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THE 2016 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 7, 2016

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

Revised: January 21, 2016 **4:00p - 8:00p** - Registration, ***Atrium*** **Revised: January 21, 2016**

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

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

Monday, February 8, 2016

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
Eurovent Update
Multi Agencies Report
Certification Report

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

8:30a - 9:00a

TP16-01

Mechanical Behavior Of Polymer Fills **1**

Nina Woicke, Ph.D and Daniel Dierenfeld, GEA 2H Water Technologies GMBH

Born on 17 Nov 1975 in Kiel (Germany). Engineering degree in process engineering in 2002 and Ph.D. in Polymer Engineering in 2006. Since then head of R&D of GEA 2H Water Technologies GmbH and responsible for fill design and material composition.

This paper will outline the mechanical properties of polymer fills and discuss the influence of different parameters (like design, foil thickness, PP vs PVC) as well as the influence of the boundary in cooling tower surrounding.

9:00a - 9:30a

TP16-03

A Technical Evaluation and Reconstruction of Factory Assembled Cooling Towers Including The Retrofit To Direct Drive Fan Motor Technology **N/A**

Philip Poll, OBR Cooling Towers, Inc.; Slava Prash, NRG Thermal

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

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Long Range Planning
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Donatello Room (Water Treating Sessions)

8:30a - 9:00a

TP16-02

Increasingly Complex Tower Makeup Water Issues **18**

Brad Buecker and Behrang (Ben) Pakzadeh, Kiewit Engineering And Design

Brad Buecker is a Process Specialist with Kiewit Engineering and Design Company. He has 34 years of experience in the power industry, including 18 years as a chemist, air quality control specialist, and results engineering specialist at City Water, Light & Power (Springfield, IL) and Kansas City, Power & Light. He has authored many articles and three books on steam generation topics.

As fresh water becomes increasingly scarce in the United States, or perhaps due to political pressures, new power and industrial plant owners are turning to alternatives supplies for plant makeup, including the makeup to cooling towers. A common source is secondary treated municipal wastewater effluent. These waters often contain impurities that serve as nutrients for microbiological fouling in cooling systems, and include ammonia, phosphorus, organics, and suspended solids. It may not only be beneficial but imperative to remove these containments upstream of the cooling tower, but methods to do so require careful planning and selection. Technologies that are coming to the forefront from include membrane bioreactors (MBR) and moving bed bioreactors (MBBR). They may be integrated with clarification and other treatment methods to achieve the desired cooling tower makeup quality. This paper examines these emerging issues.

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PROGRAM continued

The Technical Sessions will run simultaneously between two separate Ballrooms.

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

management, product design, equipment inspection and water treatment for both fields erected and packaged cooling towers. Prior to joining OBR, Philip was employed as a District Representative for The Nalco Chemical Company, where he completed Nalco's technical sales engineering training program.

This paper addresses a project involving the online reconstruction and upgrading of deteriorated package of cooling towers at district cooling facility located in the Southwestern United States. Examination and evaluation of the existing equipment will be explained in detail along with the process of the online repairs and conversion of the fan drive system to direct drive permanent magnet motor technology. Observed and measured performance and reliability results are presented demonstrating the effectiveness of the project.

9:30a - 10:00a

TP16-05

Safety In Cooling Tower Maintenance 28

Magose Abraham Eju, Energy Business Total Solutions Limited

Magose Abraham Eju holds a PhD Degree in Mechanical Engineering from the University of Strathclyde, Glasgow, UK and an MBA Degree in Project Management from the University of Technology Owerri, Nigeria. His PhD Dissertation was on the topic "Improving the Thermal Performance of Cooling Towers by Conditioning of Air". He has over twenty years of working experience in the oil and gas industry. Between 1991 and 1994, he worked with a multi-national marine company – Holt Leasing Marine - as a 3rd class marine engineer. Between September 1997 and June 1998 he worked as a freelance inspection engineer with a multi-national inspection company - SGS Inspection Company Limited. Between July 1998 and September 2014, he worked with a multi-national liquefied natural gas company – Nigeria LNG Limited where he worked as a Gas Production Operator, Process Engineer and Project Coordinator. He has undergone / attended several professional technical / management training / conferences in Australia, Belgium, Holland, Malaysia, Nigeria, UK and USA during his working career. He is currently the Chief Operating Officer of Energy Business Total Solutions Limited.

