrial cooling applications such as natural draft cooling tower and packaged cooling towers.

The paper will focus on the development of Eskom's new standardized fill test facility with which various fill materials can be tested and compared, using the Stellenbosch University test facility as a basis. Details regarding the fill performance testing methodology, using the Merkel theory as analysis basis, for the standardized test facility are also presented. Finally, the test results of a reference fill are presented in terms of the air-side pressure drop and thermal performance as obtained from tests performed in both test facilities.

9:30a - 10:00a

TP18-05

A Case for Structural Health Monitoring for Cooling Towers.....49

Mark E. Williams, Ph.D., P.E., Narendra Gosain, Ph.D., P.E. and Matthew Pavelchak, P.E., Walter P Moore and Associates

Mark Williams, Ph.D., P.E., S.E., is a Principal and Senior Project Manager in Walter P Moore Diagnostics Group. He has 15 years' experience in structural engineering analysis, design and management, as well as software engineering research and development. Dr. Williams has been involved with the restoration of several cooling towers as well as repair of several bridges and garage projects that have used state of the art carbon fiber reinforced polymers for structural enhancements.

This paper will explore the current state of the art in Structural Health Monitoring (SHM) concepts and instrumentation for evaluating the structural behavior of cooling towers. The process of SHM project planning, sensor selection, remote and wireless sensing technology, data collection and acquisition systems to capture specific behaviors will be addressed in simplified and usable terms. Sensor technologies will also be discussed including inclinometers, accelerometers, strain gages, anemometers and thermocouples. Case studies of SHM executed

Donatello (Water Treating Sessions)

9:00a - 9:30a

TP18-04

Investigation About Wastewater Profile to Reuse in Cooling Tower, An Operational Risk Discussion.....31

Salvador Avita Filho, Jean M.P. Silva, José R.N. Lopes, Marco A.B. Araújo, Maria B. M. M. Nobrega, Federal University of Bahia

Chemical Engineer and Petrochemical Processing has actuated in Chemical Industry. Salvador specialized as: statistical techniques to investigate abnormalities in the industry and as Organizational Consultant for transforming culture. As manager of a small factory he set model for clean management. As teacher, he actuated at undergraduate courses in Administration, Chemical Engineering, and Production. He was a researcher in clean technologies to reduce water consumption. His doctorate research was in the area of human and organizational cultures. He has conducted research and services in the areas of Risk Management, Organizational Culture, Human Reliability, and Process and Operational.

Cooling towers are fundamental equipment in the industry to remove process heat and cool the working fluid. When cooling is due to the use of water evaporation, the volume of water lost is substantial. In a scenario of reducing the supply of water to industry, reuse of non-potable water from liquid effluents has been used as a make-up feature in cooling towers. This paper discusses the main problems and risks associated with the use of reuse water in an oil refinery.

9:30a - 10:00a

TP18-06

Importance of Corrosion Monitoring in Cooling Water Systems.....77

Michael Dorsey, AquaCorr Services

Prior to AquaCorr Services, Dorsey was a Senior Specialist in the Corporate Engineering Materials Group at E.I. DuPont de Nemours and Company, where he had a successful career for over 36 years.

While at DuPont, he initiated and led the development of a Corporate Water Treatment Initiative. He was the lead consultant for water-treatment and brine-treatment support to multiple plants globally across the company. He has authored papers and led committees around corrosion and water treatment practices at various associations

Corrosion monitoring in cooling water systems is used primarily to insure adequate water treatment program. Protecting the owner's equipment should be the primary goal. In many instances, there hasn't been enough importance placed on accurately measuring and reporting corrosion results. Most corrosion systems are installed in convenient locations and many of those locations do not properly provide accurate assessment. This paper will describe various methods and programs from standard corrosion coupons to various online corrosion monitoring systems and other techniques.

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Raphael Ballrooms A&B (ES&M and P&T Sessions)

successfully on different types of structures will be provided along with an instrumentation plan for a cooling tower structure as well. SHM has a tremendous potential in cooling tower structures to economically address restoration and maintenance challenges facing engineers, facilities personnel and owners.

10:00a - 10:30a

TP18-07

Managing Pipe Stresses and End Loads Utilizing Rubber Expansion Joints.....86

Lloyd B. Aanonsen, P.E., General Rubber Corp.

Lloyd B. Aanonsen is President of General Rubber Corp. General Rubber is best known for their performance rubber expansion joints utilized primarily in the Power and Industrial markets. He is a licensed Engineer, with 30-years of direct product development experience. He received a Bachelor of Science degree in mechanical engineering from Clarkson University and a Master's in Business Administration from Dowling College. He has authored numerous articles on the design and application of performance expansion joints. Within the Fluid Sealing Association, he has held multiple terms as division chair and technical committee chair, as well as being on their board.

