



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA



Agenda is subject to change.

LEGEND

TP: TRANSFORMER PROFESSIONAL PROGRAM (M-TH)

TP -A: TRANSFORMER PROFESSIONAL PROGRAM - ADVANCED TRAINING (M-TH)

TM: TRANSFORMER MAINTENANCE PROGRAM (W, TH, F)

DP: TRANSFORMER DIFFERENTIAL PROTECTION PROGRAM (M-TH)

LS: LABORATORY SEMINAR (F)

Note: There is no need to pre-register for particular sessions. Simply choose the session that's right for you.

Sunday, February 19, 2017

12:00 PM – 6:00 PM

Registration & Information Desk Open

Monday, February 20, 2017

7:00 AM – 6:00 PM

Registration & Information Desk Open

7:00 AM – 8:00 AM

Attendee Breakfast

TP &

DP 8:00 AM – 8:15 AM

Welcome & Introduction

Bryan Sayler, President

Doble Engineering Company

Bryan Sayler brings 28 years of experience developing and implementing highly engineered test solutions for wireless, EMC and microwave applications in the electronics, automotive and aerospace industries. Prior to joining Doble, Mr. Sayler was Sr. Vice President Solutions Development at ETS-Lindgren where he led global project management, hardware, software and strategic solutions development through active participation in global standards bodies including IEEE, CTIA, 3GPP and the WiFi Alliance.

TP &

DP 8:15 AM – 8:45 AM

Opening Keynote

Bill Chiu, Director of Engineering

Southern California Edison

TP &

DP 8:45 AM – 9:15 AM

Primer on Large Power Transformers

Jeff Short, Manager, Client Service Engineering

Doble Engineering Company



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA



As we move forward into the 21st Century, the use of electricity by mankind has evolved into a necessary staple of everyday life. But it wasn't always this way. The advent of power transformers in today's world is a function of necessity, a product of ingenuity, and a marvel of technology. Power transformers are the key element in the present system of electrical power distribution, and this system could not function without transformers. Let's take a look at why and how they were developed.

9:15 AM – 9:30 AM

Break

TP &

DP 9:30 AM – 10:30 AM

Transformer Specification & Vendor Prequalification

Bill Griesacker, Principal Engineer

Doble Engineering Company

An effective procurement system utilizes the preapproval process to identify suitable power transformer vendors and a design review to establish an agreed upon design and procurement process. This preapproval approval process should include factory qualification audits which are essential to confirm a manufacturer's ability to meet a purchaser's requirements and expectations. The design review is performed to establish an agreed upon design and to facilitate the procurement process. That the supplier is capable of meeting the purchaser's procurement specifications is confirmed during this process and the procurement process is expedited by bringing the purchaser and supplier together on the technical details of the purchased transformer.

Bill Griesacker is a member of Doble Engineering Company as a transformer engineer working on projects that include factory inspections, condition assessment, design reviews, failure analysis and general consulting. He previously worked for Pennsylvania Transformer Technology Inc., where he held various positions including Engineering Manager. His work included high voltage insulation design, transient voltage modeling of power transformer windings and various LTC and DETC switch development projects. Prior to this, he was employed by the Westinghouse Electric Company, working on synchronous generator projects as a member of the Generator Engineering Department. Mr. Griesacker started his career with Cooper Power Systems in large power transformers and later worked in the Kyle Switchgear, Vacuum Interrupter Department. He has earned a MS in electric power engineering from the Rensselaer Polytechnic Institute and a BS in electrical engineering from Gannon University. Mr. Griesacker is an active member of the IEEE, PES Transformers Committee where he holds positions in several working groups and subcommittees.

TP &

DP 10:30 – 12:00 PM

Transformer Design & Manufacturing

Dharam Vir, Vice President of Engineering

Troy Kabrich, Vice President & General Manager – Services Division

SPX Transformer Solutions, Inc.

Transformers are tailor made products. The design process begins with understanding customer requirements. Using optimization programs a quote design is provided with the lowest total owning cost meeting customer



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

requirements. During final design detailed dielectric, short circuit and thermal calculations are performed to ensure the transformer meets performance and customer requirements. The mechanical design of the tank, stiffeners, lifting and clamping structures enables the unit to withstand vacuum, pressure, short-circuit, seismic and shipping conditions. After completion of the design, production and fabrication drawings, designs are released for manufacturing. The presentation will review major operations in the manufacturing process including visual aids that show construction, testing, and shipping activities.

Dharam Vir joined SPX Waukesha in 2004 with over 25 years of service to the transformer industry in EHV design, testing, production and plant operations. Prior to his current position, he held the positions of Engineering Manager for the Waukesha plant and director of our EHV program, leading the team responsible for the Waukesha facility expansion. Mr. Vir is an active member of the IEEE Transformers Committee and holds a BSEE from University of Delhi India, a MS in Electrical Engineering from NIT Bhopal India and an MBA in Finance and Marketing from Bhopal University India.

Troy Kabrich is currently the Vice President & General Manager for the Goldsboro, NC Manufacturing Plant and the Service and Components Division of SPX Transformer Solutions, Inc. During his twenty-five years of industry experience, Mr. Kabrich has held positions as a Plant Manager, Director of Field Services, Repair Operations Manager, Field Service Engineer, and Sales Engineer. He has published articles for T&D World and Utility Automation and Engineering magazines, was author of Installation and Maintenance Chapter of Third Revision of the Electric Power Transformer Engineering Handbook, and is a frequent contributor to industry training programs. Troy has a Bachelor of Science degree in electrical engineering from Rose-Hulman Institute of Technology.

12:00 PM – 1:00 PM

Lunch

TP &

DP 1:00 PM – 1:45 PM

Global Transformer Market Sourcing Considerations

Patricia Hoffman

Acting Under Secretary, Office of Science and Energy

Acting Assistant Secretary, Office of Electricity Delivery & Energy Reliability

TP &

DP 1:45 PM – 3:30 PM

Understanding Factory Testing Data

Mark Lachman, Director of Diagnostic Analyses

Doble Engineering Company

Kirk Robbins, Senior Staff Engineer

Exelon Nuclear

This presentation briefly describes significance of various electrical production tests with bulk of material arranged around a typical test plan covering all final factory tests as per IEEE C57.12.00-2010 and C57.12.90-



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

2015. For each test, there will be an in-depth discussion of each measurement, physics behind the measurement, setup and test methodology and acceptance criteria.

Mark F. Lachman, Ph.D., P.E., has been with the power industry for over 30 years. In 2005, he joined Delta Star in San Carlos, CA, where, as Test Manager, he was responsible for the test department operation. In 2011, he returned to Doble Engineering Company as Director of Diagnostic Analyses.

3:30 PM – 3:45 PM

Break

TP &

DP 3:45 PM – 4:30 PM

Shell-Form Design & Construction

Dom Corsi, Senior Transformer Consulting Engineer

Doble Engineering Company

Although transformers are typically referred to according to their role in a power system, they are also classified according to their construction: core-form or shell-form. This webinar will cover history and development of shell-form transformer designs in N. America and comparison of typical shell-form and core-form design features & construction, maintenance and diagnostic testing, and replacement consideration. Shell-form technology was developed by Westinghouse Electric Corporation and was licensed to a number of transformer manufacturers world-wide. The core-form technology was favored by General Electric. Traditionally shell-form transformers were commonly found in applications above 100 MVA and 230 kV such as generator step-up transformer, transmission autotransformer, shunt reactor, mobile substation and arc furnace transformer applications.