Maintenance of Cooling Towers usually poses quite a number of occupational/personal safety challenges. For example, the process of removing and replacing packing (fill) in a cooling tower involves working at height in most cases. If not well managed, this exercise can result to accident of falling, leading to injury and/or fatality. In order to avert such safety incidences during Cooling Tower maintenance, a robust safety management system needs to be developed for ever maintenance work. This paper uses a case study to show the various safety hazards that can be associated with maintenance of Cooling Towers, as well as, suggest ways these hazards/risks could be mitigated.

Donatello (Water Treating Sessions)

9:00a - 9:30a

TP16-28

Advancements In Cleaning And Passivation of Cooling Water Systems 322

Raymond M. Post, P.E. and Prasad Kalakodimi, Ph.D, ChemTreat

Raymond M. Post, P.E., Director of Cooling Water Technology B.S.E, Chemical Engineering, Princeton University, 1976. Mr. Post has 39 years of industrial water treatment experience, including 37 years in the development, application, and evaluation of water treatment programs. Prior to joining ChemTreat in 2008, Mr. Post held several positions with Betz Laboratories and GE Water including global technical leader for cooling water chemistry, power industry technical manager, senior technical consultant, and positions in product development, product management, and technical services. Mr. Post is a licensed professional engineer and a member of ASME, Cooling Technology Institute, International Water Conference Advisory Council, and the National Society of Professional Engineers. He holds 2 US Patents and has authored more than 40 technical papers on industrial water treatment.

Cooling Systems and equipment that are not properly cleaned and passivated prior to entering service will experience corrosion problems that are difficult to overcome once the system is placed in operation. This paper reports on recent developments in cleaning and passivation chemistry that are applicable to new cooling systems and to older systems requiring rust removal and passivation. Laboratory electrochemical results will be presented as well as plant application case histories.

9:30a - 10:00a

TP16-06

Novel Efficient Non Phosphorus Cooling Water Corrosion Inhibitor 43

Mary Jane Felipe, David Fulmer, Corina Sandu, Bing Bing Guo, Khac Nguyen, Baker Hughes Inc.

Mary Jane Felipe is currently an R&D Scientist at Baker Hughes Inc. She

received her BS Chemistry degree at the University of the Philippines and PhD Chemistry at the University of Houston. Before coming to the USA, she was an instructor at the University of the Philippines-Diliman and was a Regional Task Force for United Nations Development Program - Partnerships in Environmental Management for the Seas of East Asia. She is a synthetic organic and surface chemist by profession and currently working on water soluble polymers for use in water treatment.

Corrosion may cause deleterious problems in cooling water systems and typically, when poorly controlled, may lead to decreased plant efficiency due to loss of heat transfer or even equipment failure. Most industrial cooling towers utilize orthophosphate, polyphosphates or other phosphorous-containing water treatment programs as corrosion mitigation measures. However, the use of such corrosion inhibitors is steadfastly becoming the object of federal and local regulations due to phosphorous contamination of surface water. In this regard, this paper details the technological development of non-phosphorous corrosion inhibitor for use of cooling water systems.

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The Technical Sessions will run simultaneously between two separate Ballrooms.

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

10:00a - 10:30a

TP16-07

Unique Method Using Robotics for Online Cleaning 61

Michael Dorsey, AquaCoor Services and Joe Leist, Scantron Robotics

Prior to AquaCoor 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. Under his direction, the water treatment initiative grew from a single site, in the early 2000s to more than 20 sites with multiple systems in 2014. He collaborated with plant engineers local and mid level corporate managers to accelerate progress around reliability of water treatment systems. His oversight and leadership abilities also helped improve mechanical integrity and uptime with internally documented Six Sigma projects. Dorsey also possesses experience and expertise in capital project management. He served as the mechanical lead for multiple capital projects from 1989 to 2000 at DuPont. He has authored papers and led committees around corrosion and water treatment practices at various associations.