It is a fundamental principle that all piping systems require support and some degree of flexibility. Today's pipe stress engineer must go beyond checking for just allowable pipe stresses but must also check for load limitations on the equipment and/or support structure. In this regard, it is helpful to look at several alternative solutions for the same application and compare the different end loading results. four alternative solutions can include rigid pipe loops, traditional unrestrained rubber expansion joints, as well as two other more advanced rubber expansion joint arrangements. An example application of a 36" diameter carbon steel pipe with a 100' axial run under 90 psi with temperature fluctuation of 100°F will be used. Each solution will restrain the pressure thrust forces, absorb the axial thermal movement of 0.8" and keep the piping system within allowable stresses. However, each solution will have very different end loads.

10:30a - 11:00a

TP18-09

Thermal Performance Assessment Through Cooling Tower Modeling: Refinery Case.....103

Salvador Avila Filho, Jean Marcel Prazeres Silva, Ivan Costa Passos, Jade Spinola Ávila, Federal University of Bahia

Chemical Engineer and Petrochemical Processing has actuated in Chemical Industry. Salvador specialized as: statistical techniques to investigate abnormalities in the industry and as Organizational Consultant for transforming culture. As manager of a small factory he set model for clean management. As teacher, he actuated at undergraduate courses in Administration, Chemical Engineering, and Production. He was a researcher in clean technologies to reduce water consumption. His doctorate research was in human and organizational cultures. He has conducted research and services in the areas of Risk Management, Organizational Culture, Hu-

Donatello (Water Treating Sessions)

10:00a - 10:30a

TP18-08

System Failure Unrelated to Water Chemistry.....91

Pat Guccione, Chem-Aqua, Inc. and Adam Green, Baker Donelson

Pat Guccione has a BS degree in Physics, a BS degree in Chemical Engineering and Master's degree in Analytical Chemistry. He began his career with Betz Water Management in 1976 where he held a variety of field sales and internal management positions. Pat joined Chem-Aqua in 1999 and spent time as Chem-Aqua General Manager in Europe until returning to the United States in 2004 to assume his current position with Chem-Aqua. Pat is a 35-year member of NACE (National Associations of Corrosion Engineers), as well as a member of AWT, ACS and AIChE.

Identifying the true cause(s) of building water system failures is critical to prevention, mitigation and where applicable, legal defense. Any system failure is generally the result of several, often complex, variables. Because of the specialized nature of chemical water treatment knowledge, chemical water treatment has become an easy scapegoat for a wide variety of system failure claims. However, the origin of these problems is frequently either unrelated to water chemistry, or water chemistry is just one of several variables contributing the failure. Common causes of system failure unrelated to water treatment include: (a) Operational Issues; (b) Design Issues; and (c) and the lack of Legacy Knowledge with respect to the system operation and maintenance practices. It is the intent of the authors that the understanding of the possible causes will aid in identifying the root cause of the occurrence.

10:30a - 11:00a

TP18-10

Is it Time to Reconsider How We Test for Total Bacteria and Legionella Bacteria in Cooling Tower Water Systems.....N/A

Paul Puckorius, Puckorius & Associates, Inc and John Dresty, Griswold Water Systems, Inc.

Paul Puckorius is an independent water consultant whose company does not sell chemicals or equipment. *Paul has over 50 years' experience with microbiological control in cooling water systems. He has also been involved in Legionella out breaks by working with state and federal agencies on investigations of legionella in cooling water systems. Paul has done work throughout the world with cooling water systems in major industry as well as HVAC facilities in trouble shooting problems, root cause determination, development of water treatment programs, litigation, utilization of DNA for corrosive microbiological organisms, plus the development of the scale/corrosion prodictive tool known as the Puckorius Scaling Index. He has been past president of CTI and has member of CTI for over 50 years.*

Microbiological testing, specifically for total bacteria and Legionella bacteria in cooling tower water systems has been using a methodology that basically has not changed for many years. The recent Legionnaires Disease outbreaks due to cooling tower water systems has prompted a closer look at the methodology to determine if there is a need to consider

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Raphael Ballrooms A&B (ES&M and P&T Sessions)

man Reliability, and Process and Operational.

Water is currently a major object of interest in industries because it has a great applicability, mainly as a refrigerant fluid and in parallel there is a need to develop mechanisms that optimize its use. Cooling towers are the equipment responsible for reducing the temperature of hot water from the process. In this work, we wi use the mathematical modeling as methodology for the determination of the thermal performance of a cooling tower located in an oil refinery in the state of Bahia, using design data and historical data for the related analysis.