Dom Corsi has 27 years of experience in the manufacturing and electrical design of large power transformers. This experience includes both core and shell form designs. Mr. Corsi joined Doble in 2004 as a Transformer Consulting Engineer for Doble Global Power Services. In the last 12 years, he has concentrated on electrical power apparatus testing, condition assessment, and forensics. Additionally he has designed transformers up to 400 kV and 570 MVA and reviewed or supervised transformer designs to 525 kV and 1100 MVA. His main interests are in the fields of power transformer design, and power transformer applications. A frequent presenter, Dom Corsi trains participants on many transformer related topics including Transformer Repair, Remanufacturing and Replacement, Transformer Design Review, Transformer Factory Inspections.

TP &

DP 4:30 PM – 5:15 PM

Insulating Materials Basics

Lars Schmidt, Technology Lead Center Manager – Insulation

ABB Inc.

This session offers an overview of power transformer insulation with a focus on cellulose based insulation materials. Both raw materials and the conversion of cellulose to transformer board will be discussed including environmental considerations. The main function of cellulose insulation in a power transformer will be covered and the electrical, mechanical, and aging properties of pressboard, pressboard laminate and laminated wood will be discussed.



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

Lars E. Schmidt is the Product Line Technology Manager for Transformer Insulation at ABB and located in Bad Honnef, Germany. He is responsible for the development of new insulation materials and manufacturing processes since 2011. ABB produces transformer insulation in different factories including Sweden, India, and Germany. Lars joined ABB Corporate Research in 2006 and worked in the field of polymer based medium and high voltage insulation. He has a background in Material's Science and holds a PhD from the Swiss Federal Institute of Technology, Lausanne.

TP &

DP 5:15 PM – 5:45 PM

Ask the Experts Panel

5:45 PM – 6:45 PM

Doble Product Display & Reception

7:00 PM – 10:30 PM

Welcome & Networking Event at Pacific City

All are welcome to attend the welcome event at nearby Pacific City. Sponsored by SPX Transformer Solutions, Inc. and GE this event includes great local food and drink and conversation with colleagues in a relaxed and casual atmosphere.



Tuesday, February 21, 2017

7:00 AM – 6:00 PM

Registration & Information Desk Open

7:00 AM – 8:00 AM

Attendee Breakfast

TP 8:00 AM - 8:45 AM

Autotransformers

Henk Fonk, Senior Electrical Design Engineer

SMIT Transformers

Auto-transformers have several advantages over 2-winding transformers with the same output power, such as lower weight, lower losses and hence lower costs. Auto-transformers call for several unique design considerations which require special attention and careful study. These considerations will be addressed during this presentation.



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

Henk Fonk joined SMIT as test engineer in the High Voltage Test Lab in 1991. After 3 years he moved to the test department for small power transformers. In 1998 he joined the design department as an electrical design engineer for small power transformers. In this position, he has designed transformers up to 20 MVA with a maximum voltage of 36 kV. In 2000 he moved to the large power transformers and started a part time study Electrical Engineering at the University of Applied Science in Arnhem. In 2005 he finalized this study with a graduation project at TenneT on the subject “Modelling inrush behaviour of the Phase-shifter in Meeden”. Mr. Fonk has been involved in the design of large power transformers and special applications like phase shifters and converter transformers for the past decade. Since 2008 he has been a member of CIGRE NSC D1 and the Dutch representative for CIGRE SC A2 since 2014.

TP-A 8:00 AM – 8:45 AM

Arc Furnace Transformer & Rectifier Transformers

Renato Gamba, Sales & Development Solutions Engineer

Luca Cremaschini, Export Sales Manager

Tamini Trasformatori S.r.l.

The Arc Furnace Transformer is the key equipment in a steel plant and all possible efforts have to be made in order to avoid its outages. An optimized and dedicated design and construction process, a customized set of external protections for preventing overvoltage and, a regular and scheduled maintenance and diagnosis program are the keys for achieving a reliable and durable product. This session will discuss all these aspects, pointing out the tougher challenges that the furnace transformer has to face during its life and strategies and solutions adopted in order to make the transformer ready for its task.

Renato Gamba is Technical Solutions Developer and Export Sales Engineer at Tamini Trasformatori in Milano, Italy. An Italian native, Mr. Gamba has been with Tamini since 2006 and has held positions of Electrical Design Engineer and Service and Customer Assistance Manager. Mr. Gamba holds a Master of Science degree in Electrical Engineering and graduated from the Politecnico di Milano with distinction.

Luca Cremaschini is Export Sales Manager at Tamini Trasformatori and from 2016 is supporting the US local branch Tamini Transformer USA. An Italian native, Mr. Cremaschini has been with TES Transformer Electro Service, now merged with Tamini, from 2015. Mr. Cremaschini holds Master of Art degree in Political Science from the “Università di Bologna” and a Bachelor Degree in Economics from the “Università degli Studi di Brescia”.

DP 8:00 AM – 10:15 AM

Introduction to Transformer Differential Protection

Ed Khan, Director of Protection Training

Doble Engineering Company

Ed Khan has been with Doble for more than 6 years working in various capacities including product manager for protection tested related instruments. Prior to Doble, Mr. Khan has worked for GE, ABB, SEL, KEMA and others in various capacities. He has over 30 years of experience in system studies, protection applications, relay design, power plant design, teaching and product management. He has a thorough knowledge about product development, protection, harmonic analysis, harmonic filter design, stability studies, Real Time Digital Simulations, generator protection and more. He has presented courses on behalf of Doble globally and has been



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

an invited speaker for utilities and industrial customers in Southeast Asia, Middle East, Mexico, India and China. He is a member of CIGRE working group B56.5 focusing on the optimization of protection and controls.

TP 8:45 AM – 9:30 AM

Mobile Transformers & Substations

Marion Jaroszewski, Senior Consultant

Delta Star, Inc.

Steve Larson, Manager, Substation Construction and Maintenance

Snohomish Public Utility District

Types and applications of mobile substations are presented. A mobile versus power transformer is discussed with emphasis on the temperature ratings and associated with it hybrid insulation system, short circuit and dielectric strength, oil preservation and cooling system design. The mobile transformer and substation testing is discussed. The essentials of specifications and trailer components are also addressed.

Marion Jaroszewski's expertise is in design of transportable (mobile and portable) high temperature transformers and substations as well as core type power, generator step up, auxiliary and grounding transformers, autotransformers and voltage regulators. Mr. Jaroszewski graduated from Technical University of Lodz, Poland with EE degree in 1973. His master thesis was Methods of Calculation of Optimal Dimensions of Active Parts of Power Transformers. He began his professional career with Transformer Manufacturer ELTA in Lodz, Poland. He moved to the United States in 1981 where he worked as a Transformer Engineer for Alamo Transformers in Houston. In 1985 was hired as a Design Engineer by H.K. Porter in Belmont, California and two years later was promoted to Senior Design Engineer position. In 1988, two H. K. Porter transformer plants in Belmont, CA and in Lynchburg, VA were bought by employees and became again Delta Star, Inc. In 1995, Marion was promoted to Manager of Engineering position. He was promoted to Corporate Technical Officer in 2004. The same year he was promoted to San Carlos Operations Manager and to Vice President of the company in 2005. Marion retired at the end of 2009 and currently works part time as a consultant and technical advisor for Delta Star, Inc. He is Life Member of IEEE and active participant in Transformer Committee working groups.