Typically, cooling tower basins are cleaned during planned turnarounds when the water system has been shut down. Plant operations have seen those outages greatly extended creating the need for alternative cleaning methods. This paper describes a novel online robotic cleaning system that has been shown to clean cooling towers, clearwells, tanks and other aqueous vessels while equipment is in normal operation. Multiple advantages of this technology will be discussed such as safety, elimination of downtime and economic benefits.

10:30a - 11:00a

TP16-09

Hope Creek Circulating 144-inch Water Pipeline Carbon Fiber Upgrade 83

Anna Pridmore, Ph. D, Structural Technologies, LLC

Anna Pridmore, PhD, received her doctorate in structural engineering and has over ten years of interdisciplinary experience in advanced composites, design and material science with a focus on pipeline rehabilitation. Anna has provided technical insight to hundreds pipeline owners and consultants across the United States and internationally. Anna has authored or co-authored over 20 technical papers and also contributes to the industry by serving as an active member of committees and task groups for AWWA, ASME and ASCE.

Recently Hope Creek Nuclear Station identified seven distressed segments of its 144-inch circulating water pipeline in need of repair. Carbon fiber-reinforced polymer (CFRP), a trenchless structural repair system, was selected to strengthen the pre-stressed concrete cylinder pipe (PCCP). The PCCP lines at Hope Creek are the backbone of the circu-

Donatello (Water Treating Sessions)

10:00a - 10:30a

TP16-08

A Solid Isothiazolone Biocide Controls Microbial Growth In Industrial Water Treatment Systems 68

Brian Corbin, The Dow Chemical Company

Brian Corbin is a Customer Application Specialist and Research Scientist for Dow Microbial Control. He joined Dow in 2013, and is currently responsible for technical support and development for biocides utilized in water treatment. He has a Ph.D. in Microbiology and Molecular Genetics from The University of Texas Health Science Center-Houston. He completed a postdoctoral fellowship at Vanderbilt University and has several years of experience in the biotech industry. Brian is located in Collegeville, PA.

Isothiazolone biocides have been used effectively for decades to control microbial growth in a variety of industrial water treatment applications. The most frequently used product is a 3:1 ratio of 5-Chloro-2-Methyl-4-Isothiazolin-3- one (CMIT) and 2-Methyl-4-Isothiazolin-3-one (MIT). Typically CMIT/MIT is dosed into cooling systems as a liquid, but a novel solid version was recently developed. The CMIT/MIT solid is safer to handle and easier to transport that liquid biocide formulations. We report efficacy of CMIT/MIT against microorganisms, including Legionella, biofilm-formers and sulfate-reducers. The basic characteristics of the new solid tablet will be discussed based off of laboratory and field trials.

10:30a - 11:00a

TP16-10

A CMIT/MIT Surfactant Blend To Control Biofilms In Industrial Water Systems 103

Brian Corbin, The Dow Chemical Company

Brian Corbin is a Customer Application Specialist and Research Scientist for Dow Microbial Control. He joined Dow in 2013, and is currently responsible for technical support and development for biocides utilized in water treatment. He has a Ph.D. in Microbiology and Molecular Genetics from the University of Texas Health Science Center-Houston. He completed a postdoctoral fellowship in Vanderbilt University and has several years of experience in the biotech industry. Brian is located in Collegeville, PA.

Isothiazolone biocides are used to control bacteria, algae, fungi and biofilms in industrial water systems. Surfactants are also known directly influence biofilm formation and stability. In this report, we describe a new, one-drum liquid solution that combines 5-Chloro-2-Methyl-4-Isothiazolin-3-one. (CMIT) and 2-Methyl-4-Isothisazolin-3-one (MIT) with a high-performance, low aquatic toxicity surfactant. The solution is stable, low foaming and effective in controlling microorganisms at low parts per million levels. The methods used to evaluate the performance of the product and laboratory and field testing results will be presented.

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

lating water system. CFRP is a repair material used to provide targeted structural upgrades within distressed or damaged pipeline sections of the repair. Attendees will learn about this unique material used to extend the life of circulating water pipeline systems.

11:00a - 11:30a

TP16-11

Using ATC-128 For Sound Testing & Verification In The Field 126

Erik Miller-Klein, SSA Acoustics, LLP

Erik Miller-Klein, PE is a noise control engineer and associate partner at SSA Acoustics, an acoustic consulting firm based in Seattle, Washington. He is a licensed Professional Engineer in Acoustical Engineering from the State of Oregon, the only state with this license. Erik is a nationally recognized speaker on noise control and acoustics in the built environment. His firm is a licensed CTI sound testing agency.

This paper will evaluate the standard and published data for small towers per ATC-128 with respect to usability for acoustical consultants. Through testing of fully operationally field installed units and test-stand towers some challenges and opportunities have been identified to help improve the use and accuracy of ATC-128. Using ATC-128 in the field has distinct challenges associated with height, distance, and background noise. The paper includes a comparison to ANSI/AHRI 370 the standard for Sound Performance Rating of Large Air-Cooled Outdoor Refrigerating and Air-Condition Equipment.

11:30a - Noon

TP16-13

CDF Modeling Of Wind And Velocity & Direction On Exit Air In Performance Of IDCT 147

Ram Kumar Jha, Performance Analyst Pvt. Ltd; Suresh Sarma, SS Cooling Tower Consultant, India

Mr. Jha is a graduate of Mechanical Engineering and MBA and has more than 7 years of Cooling Tower research experience.

The induced draft wet cooling tower performance is highly affected due to recirculation of saturated exit air from the cooling tower. The impact of wind velocity and wind direction further degrades the predicted performance of cooling tower. This paper covers the volumetric multi fluid analyses using CFD modeling in 18 back to back cells of 14 meter x 14 meter cooling tower in three different possible orientation like parallel, perpendicular and 45 inclined to the privilege wind direction. The quantative analysis estimate the amount of recirculation and extent of recirculation around the cooling tower and qualitative analysis identity the flow of recirculation and flow behavior for different wind direction. Prediction of recirculation allowances is generally provided by CTI (Cooling Technology Institute, USA) such as PTG-116 & PTB-110 codes.

Donatello (Water Treating Sessions)

11:00a - 11:30a

TP16-12

Application of Flow Cytometry to Rapid Microbiological Analysis of Cooling Water 135

Kelly Lipps and Doug McIlwaine, PhD, ChemTreat, Inc

Kelly Lipps currently works in the Microbiology Research and Development group at ChemTreat, Inc. She attended Virginia Commonwealth University where she received a B.S. in chemical and Life Science Engineering in 2014. During her undergraduate studies, she worked in a biomedical engineering lab where she researched cell attachment to synthetic bone tissue materials. After graduating, she came to ChemTreat where she is evaluating methods for microbial growth in industrial water samples including flow cytometry.

Microbiological growth on cooling towers, heat exchangers and piping cause a multitude of issues including microbiologically-influenced corrosion, reduced heat transfer, fill fouling, increased fluid frictional resistance, and dispersion of airborne pathogens such as Legionella. Rapid and effective microbiological monitoring is the key to ensuring that cooling water systems operate safely and efficiently. Flow cytometry has been used for many years in medical applications that involve cell counting and sorting, particularly in cancer research and diagnostics. The ability of flow cytometry to rapidly identify and enumerate large quantities of nano-scale particles and their fluorescent properties creates vast opportunities for applications in bacteria identification and monitoring. This paper examines the use flow cytometry in conjunction with fluorescent nucleic acid and bacteria stains to rapidly enumerate live and dead bacteria in industrial cooling water samples. Staining methods as a means of identifying particular species, such as Legionella, and cell viability studies using nucleic acid stains are discussed.

11:30a - Noon

TP16-14

Controlled Hydrodynamic Cavitation: A Physical Water Softening & Disinfection Method 157

Joshuah Beach-Letendre and Carl Steffen, Ecowater CHC

Joshuah Beach-Letendre earned his B.S. in microbiology and M.S. in biology from The University of Texas at Arlington. He has specialized in water chemistry and filtration for biological systems for over five years and has co-authored three publications focusing on environmental microbiology. Mr. Beach-Letendre is the current lab manager and researcher for EcoWater CHC located in Schertz, TX.

Cavitation has long been known to be a powerful force usually associated with unwanted destruction of system components. Controlled cavitation however can yield to beneficial outcomes when applied to water treatment for cooling towers. Cavitation forces calcium to be removed creating a mechanical softener that also destroys bacteria. This redirection of force is currently being employed to eliminate scaling and biofouling successfully in cooling towers around the globe. By coupling

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The Technical Sessions will run simultaneously between two separate Ballrooms.

this technology with additional filtration, cavitation technology can be adapted to provide non-chemical system water treatment to a variety of fields as well as enhance water savings in drought-stricken areas

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

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

2:00p - 2:30p

TP16-15

Thermal Modelling Of Closed Wet Cooling Tower To Predict The Cooling Capacity N/A

Rishabh Agrawal and S.C. Kaushik, Indian Institute of Technology

R. Agrawal (Author) pursuing his Ph.D from the Centre of Energy studies at Indian Institute of Technology (IIT) in Delhi. He received B.E in Mechanical Engineering from the Government Engineering College in Jabalpur, India, and obtained his M. Tech. School of Energy and Environment Studies DAVV in Indore, India. He is a certified energy auditor from Ministry of Power; Government of India has 10 years of experience in the field of Energy Management in all kinds of energy systems.

This paper presents a simplified model to analyze the heat flow in Closed Wet Cooling Tower (CWCT). Based on the existing research results and some suitable assumed conditions, we developed a model to simplify the handling of the heat rejection rates under four different input parameters and variable ambient wet-bulb temperatures. The analytical results of the data from different sources demonstrate that the model for analyzing the energy flows of a CWCT. When the model in combination with the input power model, it might represent the quantitative relationship between energy flow rate and principal input-output variables of the CWCT.

2:30p - 3:00p

TP16-17

PolyVinyl Chloride Use in Cooling Towers 189

Ken Mortensen, SPX Cooling Technologies

Ken is presently the Senior Manager of Research and Development for SPX Cooling Technologies. He has managed several Research, Engineering, and Operations departments responsible for water quality, material selection, and physical application criteria for cooling towers and components, as well as design, manufacture and servicing of water treatment equipment and installations. Ken graduated in 1977 with a Bachelor of Science Degree in Chemical Engineering from Massachusetts Institute and completed an MBA at Rockhurst University in Kansas City, Missouri in 2000.

PVC is a unique material in cooling tower history. It has been used for many and varied components. It has been used for a long time in the cooling tower business. PVC's properties and features make it well suited for operating evaporative cooling equipment. What material properties are important to proper application? What are its limitations? These questions will be explored in this paper.

Donatello (Water Treating Sessions)

2:00p - 2:30p

TP16-26

Cooling Water Scale And Corrosion Monitoring 291

L.J. Aspinall, Aquatech International; Brian Bloxam, CF Industries

L.J. Aspinall has worked in the water treatment industry for over 30 years as a specialty chemical sales representative and consultant. Within the last 3 years developed and patented a cooling water performance monitoring skid which evaluates scale and corrosion at skin temperature and velocity.

The paper reports the results of the first field evaluation of the Test Heat Exchanger Skid used to monitor scale and corrosion of a cooling water system at skin temperature and velocity.

This concludes the Water Treating papers for Monday. The afternoon's schedule continues on the next page.
Note: Technical Papers for ES&M and P&T Sessions will continue to 3:00p.

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.

THE 2016 CTI ANNUAL CONFERENCE
PROGRAM continued

Afternoon Schedule for Monday, February 8th

2:00p - 3:30p - Water Treating Panel Discussion - *Donatello*

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*

To celebrate Vicky's 35th Anniversary with CTI Monday night's activities are open to all at no charge.

Tuesday, February 9, 2016

The Technical Sessions will run simultaneously between two separate Ballrooms.

7:00a - 10:00a - 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***

7:00a - 10:00a - 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***

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

7:30a - 8:00a

TP16-27

Use Of Large Diameter Fans On Air Cooled Heat Exchangers 302

Richard J DesJardins, DesJardins Consulting; Kevin Kitz, U.S. Geothermal, Inc.

Richard DeJardins has 57 years of experience with cooling towers, evaporative cooling, and air cooled heat exchangers. BSME, University of Colorado, and MBA, University of Missouri at Kansas City.

A significant improvement in air cooled heat exchanger technology was implemented at U.S. Geothermal's Neal Hot Springs power plant. Large induced draft cooling tower fans were used to reduce the total number of fans from 270 to 30. O&M and power savings total $1.6 million dollars present value. Use of VFD controlled direct drive motors yielded additional power savings of $3.1 million dollars present value. Higher capital first costs were offset by innovative structural designs that reduced overall installed costs. CFD was used to show that the large fan design virtually eliminates hot air recirculation compared to 5% to 35% recirculation rates of traditional small fan designs..

Donatello Room (Water Treating Sessions)

8:00a - 8:30a

TP16-04

Increase Energy Efficiency By Analyzing Cooling Water Systems N/A

Corey Hensley, EPI Engineering

Responsible for the overall direction, coordination, implementation, execution, and completion of projects ensuring consistency with company strategy, commitments and goals. EPI Engineering provides intelligent, technology based engineering services focused on utility optimization, energy reduction, water conservation, and process safety, primarily for the refining and chemical processing industries. EPI offers full cycle solutions, from initial diagnosis and optimization through detailed design, implementation and construction.

Cooling water systems have traditionally not been studied in detail yet they have a large impact on your plant's performance and overall energy efficiency. With the latest advancements in cooling tower internal fill upgrades and software modeling of the piping distribution system, large cooling water systems can be significantly improved at low cost with significant impact on plant profitability. Case studies will be reviewed that demonstrate how analysis of cooling water systems are low-cost, high-impact way to improve separation efficiency of distillation columns and the overall energy efficiency of manufacturing facilities.

8:30a - 9:00a

TP16-16

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The Technical Sessions will run simultaneously between two separate Ballrooms.

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

8:00a - 8:30a

TP16-19

Methodology To Validate Sound Levels Of Factory Assembled Towers 201

John Dalton and Larry Burdick, SPX Cooling Technologies

John Dalton is a Senior R&D Engineer at SPX Cooling Technologies with excellent knowledge of sound testing, thermal ratings, and product applications. Larry Burdick is the Manager of the Ratings and Mechanical Components Groups at SPX Cooling Technologies.

The Cooling Technology Institute has a very successful, long standing program for thermal capability certification of factory assembled towers, but this type of confidence or 3rd party validation for published sound levels does not exist within the industry. The paper discusses an approach taken, with its successes and challenges, to acquire a sound data set for an entire crossflow model line that accurately reflects sound emission of all models within the line.

8:30a - 9:30a

TP16-23

New York Legionella Regulations: Are They Missing the Boat? 250

Sarah Ferrari, Evapco, Inc.

Sarah Ferrari is the Product Development Manager for Evaporative Condenser Technology at EVAPCO, Inc. Sarah is a graduate of the University of Minnesota Institute of Technology with a degree in Chemical Engineering. She holds a Master of Science in Environmental Engineering from the University of Cincinnati. She has worked in the cooling industry for more than 20 years. Sarah is an active member of the CTI Water Treatment Committee and contributes to related Standard Committees. She is also a member of ASHRAE and co-authored the recently published ANSI/ASHRAE Standard 188-2015, Legionellosis: Risk Management for Building Water Systems.

A large outbreak of Legionnaires' disease in the Bronx in 2015 prompted NYC to enact law and NYS to propose emergency regulations on the registration and maintenance of cooling towers. This paper describes the fundamental characteristics of airborne vs. waterborne outbreaks and discusses the Bronx outbreak from those perspectives. Ultimately a case is made that these new regulations will not have a measurable impact on reducing the incidence of Legionellosis. Rahter, more detailed and open-minded investigations of future outbreaks, including investigation of potential potable water sources, are called for to inform appropriate regulations and disease prevention activities.

Donatello (ES&M and P&T Sessions)

The Evolution And Practical Application Of Scale Inhibitor Modelling And Dosage Optimization In Industrial Water Treatment 171

Robert J. Ferguson, French Creek Software, Inc.

Rob Ferguson began modeling mineral scale formation and its control in 1974 and continues to be a major contributor to the practical application of physical chemistry to identifying and solving industrial water treatment challenges. Major career accomplishments include: developing the first successful ultra-low dosage treatment approaches for scale control in high volume utility once through cooling systems (1974); designing and implementing the first real-time microprocessor controlled scale inhibitor controller (1984); making advanced physical chemistry and laboratory study results to water treatment professionals through software available in a user friendly, visual format; and developing a user friendly system for evaluating scale formation and control under extreme conditions. Rob was educated at the US Naval Academy and University of Minnesota and received a BS in Biochemistry and Microbiology in 1971. Rob worked in research, marketing, and software development for several major water treatment service companies prior to cofounding French Creek Software in 1989,

Models for scale inhibitor dosage optimization have been evolving since the 1970's in parallel to the computerization of scale prediction methods. Increasing use of less than desirable water sources, and application over broad pH, temperature and iconic strength ranges have increased the need for sophisticated models to allow effective economical treatment, and to minimize treatment levels and cost, while providing acceptance levels of scale control. This paper discusses the development and practical application of state of the art models for controlling mineral scale formation in industrial systems.

Parameters used in the models discussed include, driving forces for scale formation ranging from simple indices to ion association saturation ratios and momentary excess, temperature as it affects rate, independent of temperature effects on driving force, induction time for initial seed formation, and growth on existing substrate, ionic strength, pH, and temperature as the affect inhibitor dissociation and activity and inhibitor protonation states.

Examples of models for mineral scales commonly encountered in industrials systems are provided for calcium carbonate, calcium sulfate, and barium sulfate and the special needs for calcium phosphate inhibitor modelling are discussed. Methods for dealing with interfering substance such are iron are outlined. The importance of using natural models rather than brute force statistical force fit data is emphasized. This modelling approach has been applied in general use and been evolving for over forty years in diverse scale control applications including open recirculating cooling water, high volume once through condenser cooling, reverse osmosis, mining and process waters, gas and oil production, and portable water. The derivation of the models and correlation to field applications is reviewed.

9:00a - 9:30a

TP16-20

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

9:30a – 10:00a

TP16-25

Wind Effects On Air Cooled Condensers: Insights From The Wind-Tunnel 277

Ryan Parker and Bruce R. White, University of California Davis

Ryan is a PhD candidate at the University of California Davis studying turbulent fluid dynamics in the Atmospheric Boundary Layer Wind Tunnel under the supervision of Dr. Bruce White. This research is primarily focused on understanding the effects of high speed wind on Air-Cooled Condensers through experimental modeling and full-scale data analysis.

Air-Cooled Condensers (ACCs) offer a way to significantly reduce U.S. water consumption but are susceptible to adverse wind conditions. An ongoing interdisciplinary research project is investigating the effects of wind on the thermal performance of ACCs with a field study of an existing full-scale combined cycle power plant, wind-tunnel study, and a high fidelity computational fluid dynamics (CFD) model. This presentation will focus on the insights provided by the wind tunnel study, and include limited comparisons with the other methods. Included in the modeling are the effect of some mitigation methods such as windscreens and solid walls.

10:00a – 10:30a

TP16-29

Comparison Of Fouling Kinetics On Four Different Fills Operated In Pilot Cooling Towers 339

Aurélie Mabrouk Ph.D and Mohamed Azarou, EDF

Dr Aurélie Mabrouk was born in Paris, France, in 1983. She earned her B.E. degree in chemistry, in 2006 and her M.S. degree in engineering chemistry, in 2008 from the University of Paris VI, Paris, France. She took her PhD in Chemical Engineering from Mines ParisTech in 2012. Her subject was ultrapurification of water with ion exchange resins for nuclear power plant reactors. She is currently research engineer for EDF. Her research interests include calcite precipitation (scaling) in wet open cooling circuits of nuclear power plants. In this context, she is testing new kind of treatments and materials. In order to do that, she used pilots, and develop new software with the goal to monitor and prevent scaling.

EDF operates 30 condenser open cooling circuits in its French nuclear power plants (NPP). In order to extend their lifetime, the company has to carry out major renovations of the fills located in the cooling towers, which need to be replaced after around 30 years.The choice of a fill is determined by the results of preliminary tests.

An experimental study was realized in order to study and differentiate the fouling risk of four different fills on an industrial pilot unit. The pilot is constituted of four reduced-scale open cooling circuits (around

Donatello (Water Treating Sessions)

Predicting The "Time To Clean": Avoid Unscheduled Outages And Extend Asset Life Through Operational And Chemistry Modelling, Monitoring, and Optimization 225

Edward S. Beardwood, Solenis LLC

Edward (Ted) Beardwood: Senior Global Applications Consultant, Solenis LLC B. S. Chemistry (with Honors) / University of Western Ontario – London, Ontario (1976) Ted started his water treatment career in 1976. His has expertise gained from sales, sales management, construction/commissioning of thermal systems, laboratory management, product management, and consulting. He is a member of NACE, IPE, RSES, ASTM, and ASME, including past service in leadership positions with ASME and NACE. He has published and/or presented numerous papers (>250) related to problem-solving, troubleshooting, and product application technology in the industrial water treatment arena. Ted holds 13 patents and 4 outstanding Records of Invention.

There has been a shift in industrial economic philosophy to risk-based maintenance, which comes with inherent hazards of pushing plant equipment to unscheduled downtime associated with extensive fouling and/or failure. Methods have been developed to avoid such pitfalls. Modeling and optimization of heat exchanger operational conditions and cooling water chemistry resulted in findings to improve heat exchanger fouling ruin rates, eliminate the scheduled need for bundle cleaning, and increase the life of equipment. The method processes will be illustrated, as well as laboratory findings and field case studies that document marked improvements.

9:30a - 10:00a

TP16-22

ASHRAE Legionella Standard 188: Evidence-Based Interpretation And Application 245

Janet E. 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. Dr. Stout is an authority on Legionnaires' disease, having studied Legionnaires' disease for more than 30 years. Dr. Stout is the author 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.

The first U.S. standard for the prevention of Legionnaires' disease was published by the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) on June 26, 2015. The normative sections of the standard include development of a Water Management Plan for building water systems and devices including open and closed circuit cooling towers and evaporative condensers. ASHRAE Standard

The Technical Sessions will run simultaneously between two separate Ballrooms.

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

15 thermal kW) able to mimic the thermal and chemical behavior of an industrial cooling circuit such as those found in nuclear power plants.

To allow this comparison for a duration limited to a few months, the four pilots were operated in scaling conditions, fed by Seine River water (calcium concentration around 90 mg/L and hydrogen carbonates concentration around 230 mg/L), with a Concentration Factor (CF, also called Cycles of Concentration) equal to 2, without injection of acid, and while maintaining the temperature at the output of the condenser at 40°C. Among the tested fills, two were trickle fills and two were film fills. All the fills were distributed on 4 levels. The measurement of weight gain was realized once a week for three months.

Fouling has been estimated by mass measurements on fill coupons. Contrary to expectation, the two trickle fills were heavily weighted. One of the film fill showed a lower weight and the other gave results comparable to trickle fills. These results were homogenous whatever the level within the tower.

This accelerated test carried out on reduced-scale open cooling circuit pilots and in scaling conditions, was able to discriminate the fouling potential of four different packings, which can help the tower designer to choose the best packing. Their results would need to be compared to data collected directly from fills present in the industrial towers, so as to consolidate the comparison of the fouling potentials of the different fills. On the whole, these results show that the pilots represent the thermal and chemical behavior of an industrial cooling circuit such as those found in nuclear power plants, even if some modifications could be done on this unit to improve its representativeness for the next experimentation

Grand Ballroom A&B (Water Treating Sessions)

188 will be shared to help inform these decisions so that they are evidence-based and defensible.

10:00a - 10:30a

TP16-24

Applying Ultrasound Prevents Scale Formation In Heat Exchanger 268

K. Casey Youn Ph. D, Weeco International Corp.; Simon Kim, Morko American Inc.

Casey Youn is President of Weeco International Corp., one of leading environmental engineering and service companies in U.S.

He has over 40 years of experience in petrochemical industry, including 24 years at Shell Oil. He has authored more than a dozen publications and tree patents. He has B.S. from U.C. Berkeley and Ph.D. in Chemical Engineering from Princeton University.

The paper was published in NACE Materials Performance June 2015 Issue. This presentation will almost be an exact copy of the published article but with more emphasis on cooling water heat exchanger scale problems with additional data.

Recent developments in equipment for ultrasound generators have greatly increased their available power and expanded their range of operating temperatures. This presents opportunities for scale prevention in heat exchangers by using ultrasound. Applications are refineries, sewage plants, alcohol plants, boilers have been very promising, and indicate that significant economic advantages can be realized.