11:00a - 11:30a

TP18-11

Cost/Performance Tradeoffs Among Wet, Dry and Hybrid Cooling Systems.....119

John S. Maulbetsch and Michael N. Difilippo, Maulbetsch Consulting

Since 1999, Dr. Maulbetsch has been a private consultant to government and industry. Most of his work has been on water use and conservation in electric power production. He has published two major studies on alternative cooling systems for power plants for the California Energy Commission and the Electric Power Research Institute. Prior to establishing his consulting practice, he was at the Electric Power Research Institute for 23 years where he led the Institute-wide Exploratory Research/ Strategic R&D effort. Prior to joining EPRI, Dr. Maulbetsch was the Director of the Energy Technology Center of Dynatech Corporation in Cambridge, Massachusetts and before that on the faculty of the Massachusetts Institute of Technology. Dr. Maulbetsch received his S.B., S.M. and Ph.D. degrees from M.I.T. in 1960, 1962 and 1965 respectively. He is a Life Fellow of the ASME, a former Council Delegate from the Engineering Section of the AAAS and has served on numerous governmental and academic advisory boards

The needs for increasing amounts of electric power and to conserve locally limited fresh water supply can sometimes come into conflict. Since power plant cooling is the major use of water in most plants, it is the choice of cooling system that frequently mediates this conflict. Traditional wet-cooling systems have good efficiency and low cost but high water consumption); dry cooling virtually eliminates water consumption but at higher cost and reduced efficiency. Hybrid, wet/dry cooling systems enable significant water savings, albeit at higher cost, in comparison to wet cooling and provide improved plant efficiency and output at frequently lower cost in comparison to all-dry systems. This paper presents quantified tradeoffs among wet, dry and hybrid cooling systems for typical gas-fired, combined-cycle plants operating in a range of ambient conditions characteristic of the State of California in the US.

11:30a - Noon

TP18-13

From Reactive to Proactive: A Circulating Water Pipeline System Owner's Change in Philosophy...158

Mike Larsen and Anna Pridmore, Structural Technologies

Mike has a total of 34 years of experience in Estimating, Operations Management and Business Development within the Water/Wastewater Industry. Mike is a retired

Donatello (Water Treating Sessions)

a change that would be more representative of the true microbiological levels in these systems. Testing of "Bio-Film" instead of water samples suggests that this is a much better methodology that should be implemented which will very likely reduce total bacteria and Legionella bacteria levels in the cooling tower water system thus reducing outbreaks. A field-friendly procedure has been developed and is provided.

11:00a - 11:30a

TP18-12

Underwater Robotic Technology for Online Tower Basin Cleaning.....138

Joe Leist and Randi Lee Morgan, Scantron Robotics USA, Inc.

Joe Leist is the Owner/CEO of Scantron Robotics USA, Inc., Education: Studied Electrical engineering at the University of Pittsburgh. Background: 7+ years of union boiler making prior to operating Scantron Robotics USA .

Did you know that cooling tower basins can be cleaned without confined space entry and while facilities remain in full operation? Typically, cooling tower basins and other indtrial water tanks are cleaned during facility wide outages and involve dangerous confined space entry and lengthy procedures. This presentation will introduce an innovative alternative method for cooling tower basin cleaning that utilizes robotic technology to eliminate the dangers and lost productivity that is associated with traditional tank cleaning methods. A comprehensive review of the process and its benefits will be presented.

11:30a - Noon

TP18-14

No Charge – A Novel Non-Ionic Containing Deposit Control Polymers for Water Treatment.....N/A

Michael L. Standish, Radical Polymers

Michael Standish is founder of Radical Polymers, LLC, a business designed to specifically develop and provide technologies to the independent water treatment community. Mike has 30 years' experience in water treatment additive design, development and evaluation. Prior to forming Radical Polymers, Mike served as Senior Business Manager for International Specialty Products and Global Business Manager for National Starch's Alco Chemical business. Mike has served on the Board of Directors of AWT and holds a BS in Chemistry and Masters in Business Administration from the University of Tennessee at Chattanooga.

Less than 20% of all deposit control polymer offerings for water treatment incorporate non-ionic functionality. Where utilized, non-ionic monomers are typically incorporated into polymers at levels between 5-10% on a molar basis. A new polymer containing a greater incorporation level of non-ionic monomer has been recently introduced to the water treatment market with exceptional lab, pilot and field performance results. The new polymer has noticeably enhanced properties in a wide variety of areas such as performance for phosphate and transition metal stabilization, expansion of functionality to include organic debris and deposits, online cleaning, silica and magnesium silicate control, and surface tension reduction/wetting. This paper will detail the performance benefits of non-ionic monomer incorporation and provide lab, pilot and field data to support its differentiated efficacy.

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The Technical Sessions will run simultaneously between two separate Ballrooms.

MSGT from the U.S. Air Force, which he served for 23 years within the Civil Engineering Combat Engineers. Mike earned two Associates Degrees from the Community College of the USAF. Mike has been focused on structural strengthening of commercial, industrial and underground structures since 2010. Prior to that for a decade, Mike focused on non-destructive condition assessment of large diameter pressure pipelines. Mike has provided numerous presentations to Owners & Consulting firms in addition to numerous industry conferences, which include the Structural Engineers Association, ASCE, AWWA, NASTT, ACI and other organizations.

Since pipelines comprise only one component of many systems managed within a power plant, in many generating stations regular inspection of pipelines has historically not been a standard practice. While power plants have historically taken a reactive approach to management of their pipelines, the recent increase in leaks and failures in their large diameter circulating water pipelines is highlighting a need for proactive approach to pipeline management. This paper will help in gaining insight regarding pipeline owner's shift in approach for management of circulating water pipelines as well as technologies being implemented for condition assessment and structural rehabilitation of circulating water pipelines.

Group Luncheon - 12:15p - 1:45
Raphael Ballrooms C&D

Raphael Ballrooms A&B (ES&M and P&T Sessions)

2:00p - 2:30p

TP18-15

Closing The Loop – Which Method is Best for Your System.....169

Frank Morrison and Andrew Rushworth, Baltimore Aircoil Company

Frank Morrison, currently Technical Director, Global Marketing at Baltimore Aircoil Company has worked in both Product Engineering and Research & Development at BAC, as well as managed the R&D Labs and the Design Operations Group, before moving to Marketing as Closed Circuit Cooling Tower Product Manager. He earned a BS in Mechanical Engineering from Drexel University in Philadelphia and an MBA from Loyola College in Maryland. Frank is a member of ASHRAE, voting member of ASHRAE SSPC 90.1, Chair of ASHRAE TC8.6 Standards Committee, and Past Chair of ASHRAE TC3.6 (Water Treatment). He currently serves as Chair of the AC/EC Committee of the Industrial Refrigeration and Heat Transfer Section at AHRI. He is active in the Cooling Technology Institute, currently serving as Chair of the CTI Marketing Committee. Frank is an inventor or co-inventor on ten U.S. patents and has authored numerous ASHRAE Journal articles and technical papers.

Closed loop cooling systems deliver many benefits compared to traditional open loop systems, such as reduced fouling, less risk of fluid contamination, lower maintenance, and increased system reliability and uptime. Several methods are used to close the cooling loop, including the use of an open circuit cooling tower coupled with a plate & frame heat exchanger or the use of a closed circuit cooling tower. This study examines the total installed cost using these two alternatives, including equipment, material, and labor costs and will contrast the operational and maintenance aspects of the two designs to help system designers and operators make the best heat rejection choice for their next project.

The CTI Office has worked hard to schedule a program that fits everyone's needs. Incidentals arise that may cause changes and/or omissions to parts of the program that are out of our hands. Our apologies if this happens.

Group Luncheon - 12:15p - 1:45 - Raphael Ballrooms C&D

Donatello (Water Treating Sessions)

2:00p - 2:30p

TP18-16

A Landmark Legionella Lawsuit: A Case Study Highlighting the Legal, Mechanical and Microbiological Factors.....197

Adam Green & Amy Champagne, Baker, Donelson, Bearman, Caldwell & Berkowitz, PC; Janet Stout, Ph.D., Special Pathogens Laboratory; and Robert Cunningham, International Water Consultants, Inc.

Adam Green served as lead counsel for the target defendant in the Gross v. Baltimore Aircoil case. Over the past 16 years, he has successfully defended high value, catastrophic failures of building water systems across the country arising from a myriad of different causes. Over the same period, he has routinely defended wrongful death and personal injury actions arising from a litany of exposures to various toxins and toxicants. He is regarded as one of the nation's foremost attorneys in cooling water systems and chemical water treatment.

This publication addresses the highly complex nature of the legal, mechanical and microbiological factors underlying the landmark decision in the Gross v. Baltimore Aircoil, et al. case believed to be the first reported Legionnaire's disease case wherein a chemical water treater was alleged to owe a general duty to the public to protect it from Legionella related illness. The fundamental legal issues include: (1) the existence of a legal duty by a chemical water treater to prevent the formation of a ubiquitous bacterium; (2) the existence of a legal duty by a chemical water treater to test for or "control" Legionella bacterium; (3) the lack of any statute or regulation establishing the appropriate legal standard of care regarding Legionella prevention or control; (4) the intent of the treater and its customer with respect to the scope of services; (5) the existence of a legal duty for a chemical treater to warn a premises owner about Legionella; and (6) the Plaintiff's burden of proving that insufficient treatment was the legal cause of the injuries.

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PROGRAM continued

Raphael Ballrooms A&B (ES&M and P&T Sessions)

2:30p - 3:00p

TP18-17

Changes Through the Years, Great River Energy Coal Creek Station

Pat Schwartz, Great River Energy; John Ahern, EvapTech, Inc.; and Chris Ahern, Kansas State University.....214

Pat is a Senior Systems Engineer at Coal Creek Power Station in Underwood, ND and has worked with Great River Energy for 35 years. He has a BS in Mechanical Engineering from the University of North Dakota. Pat is a Licensed Professional Engineer in North Dakota.

This presentation will summarize the evolution of the plant and detail some of the major changes/improvements thru the years. This includes new concrete circulating water piping, a coal drying system, the addition of variable frequency drives on the cooling tower fan motors, and the replacement of the cooling tower fill rings. Coal burns. Water doesn't. That is the founding principle behind a lignite fuel enhancement system which includes both drying and refining lignite. As a result of the research efforts and our partnerships with other companies, Great River Energy is DryFining all of the coal used at Coal Creek Station. The three cooling tower fill rings have each been replaced twice. These results and operating changes for both the cooling towers and the units will be discussed, focused on energy usage and power demands.

3:00p – 3:30p

TP18-19

Rental Cooling Towers and CTI Certification.....236

Billy Childers and Atul Swamy, Aggreko

Billy Childers has been part of the cooling tower industry for the past 26 years and is currently the National Manager of Aggreko Cooling Tower Services (ACTS). Billy is responsible for Aggreko's industrial cooling tower rental business for the Americas. Responsibilities over the past years have included R&, 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.

Cooling towers are not one size fits all and are therefore designed and built to achieve a specific amount of cooling at a predetermined water flow. However, in the rental market a single cooling tower will be utilized in various applications, with varying water qualities, temperatures and flow rates without any changes or rating adjustments to adjust for the varying conditions. The paper will cover case studies including 3rd party test results that demonstrate how this effects performance and how having CTI Certification for rental cooling towers can help ensure the end user gets the results they are paying for.

Donatello Room (Water Treating Sessions)

2:30p – 3:00p

TP18-18

Legionella Litigation: How Cases are Won and Lost at the Microbial Level.....230

Janet Stout Ph.D., Special Pathogens Laboratory

Dr. Janet E. Stout is the Director of the Special Pathogens Laboratory in Pittsburgh, PA, and an Associate Professor at the University of Pittsburgh Swanson School of Engineering in the Department of Civil and Environmental Engineering. She is an authority on Legionnaires' disease, having studied Legionnaires' disease for more than 30 years. She has authored of more than 100 papers and book chapters on Legionnaires' disease in water systems. She is a member of the American Society for Microbiology, the Association for Professionals in Infection Control, and the American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE), and a member of the ASHRAE Legionella Standard Committee.

Outbreaks of Legionnaires' disease are well publicized and cases often make their way into court. Determining the source of exposure is a key factor in determining responsibility and involves many disciplines, including engineering, water treatment, epidemiology and microbiology. The microbiology of *Legionella* in the suspected environmental source is explored through examination of culture results. The role of microbiology in determining the source of infection will be discussed along with examples of cases and their outcomes from hotels and healthcare facilities.

3:00p – 3:30p

TP18-20

What is the Best Metallurgy for My Package Evaporative Cooling Device.....249

Robert J. Cunningham, International Water Consultants, Inc and Zan Liu, Johnson Controls

Bob has 54 years of experience in the field of water treatment. He is currently the president of International Water Consultants Inc., a firm that he founded. He holds a BS in Chemistry as well as an MBA from the University of Pittsburgh. He is a registered professional corrosion engineer in California, and the author of numerous papers on water treatment and corrosion issues. Bob is a member of the ASHRAE legionellosis committee; ASME; past president of CTI; a former member of the board at AWT; NACE; and a former member of the Advisory Committee of the IWC.

Evaporative condensers are used almost exclusively in industrial refrigeration systems, especially with ammonia applications in the U.S. Their unparalleled heat rejection efficiency, associated with the lowest first costs, comes from evaporative cooling, which means the inside of the condenser is being constantly exposed to aerated water for the majority of its operation time. It is critical to choose the right materials of construction, not only for protecting the equipment investment and maintaining the maximum efficiency, but also for safety and structural integrity. The common materials used in evaporative condensers are hot dipped galvanized carbon steel (HDG) and 300 series stainless steel (SS). Even though evaporative condensers have been widely used for decades, the complexity and variation of water chemistry, metallurgy, and the multiple environmental restraints encountered, has resulted in neither a good understanding nor a guideline on when it makes sense to upgrade to SS versus when it is better to stay with HDG.

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Afternoon Schedule for Monday, February 5th

3:00p - 4:00p -  **Break -** ***Atrium***

3:45p - 5:00p - Technical Committee Meetings

- **Engineering Standards & Maintenance -** ***Raphael Ballrooms A&B***
- **Performance & Technology -** ***Donatello***
- **Water Treating -** ***Salon 2***

5:00p - Midnight - Hospitality Suite - ***Raphael Ballrooms C&D*** **(*Bar Closes @ 9:30p*)**

6:30p - 9:40p - Monday Night / Hospitality Suite - ***Raphael Ballrooms C&D***

Come join us for fun, food, music and fellowship with others inthe cooling tower industry. This venue will be open to everyone who has paid for a 3 day Meeting registration

Tuesday, February 6, 2018

The Technical Sessions will run simultaneously between two separate Ballrooms.

7:00a - 8:00a - New Member's Breakfast, ***Salon 10***

7:00a - 10:00a -  Service, ***Atrium***

7:00a - 5:00p - Registration and Paper Sales, ***Atrium***

7:00a - 5:00p - Speakers' Breakfast, ***Salon 1***

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7:00a - 5:00p - Speakers' Breakfast, ***Salon 1***

The Technical Sessions will run simultaneously between two separate Ballrooms.

Raphael Ballrooms A&B (ES&M and P&T Sessions)

7:30a - 8:00a

TP18-21

Visual Inspection by Drone.....268

Anne Vacque, EDF

Anne is a Civil Engineer in cooling tower monitoring. EDF survey the civil engineering of nuclear power plants. In addition to topographic controls, the traditional visual inspection is operated from the ground, at a long distance from the buildings, to characterize civil engineer defects: cracks, corrosions, concrete peeling... and help to define the maintenance. To improve the quality of the controls EDF is testing innovative technologies especially with drones. A visual inspection was tried on a cooling tower with a drone, equipped with a high-resolution camera, and GPS system. The photos were assembled and corrected to generate a high-quality orthophoto map of the inspected structure. The developments with R&D Department are focused on automatic detection of the defects.

Donatello (ES&M and P&T Sessions)

7:30a – 8:00a

TP18-22

Strategies for Reducing Uncertainty in Legionella Analysis.....276

Brian Swalla, IDEXX Laboratories, Inc.

Brian Swalla is a Staff Scientist in the Water R&D group at IDEXX Laboratories, Inc., where he leads interdisciplinary teams on the development of new products for water microbiology testing. Most recently, Brian co-led the development of Legiolert, a new culture method for detection of Legionella pneumophila. Brian has 15 years of experience in industrial microbiology, in diverse areas including water quality, bioinformatics, biofuels, protein engineering, and nucleic-acid technologies. Brian obtained his Ph.D. in Microbiology from the University of Illinois.

Accuracy and efficacy of Legionella testing is affected by various factors that can increase measurement uncertainty. Such factors include interference from non-Legionella organisms, subjective interpretation of test results, and differential performance of agar media, among others. Examples will be discussed in relation to strategies for minimizing uncertainty. Legiolert, a new culture-based method for detection of Legionella pneumophila, provides an alternate approach to reducing measurement uncertainty. A comparison of Legiolert with conventional culture methods will be presented with a specific focus on the challenges associated with testing nonpotable water from cooling towers and related sources.

THE 2018 CTI ANNUAL CONFERENCE
PROGRAM continued

The Technical Sessions will run simultaneously between two separate Ballrooms.

Raphael Ballrooms A&B (ES&M and P&T Sessions)

8:00a - 8:30a

TP18-23

Comparative Evaluation of Pitot Tube Designs for Water Flow Measurement Devices.....297

Kenneth W. Hennon, P.E. and David E. Wheeler, P.E., CleanAir Engineering

Kenneth Hennon is a Senior Vice President of CleanAir Engineering and has long been associated with cooling tower and plant component performance evaluations. He has presented numerous papers associated with topics related to heat rejection issues.

The Simplex pitot tube has long been used for water flow rate determinations. However, the accuracy of Simplex based flow measurements is known to be negatively impacted affected by a number of commonly occurring flow conditions including high flow velocity, Reynolds number sensitivity, and disturbed flow profiles. CleanAir Engineering was contracted by the Cooling Technology Institute to conduct research regarding the suitability of two new candidate pitot designs for water flow rate measurements. These alternate tube designs were analyzed under a variety of flow conditions in controlled settings, and their responses were compared to that of the Simplex design. This paper documents work conducted by CleanAir and the associated findings.

8:30a - 9:00a

TP18-25

Preventing Degradation And Improving Efficiency In Cooling Towers, How? "Wind Screens".....338

James L. (Jim) Baker and Jaime Wilde, Galebreaker Industrial Limited

Jim Baker brings a unique marketing diversification to the industry through his 37 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 use of windscreens has been utilized in the Industrial and Agricultural Markets to provide performance and maintenance improvement solutions for over 30 years. We are now focusing on improving the performance of Cooling Towers, Fin Fan Air Coolers, and Air-Cooled Condensers across refineries, power plants and many other manufacturing facilities. This paper will identify some of the performance and degradation problems associated with fill clogging and fouling, freezing and winterization, re-circulation and interference, and plume abatement and discuss the use of windscreens as industry leading solutions. Case studies will be provided to illustrate these solutions.

Donatello (Water Treating Sessions)

8:00a - 8:30a

TP18-24

New Yellow Metal Corrosion Inhibitor with Better Performance, Improved Stability, and Lower Toxicity.....320

Andrew Yanjiao Xie and Daniel Meier, Nalco Water, An Ecolab Company

"Andrew" Yanjiao Xie is a lead chemical engineer at Nalco Water, an Ecolab company. Andrew has over ten years of research experience in chemistry and analyzer development for cooling water and wastewater treatment. His research expertise covers cooling water treatment chemistry, wastewater treatment chemicals, sensor, and automation. Prior to Nalco, Andrew received a master degree and a doctoral degree in Environmental and Chemical Engineering from Washington University in St. Louis.

Yellow metallurgy (copper and its alloy including admiralty brass) has been widely used in heat exchangers due to its high thermal conductivity, antimicrobial properties etc. These metals suffer from corrosion in acidic-to-neutral and highly halogenated environments that are common in cooling water systems. This may result in failure of heat exchangers and consequently loss of production and costly replacement. In the last few decades, different triazole chemistries were used as a protective filming inhibitor for yellow metal. These chemistries have their limitations. To overcome these challenges, Nalco Water has developed an innovative non-triazole based yellow metal corrosion inhibitor with improved halogen stability, lower consumption rates, and reduced aquatic toxicity compared to triazole compounds. The new patent-pending chemistry has been evaluated for its performance in electrochemical tests, pilot cooling tower tests and customer field trials. The results from both lab and field trial will be discussed in detail. Additionally, a handheld analyzer has been developed and evaluated to precisely measure this eco-friendly, next generation non-triazole based yellow metal corrosion inhibitor.

8:30a - 9:00a

TP18-26

Legionnaires' Disease Risk Management: First Requirement For Cooling Tower Systems.....360

Mario Bellavance, Blue Heron Cooling Tower Inc.

Mario Bellavance is a mechanical engineer that graduated from l'École de technologie supérieure. Afterwards, he completed a Masters in Engineering from l'Université de Sherbrooke. He began working in the cooling tower industry in 1995. He's the founder of Blue Heron Cooling Tower Inc. Now consultant, he works to help Cooling Tower operators to protect public health by successfully managing the risks of transmitting Legionellosis. He has delivered speeches during previous CTI Winter Conferences.

It is usually recognized that a Cooling Tower System needs water treatments and a maintenance program to prevent the transmission of Legionnaires Disease. Is it enough? Referring to ecology of Legionella pneumophila in water system, various cases studies, standard or guidelines, the author will illustrate how a risk analysis and consequently a risk management program are the first requirements for operating a Cooling Tower System safely.

THE 2018 CTI ANNUAL CONFERENCE
PROGRAM continued

The Technical Sessions will run simultaneously between two separate Ballrooms.

Grand Ballroom C (ES&M and P&T Sessions)

9:00a – 9:30a

TP18-27

Cooling Equipment Sound Measurements: Test Code Comparisons and Recommendations.....371

Jean-Pierre Libert, Jennifer Hamilton, Scott Nevins, Will Nuckolls and Andrew Carl, Evapco, Inc.

Jean-Pierre R. Libert holds a MS Degree in Mechanical Engineering from Faculte Polytechnique of Mons, Belgium. As Vice-President of Advanced Technology at Evapco, he oversees the R&D, product development, testing, and rating of field-erected cooling towers and air-cooled steam condensers. Before joining Evapco, Jean-Pierre held technical and management positions in cooling technologies in Belgium, Mexico and the USA. An active CTI participant, he has chaired several technical committees. He is an Advisor to the Electric Power Research Institute and a member in good standing of the American Society of Mechanical Engineers. He has authored and presented technical papers on cooling systems at CTI, EPRI and ASME conferences.

CTI's ATC-128, Europe's ISO-3744 and China's GB/T 7190 are test codes which describe methods to measure sound pressure levels from water-cooling towers to compute sound power levels. In accordance with these codes, our engineers collected sound pressure measurements on a variety of factory-assembled cooling towers of different types and shapes and computed the sound power levels. The data collected and the results of calculations from the different techniques will be compared. Recommendations to update ATC-128 will be proposed to improve the correlation of results between the codes.

9:30a – 10:00a

TP18-29

Fundamentals of Compression Testing Cooling Tower Fill Packs for Load Capacity.....458

Joe Evans and Bob Petterson, SPX Cooling Technologies

Joe Evans has worked as a Materials Engineer for SPX for 6 years, where is primary function is development of new materials, including fill. He graduated from the University of Missouri Rolla in 2009 with a dual major in Metallurgical & Chemical Engineering.

This paper covers the fundamentals of testing cooling tower fill packs for load capacity. Consistent testing methods guarantee accurate data, and therefore contribute to reliable design. Understanding how temperature, support width & mil thickness affect the ultimate compression strength of the fill product is key to optimum design. Failure modes and the influence of pack geometry and support span are also discussed..

Grand Ballroom A&B (Water Treating Sessions)

9:00a - 9:30a

TP18-28

Novel Galvanized Cooling Tower Corrosion Inhibitor.....447

Mary Jane Felipe and Sidney Dunn, Baker Hughes Inc.

Jane is currently a Water Technology Specialist at Baker Hughes Inc. She leads the technical development and project management of new products for Industrial Water Treatment. Jane received her Ph.D. Chemistry degree at the University of Houston and BS Chemistry degree at the University of the Philippines. She authored and co-authored more than 50 publications and 10 patent pending applications and has recently won the 2017 Hart's E&P Meritorious award for Engineering Innovation for Drilling and Stimulation Fluids category.

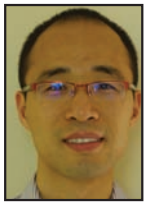
Galvanized coatings for cooling tower systems have been used since the 1950s. The galvanizing process binds a layer of zinc to steel and serves as a sacrificial anode to prevent corrosion of the underlying steel structure. However, galvanized cooling towers that have not been properly treated at start-up may experience rapid formation of a soft, white, fluffy, non-protective zinc-corrosion product known as "white rust". Consequently, the corrosion of the underlying steel can become concentrated under the white rust bumps, quickly develop into pitting corrosion and if left unchecked, leads to leaks in the system. This study presents a novel passivation procedure and new chemistry for galvanized systems. The procedure is free of white rust and calcium phosphate scale formation.

9:30a - 10:00a

TP18-30

A Robust Non-Phosphorous Corrosion and Scale Control Program for Cooling Systems.....467

Bingzhi Chen, Nalco Water, An Ecolab Company



Bingzhi Chen received his Ph.D. from East China University of Science and Technology, 2003, majored in advanced organic materials. He services in water treatment industry since 2005. Presently, he is a senior staff scientist in Nalco Water. His areas of research include: scale & corrosion control in industry water process and reagent based sensor development.

Non-Phosphorous programs for mild steel corrosion control in cooling system are often challenged by deteriorated performance, limited application window (medium/high Ca/Alkalinity water) and a potentially high treatment cost. The newly developed cost effective Non-Phosphorus program composes of both organic as well as inorganic components. This novel new program not only provides superior CaCO3 inhibition, but also provides excellent anodic and cathodic corrosion protection to mild steel. The extended application window to soft and high conductivity water, along with high tolerance to pH upset impart significant operation flexibility to the program when compared to stabilized phosphate program. The lab performance evaluation, field trial results and mechanistic study will be reported and discussed in this presentation.

THE 2018 CTI ANNUAL CONFERENCE
PROGRAM continued

Mid-Morning to Afternoon schedule for Tuesday, February 6th

10:00a - Noon - Technical Committee Meetings

- **Engineering Standards & Maintenance - *Raphael Ballrooms A&B***
- **Performance & Technology - *Donatello***
- **Water Treating - *Salon 2***

Noon - 2:00p - Owner Operator Seminar (w/box lunch) - *Raphael Ballroom D*

12:00p - 2:00p - Lunch on your own

2:00p - 3:00p - Services, *Atrium*

2:00p - 4:30p - Seminar to.... 

Raphel Ballroom A&B

4:00p - 8:30p - Table Top Exhibits and Hospitality Suite
Atrium
(*Bar Closes @ 9:30p*)

Wednesday, February 7, 2018

7:00a - 10:00a	**Services, *Atrium***
7:00a - 5:00p -	**Registration and Paper Sales, *Atrium***
7:00a - 8:00a -	**Speakers' Breakfast, *Salon 1***
8:00a - 12:00p -	**Educational Seminar, *Raphael A&B***
12:00p - 1:30p -	**Lunch on your own**
1:30p - 5:00p -	**Technical Committee Meetings**
	• Engineering Standards & Maintenance, *Raphael Ballrooms A&B*
	• Performance & Technology, *Donatello*
	• Water Treating, *Salon 2*
2:00p - 3:00p -	**Services**
5:00p - 8:00p -	**Hospitality Suite (*Bar closes @ 8:00p*) *Campobello***

Thursday, February 8, 2018

Thursday's activities involve the Board of Directors and Committee chairs only

7:30a - 8:15a Board of Directors' (includes Committee Chairs) Breakfast, *Campobello Room*

8:30a - 2:00p Board of Directors' Meeting, *Salon 3*