Steve Larson is Manager of Substation Construction and Maintenance at Snohomish County Public Utility District. He has a Master's degree in Electrical Engineering from University of Colorado and is a licensed Professional Engineer in Washington state. Steve is a Senior Member of IEEE, former Doble Circuit Breakers committee chairman, and is currently the Vice-Chairman of the Doble Advisory committee.

TP-A 8:45 AM – 9:30 AM

HVDC

Waldemar Ziomek, Senior Global Expert – Power Transformers

PTI Manitoba Inc.

The electric power systems – generation, transmission and distribution - are generally employing AC-based technology. However, in many situations using transmission with HVDC is beneficial for economical or technical reasons. The HVDC converter transformers used in such system are subjected to specific operational conditions resulting from presence of DC potentials and flow of DC currents. The presentation will discuss benefits of HVDC transmission and its history, HVDC schemes, transformer design, dielectric requirements (for AC, DC, and polarity reversal stresses), issues associated with current harmonics, DC current excitation and related losses.



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

HVDC transformer manufacturing and processing requirements will be also discussed. Finally, some typical problems and test failures will be presented.

Dr. Waldemar Ziomek works as a senior expert - power transformers and high voltage insulation, for PTI Manitoba Inc, Canadian manufacturer of power transformers. In 2013-2015 he worked for CG Power Systems, an international T&D equipment company, as a global senior expert. Till 2013 he was employed by CG Power Systems Canada Inc (formerly Pauwels Canada Inc) as Manager of Engineering. He started with Pauwels in 1997 as an electrical designer, then in 1999 as an electrical engineering manager, and since 2003 as manager of engineering. Since 2001 he is also an adjunct professor at The University of Manitoba.

TP 9:30 AM – 10:15 AM

Generator Step-Up Transformer Overview

Jeffrey C. Wright, P.E., Senior Electrical Engineer – Power Transformer Division
Mitsubishi Electric Power Products Inc.

Generator Step-up Transformers (GSU's) are a specific application that can present unique challenges to both the user and the manufacturer. The purpose of this presentation is to demonstrate how the unique parameters of this application can impact the design and construction of the transformer.

Jeffrey Wright has worked as a design engineer and consultant on Shell-form and Core-form Power Transformers for 40 years. Since 2014 Mr. Wright has been with Mitsubishi Electric Power Products, Inc. (MEPPI) in Memphis, TN. Previous engagements have included transformer design and consulting positions at McGraw-Edison, Cooper Power Systems, ABB, Weidmann-ACTI, Allegheny Power (First Energy), and Pennsylvania Transformer Technology, Inc. Mr. Wright is a graduate of Carnegie-Mellon University and is a registered Professional Engineer in Pennsylvania. Mr. Wright is a member of the IEEE Standards Association and Transformers Committee.

TP-A 9:30 AM – 10:15 AM

Dry Type Transformers

Kevin Eaton, Business Development Leader
ABB Dry Type Technologies

In this age of deregulation, the need for operating cost reductions and the scarcity of capital for new equipment; users are looking for ways to better use existing equipment and new purchases. Overloading of transformers or how to more effectively use transformers is a general topic of discussion. Exceeding the rating of a transformer in previous years was normally due to an emergency situation. However, in today's environment, overloading of transformers is becoming a part of the planning process. The purpose of this presentation is to discuss some of the issues surrounding this topic. This presentation will cover both liquid and dry type transformer insulation system ratings and the typical uses and applications for each type of transformers utilized.

Kevin Eaton is the Business Development Leader for ABB's North American Market Dry Type Transformer Division. He has a Bachelor of Science degree in Engineering Technology and has almost 20 years experience in the electrical field between his time as a certified electrician (journeyman / wireman) and the manufacturing & supply side of the electrical industry. His experience within the electrical field includes Elec-Tech Electrical Services, Square D / Schneider Electric and presently ABB. His area of expertise includes NEC codes and standards, quality assurance, supply chain management, product application and sales, product development and production, marketing and commercial operations.



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

10:15 AM – 10:30 AM

Break

TP 10:30 AM – 12:00 PM

Transformer Bushing Fundamentals

David Geibel, Technical Director

ABB Inc.

This session will address the fundamental theory, design, and application of fine graded condenser bushings. This discussion will include advantages and limitations of legacy OIP bushings and state-of-the-art oil-less, non-ceramic "dry" bushings.

David Geibel started out at General Electric Co. in Pittsfield MA over four decades ago and became a transformer components engineer. GE sold him to Westinghouse and Westinghouse sold him to ABB. Mr. Geibel has been the Engineering Manager for the ABB Alamo transformer components plant for about the past decade and have recently transitioned over to Technical Director. He graduated Magna Cum Laude from the University of Pittsburgh with a BSEE and holds several transformer components patents.

TP-A 10:30 AM – 11:30 AM

Geomagnetic Induced Current (GIC) Disturbance Mitigation: NERC TPL-007-1 Compliance

Part 1: Exelon Geomagnetic Disturbance Assessment Strategy

Sami Debass, Senior Staff Engineer

Exelon Nuclear

Part 2: GIC Thermal Impact Assessment Requirements

Dom Corsi, Senior Transformer Consulting Engineer

Doble Engineering Company

The NERC standard TPL-007-1 Compliance presentation will cover geomagnetic disturbance (GMD) risk mitigation on large power transformers. The standard requires that generation and transmission asset owners must conduct a thermal impact assessment is required for all applicable high-side, wye grounded >200kV transformers to ensure they can withstand thermal transient effects associated with benchmark GMD event. IEEE C57.163-2015 guide was developed to provide a background that can help evaluate the effect of GIC on a power transformer design and its GIC capability. This presentation will cover the transformer design information inputs required to perform the thermal impact assessment and the challenges associated with older transformers where design documentation may not be available.

Dom Corsi has 27 years of experience in the manufacturing and electrical design of large power transformers. Mr. Corsi joined Doble in 2004 as a Transformer Consulting Engineer for Doble Global Power Services. In the last 12 years, he has concentrated on electrical power apparatus testing, condition assessment, and forensics. Additionally he has designed transformers up to 400 kV and 570 MVA and reviewed or supervised transformer designs to 525 kV and 1100 MVA. His main interests are in the fields of power transformer design, and power transformer applications. A frequent presenter, Dom Corsi trains participants on many transformer related topics



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

including Transformer Repair, Remanufacturing and Replacement, Transformer Design Review, Transformer Factory Inspections.

DP 10:30 AM – 12:00 PM

Differential Protection Application and Testing Procedures: : ABB RET670

Mike Kockott, Senior Application / Product Specialist

ABB

This session will discuss the application of 87T protection to two- and three-winding transformers, in single- and multi-breaker applications including adopted references, calculation of differential and bias currents and techniques to achieve optimal biasing in multi-breaker applications. The need for elimination of zero sequence currents and how achieved and a description of the characteristic and blocking criteria (2nd harmonic and waveform to avoid tripping for CT saturation and inrush current, and 5th harmonic to avoid tripping for overexcitation) will be examined. Additional features incorporated to overcome shortcomings of traditional 87T protection, including inherent lack of sensitivity for low level turn-to-turn faults, based on directional comparison of the negative sequence components will be addressed as well as dynamic adaptation to actual tap position for applications with OLTC, thereby permitting optimal pickup sensitivity, switch-on-to-fault feature, to achieve fast tripping when energizing a faulty transformer and detection of open CT.

***Mike Kockott** is a Senior Applications / Product Specialist at ABB, NAM SA Products, located in Raleigh, North Carolina. He has been there since December 2011. Prior to this he worked as a Senior Applications Specialist / Senior Regional Technical Manager for 12 years at the SA Product factory in Västerås, Sweden. Before joining ABB SAP in Sweden in 2000, Mr. Kockott was Senior Consultant, Protection (Transmission) at Eskom (national power utility, South Africa and training engineer before becoming senior consultant, and rose to the position of Line Protection Design Manager.*

TP-A 11:30 AM – 12:00 PM

Case Study: Nuclear GSU Transformer Intermittent Ground Fault Trip

Lessons Learned

Greg Howard

Exelon Generation

12:00 PM – 1:00 PM

Lunch & Heavy Equipment Viewing and Demonstrations

ABB, Delta Star, Reinhausen and Siemens heavy equipment will be on display during the lunch hour

TP 1:00 PM – 1:45 PM

Intelligent Transformer Condition Monitoring

Tony McGrail, Solutions Director, Asset Management & Monitoring Technology

Doble Engineering Company

In this presentation we will look at aspects of transformer condition monitoring - from the need to set goals and defining relevant monitoring parameters through to communicating of data/information and the need to have a predefined and agreed action plan. Intelligent condition monitoring can yield great benefits and we will discuss and present ways and means to achieve those benefits.



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

Tony McGrail is Doble Engineering Company's Solutions Director for Asset Management & Monitoring Technology, providing condition, criticality and risk analysis for utility companies. Previously Dr. McGrail has spent over 10 years with National Grid in the UK and the US; he has been both a substation equipment specialist, with a focus on power transformers, circuit breakers and integrated condition monitoring, and has also taken on the role of substation asset manager and distribution asset manager, identifying risks and opportunities for investment in an ageing infrastructure. Dr. McGrail is a Fellow of the IET, Chairman of the IET Council, a member of the IEEE, ASTM, CIGRE and the IAM, is currently on the executive committee of the Doble Client Committee on Asset and Maintenance Management, and a contributor to SFRA and other standards. His initial degree was in Physics, supplemented by an MS and a PhD in EE and an MBA. Dr. McGrail has a commitment to lifelong learning and is an Adjunct Professor at Worcester Polytechnic Institute, MA, leading courses in power systems analysis and distribution fundamentals.

TP-A 1:00 PM – 1:45 PM **Transportation & Rigging**
Andy Burns, Sales Manager
Edwards Moving & Rigging

DP 1:00 PM – 2:30 PM **Differential Protection Application and Testing Procedures: : Basler 87T**
Suparat "Poom" Pavavicharn, Senior Application Engineer
Basler

This presentation will discuss basic theory settings utilized and provide sample calculations for the Basler BE1-11t Transformer Protection System. Following the sample settings implementation, testing will be performed to validate operation. Part of the reason for the settings flexibility is the development of modern high flux density transformers. Protective relays look at harmonics as electrical signatures to differentiate between inrush and fault. With modern transformers, harmonic levels often fall below recognizable pickup levels. As a result, the BE1-11t now includes numerous methodologies to allow users to optimize security and reliability. This presentation will outline the available methods. A few of the unique operation capabilities are: simultaneous dual slope plus transient monitor, multiple harmonic sharing algorithms, maximum or average slope mode, settings file flexible transformer connections, and manual or automatic tap calculation. Tools available during testing and validation include full live metering, phasor diagrams, digital points list, and a full differential report.

Suparat Pavavicharn is a Senior Application Engineer with Basler Electric Company. Ms. Pavavicharn received a Bachelor of Science Degree in Electrical Engineering from Khon Kaen University in Thailand and a Master of Science in Sustainable Energy and Management from Flensburg University in Germany. Her experience includes power systems engineering for power generation plants and substations in different countries. For more than ten years she has focused on all facets of protection including design, fault studies, setting and testing, and on site commissioning. Poom Pavavicharn is an active member of IEEE PSRC and IEEE IAS working groups and a registered professional engineer in the state of Nebraska.

TP 1:45 PM – 2:30 PM **Transformer Cooling Fundamentals**
Craig Stiegemeier, Director of Technology and Business Development
ABB Inc.

Kevin Riley, Supplier & Product Development Manager



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

Trantech Radiator Products

With temperature control being crucial in newer transformers, heat dissipation becomes very important. However, cooling system performance, with or without moving mechanical equipment, deteriorates with age. Even systems without oil-pumps or fans can fail due to weathering, rusting and fouling. How do we evaluate the health of the cooling system? Technology has improved with time, so what optimized solutions are available?

Craig Stiegemeier is the Director of Technology and Business Development for ABB's North American Transformer Remanufacturing and Engineering Services (TRES) organization. He is responsible for developing effective processes supporting condition evaluation, assessment tools and life extension solutions for utility and industrial users of power transformers. Mr. Stiegemeier began his career 36 years ago as a development and design engineer for large shell-form transformers for Westinghouse in Muncie, Indiana. He also has project management experience for the US Navy as well as technical and commercial management for ABB's transformer components business. He led the ABB TrafoStar winding production improvement processes and was commercial operations manager for the St. Louis power transformer operations before moving into transformer services in 2004.

Kevin Riley is a Mechanical Engineer and certified Six Sigma Black Belt. He has been with Trantech Radiator Products for 7 years and is the Quality and Product Development Manager. Kevin has worked in the heat exchanger industry for over 10 years holding positions at Young Touchstone and Trantech within senior engineering and operations for products as diverse as Cuprobrazed, Fin and Tube and Plate Radiator technologies. Kevin has also worked with Electric Utility and Generation customers for over 12 years in the Fleet, Genset and T&D sectors. He currently works on cooling systems development and components with OEM and utility customers for new and replacement applications covering all types of transformers and equipment. Before beginning his career in the private sector with Caterpillar, Mr. Riley served as an officer in the United States Navy.

TP-A 1:45 PM – 2:30 PM

High-Temperature, Liquid-Immersed Transformer Design using Advanced Materials

Jim McIver, Principal Applications Engineer
Siemens

Use of advanced insulation materials allows high-temperature liquid immersed transformers to meet a variety of specialty applications. Requirements such as higher temperature operation, increased fire/flashpoint or biodegradable insulating fluids can be met with solid and liquid high-temperature materials. During this session we will look how these specialty transformers are designed, built, and tested. In addition, the standards and specifications needed to request high-temperature operation will be reviewed.

Jim McIver has 40 years of experience in the North American electric power industry. Prior to Siemens' acquisition of VA Tech, he was VA Tech's Technology Director and now serves as Principal Application Engineer. While at Nevada Power, he managed design, procurement and maintenance of transformers, breakers and switchgear. As a GE Senior Application Engineer, he specified phase shifters, provided forensic analysis of transformer field failures and developed gas-in-oil diagnostics for sealed-tank, network transformers. Mr. McIver is member of Eta Kappa Nu, IEEE Transformer Committee, and is Professional Engineer in the State of New York. He earned his MSEE from Rensselaer Polytechnic and is a New York state registered P.E.



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

2:30 PM – 2:45 PM

Break

TP 2:45 PM – 4:15 PM

Load Tap Changer Fundamentals

Bernhard Kurth, General Manager
Reinhausen Manufacturing, Inc.

David Geibel, Engineering Manager
ABB Inc.

Energized Load Tap Changers (LTCs), De-Energized (DETC), Transmission Class, Distribution Class, Resistive, Reactive, and so very much more. This is by far one of the most impressive presentations of the week, and it is jam-packed with information about history, usage, various designs, operations, maintenance, gas analysis, repairs, failures and components. Representatives of ABB and Reinhausen will be on hand to make presentations and then open the floor for discussion, and most importantly, to field your questions. This extremely practical presentation will allow the attendees to ask about all types of subjects related to the everyday operations, loading, and maintenance of transformer tap changers.

***Bernhard Kurth** was born in Quito, Ecuador on June 29, 1960. He received a M.S. degree in Electrical Engineering from Rhineland Westphalia Technical University at Aachen, Germany in 1987. Mr. Kurth has been around On-Load and Off-Circuit Tap Changers for his entire career. He has been President of Reinhausen Manufacturing in Humboldt, TN since its foundation in 1991. Before joining Reinhausen Manufacturing, Bernhard worked as Area Sales Manager at Maschinenfabrik Reinhausen GmbH in Regensburg, Germany, being then transferred as President of Reinhausen Canada Ltd. to Toronto, Canada in 1990.*

***David Geibel** started out at General Electric Co. in Pittsfield MA over four decades ago and became a transformer components engineer. GE sold him to Westinghouse and Westinghouse sold him to ABB. Mr. Geibel has been the Engineering Manager for the ABB Alamo transformer components plant for about the past decade and have recently transitioned over to Technical Director. He graduated Magna Cum Laude from the University of Pittsburgh with a BSEE and holds several transformer components patents.*

TP-A 2:45 PM – 3:30 PM

EMI Diagnostic Testing:

Electric Plant Reliability for HV Power & Industrial Sites

James Timperley, Senior Principal Engineer

Doble Engineering Company

Since 1980 electromagnetic interference (EMI) Diagnostics has provided information on the electrical and mechanical condition of several thousand mission critical assets in power plants, heavy industry, petrochemical and marine locations. This on-line technique has been applied to many sizes and designs of generators, motors, transformers, switchgear, power cables and bus. This session provides case studies of electrical and mechanical deterioration identified with EMI Diagnostics. Several methods for data analysis are offered.



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DP 2:45 PM – 4:15 PM

Differential Protection Application and Testing Procedures: *Beckwith M-3311A*

Steve Turner

Beckwith Electric

Numerical transformer differential relays require careful consideration for proper testing. These relays typically provide the following types of differential protection: restrained phase differential, high-set phase differential and restricted earth fault. Test categories cover a wide range such as verification of the manufacturer specified accuracy, power system simulation, field commissioning, maintenance and standards. It is also important to test differential protection to ensure the transformer is adequately protected for the actual application. This paper covers power system simulation testing to check the relay functionality and verify the accuracy of the protection. One such test case presented uses a simple power system model to calculate ground fault current at a fault close to the neutral of a wye connected winding; source strength and fault resistance are varied to determine the maximum sensitivity for restricted earth fault protection.

The paper presents test methods that are both simple to implement and practical: testing along the entire boundary of dual-slope phase differential operating characteristic and testing the directional element used to supervise restricted earth fault protection. Basic protection functions for transformer protection such as overexcitation are also presented.

Steve Turner, IEEE Senior Member, is a Senior Applications Engineer at Beckwith Electric Company. His previous experience includes work as an application engineer with GEC Alstom, and an application engineer in the international market for SEL, focusing on transmission line protection applications. Steve worked for Duke Energy (formerly Progress Energy), where he developed a patent for double-ended fault location on overhead transmission lines. Mr. Turner has a BSEE and MSEE from Virginia Tech. He has presented at numerous conferences including Georgia Tech Protective Relay Conference, Western Protective Relay Conference, ECNE and Doble User Groups, as well as various international conferences.

TP-A 3:30 PM – 4:15 PM

Updated Iso-Phase Bus Inspection & Maintenance Best Practices

Gary Whitehead, Power Projects Specialist

Electrical Builders Inc.

This presentation will review best practices for analysis, inspection, cleaning and maintenance of the bus duct systems of the power generation facility. Many plant operations and maintenance managers ignore the bus duct system, forgetting it is a system critical component in the power plant that does not have redundancy AND is connected to expensive plant assets on both ends. The presentation will review numerous case studies from more than forty years of field.

Gary Whitehead is the Power Projects Specialist at Electrical Builders Inc. (EBI). Since coming to EBI his main focus has been working on projects such as new installation, retrofits as well as design improvements and value engineering on existing systems. Mr. Whitehead has attended numerous colleges studying industrial and architectural drafting and design. He has over 7 years of experience in this industry working for AZZ/Calvert, a designer and manufacturer of Iso-Phase systems as an Engineering Technical Coordinator and also in their Installation Services as a Designer/Quotation Specialist and Project Manager.



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February 20-24, 2017 | Huntington Beach, California USA



TP &

DP 4:15 PM – 5:15 PM

Heavy Equipment Demonstrations

Join ABB, Delta Star, Reinhausen and Siemens for demonstrations of their heavy equipment.

5:30 PM – 8:00 PM

Industry Expo & Reception

Wednesday, February 22, 2017

6:00 AM – 6:00 PM

Registration & Information Desk Open

6:00 AM – 8:00 AM

Attendee Breakfast

TM 7:00 AM – 8:00 AM

What's in the Box?

(Designed for 3-Day Transformer Maintenance Program Seminar Attendees)

Troy Kabrich, Vice President & General Manager – Services Division

SPX Transformer Solutions, Inc.

This presentation is designed for personnel who will be attending the three day Transformer Maintenance Program. Presentation is intended to provide a high level summary of the first two days of the seminar and will briefly cover transformer theory, transformer application, transformer construction, and transformer components and function.

Troy Kabrich is currently the Vice President & General Manager for the Goldsboro, NC Manufacturing Plant and the Service and Components Division of SPX Transformer Solutions, Inc. During his twenty-five years of industry experience, Mr. Kabrich has held positions as a Plant Manager, Director of Field Services, Repair Operations Manager, Field Service Engineer, and Sales Engineer. He has published articles for T&D World and Utility Automation and Engineering magazines, was author of Installation and Maintenance Chapter of Third Revision of the Electric Power Transformer Engineering Handbook, and is a frequent contributor to industry training programs. Troy has a Bachelor of Science degree in electrical engineering from Rose-Hulman Institute of Technology.

TP 8:00 AM – 8:45 AM

Insulating Fluid Basics & How to Take a Proper Oil Sample

Eileen Finnan, Director, Field Services

Doble Engineering Company

This presentation will provide information on insulating fluids, focusing on various characteristics and the most common analytical tests performed on insulating fluids to assess the condition of the insulating fluid and health of the transformer. Important aspects of the sampling process for insulating fluids will be covered to help ensure that a representative sample of the bulk insulating fluid is obtained.



Life of a Transformer™ Seminar

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February 20-24, 2017 | Huntington Beach, California USA

Eileen Finnan is Director of Field Services, Doble Engineering Company. Ms. Finnan received her BS Degree in Physics and Chemistry from Trinity College Dublin, Ireland. She joined Doble as a Chemist in 1988 and held the position of Laboratory Manager from 1998-2003. She was a member of ASTM D27 on Electrical Insulating Liquids and Gases and has held a number of positions on its subcommittees. She is currently part of the Testing and Consulting group, focusing on condition assessment of electrical apparatus and asset health review and also has responsibility for managing the quality program at the Doble Laboratories.

TP-A 8:00 AM – 8:45 AM

High Voltage Withstand Testing

Tom Melle, Manager

HighVolt

Gilbert Lemos, Manager – Apparatus and Maintenance Technical Support
Southern California Edison

Part 1: Power transformer withstand testing is one of the most sophisticated processes undertaken to assess a transformer before it can be placed into operation. The full range of tests to be performed are very complex and the test systems must fulfill challenging demands. Ongoing technical progress in power electronics now gives transformer manufacturers and end-users access to static frequency converter (SFC) based power sources in the factory and field. These systems can provide a stable and virtually harmonic-free test voltage for a transformer test system. Because the output frequency can be freely adjusted, a wide range of AC transformer tests are possible. The main principles and applications of test systems for transformers with SFC-based power sources will be presented and explained.

Part 2: Southern California Edison has been proactively replacing old and unreliable extra high voltage (EHV) transformers within our service territory over the past several years. All new transformers are now coming from manufacturers based overseas. Consequently, these transformers are more susceptible to damage caused by extra handling, including on and off-loading at docks, traveling over-seas, railcar or truck, and off-loading at final destination. At any point along the way, this handling exposes transformers to possible damage. In addition, the introduction of localized conductive contamination is possible during disassembly at the factory or assembly at the final destination. As a result, this damage or contamination may not be detected through internal inspection or routine acceptance testing. Since 2006, Southern California Edison has implemented field induced testing with partial discharge (PD) measuring equipment as a final check to ensure the integrity of the transformer before placing in service. This paper illustrates the benefits of performing field induced testing utilizing various PD detection methods to identify insulation issues, including the drivers which lead to performing this additional test in the field. In addition, several supporting case studies will be illustrated.

Thomas R. Melle resides in Raleigh, NC having received a B.S. degree in electrical engineering from North Carolina State University. He has worked in the power industry as a Transformer Test Engineer and Project Manager. He now represents HIGHVOLT (Dresden, Germany) in the United States and Canada. He is active in several IEEE Committees, including Transformers, Insulated Conductors, and Power System Instrumentation and Measurements. Mr. Melle is presently Secretary for IEEE C57.142™, Investigation of the Interaction between Substation Transients and Transformers in HV and EHV Applications and for IEEE 1122™, Standard for Digital Recorders for Measurements in High-Voltage Impulse Tests.



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

Gilbert Lemos has been employed at Southern California Edison since 1980. Currently is Manager of Apparatus and Maintenance Technical Support group in Substation, Construction, and Maintenance Department. Prior to this position, he performed and supervised all factory-type transformer test activities for both large and small power transformers for most of his career in the transformer repair facility in Westminster, California for SCE. He has a BA from the University of La Verne.

DP 8:00 AM – 8:45 AM

Case Study: Implementing IEC 61850 Substation Automation Standard

Devin Kaufman, Technical Specialist

SCE

TP 8:45 AM – 10:15 AM

Transformer Assembly, Oil Processing & Commissioning

Troy Kabrich, Vice President & General Manager – Services Division

SPX Transformer Solutions, Inc.

Steve Larson, Manager, Substation Construction & Maintenance

Snohomish Public Utility District

This presentation will highlight recommendations for the proper receipt, inspection, field assembly, oil processing, and acceptance testing of large liquid immersed power transformers. Transformer field installation processes and standards will be reviewed to include impact recorders, equipment requirements, assembly operations, field dry out techniques, determination of insulation moisture concentration, provisions for cold ambient temperature processing, vacuum filling processes, and acceptance testing.

Troy Kabrich is currently the Vice President & General Manager for the Goldsboro, NC Manufacturing Plant and the Service and Components Division of SPX Transformer Solutions, Inc. During his twenty-five years of industry experience, Mr. Kabrich has held positions as a Plant Manager, Director of Field Services, Repair Operations Manager, Field Service Engineer, and Sales Engineer. He has published articles for T&D World and Utility Automation and Engineering magazines, was author of Installation and Maintenance Chapter of Third Revision of the Electric Power Transformer Engineering Handbook, and is a frequent contributor to industry training programs. Troy has a Bachelor of Science degree in electrical engineering from Rose-Hulman Institute of Technology.

Steve Larson is Manager of Substation Construction and Maintenance at Snohomish County Public Utility District. He has a Master's degree in Electrical Engineering from University of Colorado and is a licensed Professional Engineer in Washington state. Steve is a Senior Member of IEEE, former Doble Circuit Breakers committee chairman, and is currently the Vice-Chairman of the Doble Advisory committee.

TP-A 8:45 AM – 9:30 AM

Transformer Design Reviews

Bill Griesacker, Principal Engineer, Consulting and Testing Services

Doble Engineering Company

An effective procurement system utilizes the preapproval process to identify suitable power transformer vendors and a design review to establish an agreed upon design and procurement process. This preapproval approval process should include factory qualification audits which are essential to confirm a manufacturer's



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February 20-24, 2017 | Huntington Beach, California USA

ability to meet a purchaser's requirements and expectations. The design review is performed to establish an agreed upon design and to facilitate the procurement process. That the supplier is capable of meeting the purchaser's procurement specifications is confirmed during this process and the procurement process is expedited by bringing the purchaser and supplier together on the technical details of the purchased transformer.

Bill Griesacker is a member of Doble Engineering Company as a transformer engineer working on projects that include factory inspections, condition assessment, design reviews, failure analysis and general consulting. He previously worked for Pennsylvania Transformer Technology Inc., where he held various positions including Engineering Manager. His work included high voltage insulation design, transient voltage modeling of power transformer windings and various LTC and DETC switch development projects. Prior to this, he was employed by the Westinghouse Electric Company, working on synchronous generator projects as a member of the Generator Engineering Department. Mr. Griesacker started his career with Cooper Power Systems in large power transformers and later worked in the Kyle Switchgear, Vacuum Interrupter Department. He has earned a MS in electric power engineering from the Rensselaer Polytechnic Institute and a BS in electrical engineering from Gannon University. Mr. Griesacker is an active member of the IEEE.

DP 8:45 AM – 10:15 AM

Transformer Differential Protection Issues & Solutions:

ERLPhase T-Pro

Krish Narendra, Chief Technical Officer

ERLPhase Power Technologies Ltd.

Traditionally, differential protection is in use to protect power transformers as primary protection. Percentage differential characteristics is the basic principle used with classical two slopes settings. This presentation discusses the issues with the percentage differential principles and solutions using different principles as supervisory and /or alternative method to make the differential protection more secure and reliable.

Dr. Krish Narendra has over 25 years of experience in power system protection, monitoring, control and analysis. He is responsible for innovative design, implementation, quality and commercialization of protective relays and disturbance monitoring recorders using advanced digital signal processing technologies on embedded systems, and in Windows development environments. He worked as a Research Assistant (Post-Doctoral Fellow) at Concordia University in Montreal, Canada in 1995 and 1996. In 1986 he obtained a BE (Electrical Engineering) from the University Visweswaraiah College of Engineering (UVCE), and an MSc (EE) and PhD (EE) with a specialization in High Voltage Engineering from the Indian Institute of Science in India in 1989 and 1993 respectively.

Dr. Narendra has been a valued IEEE member for over 15 years. He is actively participating in the IEEE PRSC working groups, and is a member of the PRTT of NASPI. He is a member of the CIGRE C4-B5 working group and NERC SMS committee. He has published over 35 papers in various IEEE/IEC journals and conferences, and is an innovator of several patents.

TP-A 9:30 AM – 10:15 AM

Asset Health and Criticality within an Aging Transformer Infrastructure

Carl Kapes, Manager – Transmission & Substation Reliability

Pepco Holdings, An Exelon Company



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February 20-24, 2017 | Huntington Beach, California USA

ALL 10:15 AM – 10:45 AM

Break & Heavy Equipment Viewing and Demonstrations

Opportunity to visit our exhibitors with large vehicles on display: ABB, Delta Star, Reinhausen & Siemens

ALL 10:45 AM – 12:15 AM

Transformer Field Testing

Robert Brusetti, Director, Client Service Engineering
Doble Engineering Company

Financial implications and complex of the asset are the primary reasons power transformers are viewed as the most critical component in the electric power system. Field-testing provides the engineer with a group of tools to assess the condition of the transformer and to identify problems and the level of criticality. Each test provides data to support decisions about transformer. The early detection of problems can minimize the repairs involved and mitigate catastrophic failures. The scope of this presentation is to consolidate all the current techniques for field testing transformers and identify each test's true capability.

***Robert Brusetti** received his BS in Electrical Engineer degree from the University of Vermont in 1984 and a MBA from Boston College in 1988. He has been employed at Doble Engineering Company for twenty years and currently serves as Director of Client Service Engineering. Prior to his present responsibility he has held positions as Product Manager and Field Engineer. Mr. Brusetti is a licensed Professional Engineer in the state of Massachusetts.*

12:15 PM – 2:15 PM

Industry Expo & Lunch

***Heavy Equipment on Display:** ABB, Delta Star, Reinhausen and Siemens heavy equipment will be on display during the expo lunch period*

TP 2:15 PM – 3:00 PM

Transformer Oil Processing & Field Vacuum Dry-out

Greg Steeves, General Manager
Baron USA, LLC

Transformer life depends mainly on the condition of the liquid & solid insulation. The liquid insulation can be maintained and restored with purification & reclamation. The solid insulation however is difficult to maintain directly. Various technologies and techniques are available to maintain the insulation (both directly & indirectly). Appropriate selection and application of transformer dry-out technologies and techniques can extend transformer life, reduce downtime and save money. These technologies and their field applications will be discussed during this presentation.

***Greg Steeves** is General Manager and principle engineer of Baron USA, LLC. Baron is the premier provider of transformer dry-out and dielectric fluid processing systems for OEM's, utilities and field service organizations worldwide. Mr. Steeves joined Baron USA as Engineering Manager in 1987. He is currently responsible for managing the daily operations and overseeing the application, engineering design and manufacturing of oil purification equipment, vacuum chambers, vapor phase processing and transformer dry-out equipment. He earned his degree in Mechanical Engineering from Tennessee Technological University and is licensed in the state of Tennessee.*



Life of a Transformer™ Seminar

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February 20-24, 2017 | Huntington Beach, California USA

TP-A 2:15 PM – 3:00 PM

Internal Inspection

Kirk Robbins, Senior Staff Engineer
Steve Moorhead, Senior Project Manager
Exelon

DP 2:15 PM – 3:45 PM

Differential Protection Application and Testing Procedures:

GE T90

Terrence Smith, Commercial Application Director
GE Grid Automation

Terrence Smith is the Commercial Application Director for the GE Grid Automation North American Commercial team. In this role he leads the team of technical application engineers supporting the Protection and Control, Substation Automation, and Monitoring and Diagnostics portfolio. He joined GE in 2008 supporting the Grid Automation Protection and Control Portfolio. Prior to joining GE, Terrence has been with the Tennessee Valley Authority as a Principal Engineer and MESA Associates as Program Manager. He received his Bachelor of Science in Engineering majoring in Electrical Engineering from the University of Tennessee at Chattanooga in 1993 and is a professional Engineer registered in the state of Tennessee. He has authored and presented several white papers at IEEE conferences and white paper conferences in the United States

TP 3:00 PM – 5:00 PM

Focus Group: Transformer Life-Extension & Maintenance Solutions for Improved Reliability

Part 1: Transformer Maintenance Frequency Intervals

Rick Youngblood, Consultant
Doble Engineering Company

Rick Youngblood's engineering career spans more than three decades. After leaving active duty from the Air Force he joined Cinergy Corporation (then known as Public Service of Indiana) as an entry level engineer. After receiving his BSEE from Purdue University he was promoted to Project Engineer and then Manager of Technical Services in their Northern Division responsible for construction, maintenance and metering. After merging with Cincinnati Gas and Electric and forming Cinergy Corporation, Mr. Youngblood became Senior Engineer responsible for implementing their CMM System "Maximo" and developing their condition-based maintenance program. He went on to become Supervising Engineer for Substation Services. In 2004 Mr. Youngblood joined American Electrical Testing Company as Regional Manager of their Midwest office. He obtained his NETA 3 certification and went on to perform maintenance and testing in utility and industrial environments. He joined Doble Engineering Company in 2010 as Principal Engineer in the Client Service group and remained at Doble until his retirement in 2015. Mr. Youngblood is currently a consultant.



Life of a Transformer™ Seminar

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February 20-24, 2017 | Huntington Beach, California USA

Part 2: On-site Major Core Rewinds/Repairs

Ken Carpenter, Senior Design Engineer

GE Energy Connections

Part 3: Bushing Changeouts

Juan Acosta, Manager Business Development

Siemens

One vital component that is commonly replaced during a transformer's lifetime is the bushing. Bushings may require replacement due to reasons such as electrical issues, physical damage, unsatisfactory DGA when oil filled, leaks, and reasons related to the bushings manufacture and design. Presentation will cover key aspects to considering when replacing bushings.

Juan Acosta manages the Transformer Lifecycle Management business for Siemens in the US. He is responsible for providing leadership to the applications engineering team to successfully grow the Power Transformer Service portfolio. Acosta joined Siemens in 2004 and has held positions in the strategic planning, manufacturing, continuous improvement and service of transformers with Siemens in Europe, North America and South America. Juan has a BS in Mechanical Engineering, MBA and is a licensed PMP.

Part 4: Cooling System Maintenance & Upgrades

Jeff Cooper

Unifin

Jeff Cooper is Regional Manager at Unifin. Prior to joining Unifin Mr. Cooper was employed at Westinghouse Electric Corp in their Power Transformer & Circuit Breaker After-Market Services Group and at ABB in Power Transformer Marketing and in Utility Field Sales. He holds and International B.S. Mechanical Engineering from Pennsylvania State University.

Part 5: LTC Retrofits

Craig Stiegemeier, Director of Technology and Business Development

ABB Inc.

Part 6: Ester Transformer Retrofills

Larry Christodoulou, Southeast Regional Director

Electric Power Systems

This paper will discuss the retro fill of two oil-filled power transformers which are over forty years old with a natural-based ester fluid known as FR3TM. The advantages in using FR3TM as a replacement fluid in a mineral oil transformer will be reviewed along with any negative concerns. Procedures for draining existing mineral oil, flushing internal tank core and coil assembly, vacuum filling and final electrical testing will be covered in this paper.



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

Larry Christodoulou, Southeast Regional Director, has been with Electric Power Systems since 1998. Mr. Christodoulou brings over thirty five years of experience with the electrical service industry. Prior service includes Southwest Electric and United Power Services with focus on substation testing and insulating fluid analysis Mr. Christodoulou received a Bachelor of Science in Geology from Vanderbilt University. He is a member of ASTM, IEEE, NETA and Doble Engineering where he is active in several committees and subcommittees devoted to developing and improving standards used by the electrical industry.

TP-A 3:00 PM – 5:00 PM

Advanced Insulating Fluid Topics

Part 1: Isoparaffinic Transformer Oils

Chris Armstrong, Sr. Technical Services Advisor

Petro-Canada Lubricants Inc.

Catalytic dewaxing technology has led to the development of isoparaffinic transformer oils with desirable physical and chemical properties. Severe refining processes produce isoparaffinic oil that has excellent additive response and is virtually corrosive-sulphur free. These properties make isoparaffinic base oils ideally suited for transformer oil applications in various operating environments. The technologies available for the production of isoparaffinic transformer oils will be discussed in this presentation, with an emphasis on factors that have led to technological improvements in the industry.

Chris Armstrong is a Sr. Technical Services Advisor for Petro-Canada Lubricants' Luminol Transformer Fluid product line. He has worked for Petro-Canada for over 22 years and has held positions in Refinery Operations, Research & Development, Sales and Technical Services. Currently as a Sr. Technical Services Advisor, he is a voting member of ASTM Committee D27 on Electrical Insulating Liquids and Gases. He holds a Material Engineering Technology diploma from Mohawk College and his CLS certification from the STLE.

Part 2: Naphthenic Mineral Insulating Oil Manufacture, Additives & Storage

Jimmy Rasco, Vice President – Global Base Oil Technology

Ergon, Inc.

This portion of the panel will cover Naphthenic Mineral Insulating Oil Manufacturing, Additives and Storage. Naphthenic oils have been used as transformer insulating oil successfully for many years. They have heat transfer and low temperature properties that make them well suited for this application. This paper will review some history of naphthenics use as insulating oil and manufacturing processes that refiners employ to produce



Life of a Transformer™ Seminar

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February 20-24, 2017 | Huntington Beach, California USA

them. It will review how refining impacts the type, quality and performance of the oils in transformers along with different additives that can impact performance. It will also look at transformer oil is stored to ensure its integrity for delivery.

***Jimmy Rasco** has responsibility for quality and development of naphthenic and paraffinic base oils. He has worked with Ergon for 22 years and has 42 years of experience in Quality Control and Technical Support of petroleum refined products. He has a BS degree in Chemistry from Alcorn State University and is a member of the American Chemical Society, CIGRE, IEEE, IEC, ANSI TAG to IEC TC 10 and ASTM where he serves as Chairman of Subcommittee 27.01 for Mineral Oil. He has served on numerous Maintenance Teams and Working Groups for International organizations governing transformer oil.*

Part 3: Synthetic Esters

Jinesh Malde, Applications Engineer

M&I Materials

Synthetic ester-based fluid has been used for nearly four decades in a myriad of different transformer and non-transformer applications due to its robust nature. This fluid can be used in almost every type of transformer, from distribution to large power, breathing, sealed and high temperature. It stands up to the most rigorous conditions and has a proven track record in applications such as compact rolling stock transformers.

***Jinesh Malde** received B.Ss in Electrical Engineering from Lawrence Technological University, Southfield MI in 2007. For 3 years he worked as transformer design engineer at Marcie Electric Inc. followed by 6 years at Weidmann Electrical Technology Inc. as distribution transformer engineer. In 2016 Mr. Malde joined M&I Materials Inc. as applications engineer supporting customers with the application of natural and synthetic esters in transformers.*

Part 4: Natural esters based liquids for in service transformer: in-service performance and process of treatment, reconditioning and reclaiming

Alan Sbravati, Dielectric Fluids Specialist

Cargill Industrial Specialties

As the quantity and age of natural ester filled transformers grows, demand for field service, fluid treatment and transformer maintenance are expected to be generated. The behavior of in service transformers filled with natural ester liquids will be presented in this article, for discussion of the overall performance and estimation of time to reach the continuous operation limits. Instances where variation of the dielectric liquid properties requires a



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February 20-24, 2017 | Huntington Beach, California USA

treatment and the situations caused by abnormal operation conditions will as well as the reclaiming process and results will also be discussed

Alan Sbravati was born in Brazil, in 1979. He acts as specialist on dielectric liquids application with Cargill Industrial Specialties. He holds a B.Sc. in Mechanical Engineering from the UNICAMP in Brazil, a MBA from FGV/São Paulo and a Master Degree from ILEDE/Pittsburgh University. Having started his career in power transformer manufacturer, he has large experience in design, calculation, testing, installation and assessment of power transformers. He is currently chairman of Brazilian committee for Power Transformers, active in Cigre working groups and IEEE Transformer Committee.

DP 3:45 PM – 5:00 PM

Differential Protection Application and Testing Procedures:

Siemens 7UT

Roy Moxley

Siemens

Differential protection is recognized as a fast, sensitive, and selective way to protect many types of system assets. Changes in transformer construction have complicated differential protection. This presentation discusses the latest methods to improve protection speed and security. Tradeoffs and benefits are discussed along with real-world case studies.

Roy Moxley has worked in relaying and T&D application engineering for more than 36 years. He joined Siemens Smart Grid as Principle Power Systems Protection Consultant in 2012, following 23 years at GE and 13 years at SEL. Mr. Moxley holds a BSEE from the University of Colorado at Boulder. He is a member of IEEE, a PE in Pennsylvania and a seasoned presenter with more than 20 papers on protective relay to his credit.

ALL 5:00 PM – 5:30 PM

Ask the Experts Panel

6:00 PM – 10:00 PM

Social Event at the Lyon Air Museum

Seminar sponsors A-Line, Delta Star, Edwards Moving & Rigging, Electrical Builders Inc., Siemens and Doble invite seminar attendees to the Lyon Air Museum to see airplanes, cars, motorcycles and World War II memorabilia and artifacts and enjoy cocktails and dinner.



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA



Thursday, February 23, 2017

7:00 AM – 6:00 PM

Registration & Information Desk Open

7:00 AM – 8:00 AM

Attendee Breakfast

TP 8:00 AM – 8:45 AM

Transformer Asset Health Indexing & Fleet Management

Paul Griffin, Vice President Global Professional Services
Doble Engineering Company

Kurt Schamburg, Transformer Program Manager
Calpine Corporation

In today's modern utility, capital investments in transmission and distribution assets can be on the order of billions of dollars. With all that spending, there is enormous pressure to ensure that we are making the right decisions with regard to managing risk and ensuring the reliability of our system. With the ever increasing amount of real-time asset health information that is available to the asset manager, as well as all the traditional database type condition information obtained from preventative maintenance, the sheer amount of data can be challenging. Without a viable solution for turning that data into information that can drive repair replace decisions, the job of the asset will be difficult. This presentation will discuss PHI's approach to fleet asset health indexing and our partnership with Doble on the dobleARMS project.

Paul Griffin is Doble Engineering Company's Vice President of Global Professional Services. Mr. Griffin has been with Doble since 1979 and prior to his current role has held various positions including Laboratory Manager and Vice President of Laboratory Services. Since joining Doble, Mr. Griffin has published over 50 technical papers pertaining to testing of electrical insulating materials and electric apparatus diagnostics. He is a Fellow of ASTM and a member of Committee D-27 on Electrical Insulating Liquids and Gases. He was formerly ASTM Subcommittee Chairman on Physical Test, ASTM Section Chairman on Gases in Oil, and the Technical Advisor to the U.S. National Committee for participation in the International Electrotechnical Commission, Technical Committee 10, and Fluids for Electrotechnical Applications. Mr. Griffin is a member of the IEEE Insulating Fluids Subcommittee of the Transformer Committee.

TP-A 8:00 AM – 8:45 AM

Factory Repair

Ken Carpenter, Senior Design Engineer
GE Energy Connections

Learn the repair process for a typical medium to large power transformer including failure modes -incoming inspection, testing, untanking, design, redesign, materials, disassembly, rewind, re-assembly, tanking, dry-out and testing.



Life of a Transformer™ Seminar

Get Empowered with Doble

February 20-24, 2017 | Huntington Beach, California USA

Kenneth Carpenter, