TP16-01
Mechanical Behavior Of Polymer Fills
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

TP16-02
Increasingly Complex Tower Makeup Water Issues
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.
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 inhibitors. However, the use of such corrosion inhibitors is steadily 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.
The Technical Sessions will run simultaneously between two separate Ballrooms.

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

TP16-07
Unique Method Using Robotics for Online Cleaning
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.

TP16-08
A Solid Isothiazolone Biocide Controls Microbial Growth In Industrial Water Treatment Systems
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 post-doctoral 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-redusers. The basic characteristics of the new solid tablet will be discussed based off of laboratory and field trials.

TP16-09
Hope Creek Circulating 144-inch Water Pipeline Carbon Fiber Upgrade
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 of 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-
Raphael Ballrooms A&B (ES&M and P&T Sessions)

TP16-11
Using ATC-128 For Sound Testing & Verification In The Field
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 advantages 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.

TP16-12
Application of Flow Cytometry to Rapid Microbiological Analysis of Cooling Water
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.

TP16-13
CDF Modeling Of Wind And Velocity & Direction On Exit Air In Performance Of IDCT
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 identify 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.

TP16-14
Controlled Hydrodynamic Cavitation: A Physical Water Softening & Disinfection Method
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...
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; Gov- ernment 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.

TP16-17
PolyVinyl Chloride Use in Cooling Towers
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.
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.

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

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

Donatello Room (Water Treating Sessions)

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

TP16-27
Use Of Large Diameter Fans On Air Cooled Heat Exchangers
Richard J DesJardins, DesJardins Consulting; Kevin Kitz, U.S. Geothermal, Inc.

TP16-28
Advancements In Cleaning And Passivation
Raymond M. Post, P.E. and Prasad Kalakodimi, Ph.D, ChemTreat
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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
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 - 9:00a

TP16-21
Using Cooling Towers For Energy Recovery In Hot and Humid Climatic Conditions
Moe Salem, Air2O Cooling Limited

Mr. Salem is the Co-Founder and the CTO of AIR2O Cooling LLC. Mr. Salem has a B.Sc. in Mechanical Engineering and a Diploma of Business Administration. He serves as capacity of CTO (Chief technical Engineer & Consultant) for Air2O Cooling LLC. He holds many patents for the Indirect/Direct Evaporative cooling technology as well as the control Systems for its Hybrid operations. Mr. Salem has over 20 Years of Experience in the HVAC field as well as experience in the sustainable energy saving solutions for HVAC and energy recovery systems. Mr. Salem taught at many engineering schools in USA (San Jacquie Valley Collage –California) (Fresno Institute of technology –California). Mr. Salem is one of the pioneers of the outdoor cooling systems. He was the head of the design team for one of the largest outdoor cooling projects in the world (Universal Studio Singapore Theme Park). Currently he is leading AIR2O Cooling LLC. as CTO in Indirect/Direct Evaporative cooling solutions with its revolutionary product line (CRS) that could save up to 80% of energy consumption, and in its effort for market transformation, across the American, European, and Middle Eastern markets. This paper evaluates the energy savings potential of evaporative recovery (Using a cooling tower and coil) as fresh air pre-cooling in hot and humid climatic conditions. Energy saving chart was generated for various climatic conditions. Depending on the climatic conditions observed, results show that ER has an energy range from 40% to 90% higher when compared to using thermal wheel or run around coils.

Donatello (ES&M and P&T Sessions) 8:30a - 9:00a

TP16-16
The Evolution And Practical Application Of Scale Inhibitor Modelling And Dosage Optimization In Industrial Water Treatment
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.
Wind Effects On Air Cooled Condensers: Insights From The Wind-Tunnel

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.

New York Legionella Regulations: Are They Missing the Boat?

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. Rather, 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.

Predicting The “Time To Clean”: Avoid Unscheduled Outages And Extend Asset Life Through Operational And Chemical Modelling, Monitoring, and Optimization

Edward S. Beardwood, Solenis LLC


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

TP16-29
Comparison Of Fouling Kinetics On Four Different Fills Operated In Pilot Cooling Towers
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 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
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Mid-Morning to Afternoon schedule for Tuesday, February 9th

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... Grand Ballroom C

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

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Wednesday, February 10, 2016

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 1

2:00p - 3:00p  Services
5:00p - 8:00p  Hospitality Suite (Bar closes @ 8:00p) Raphael Ballroom C

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Thursday, February 11, 2016

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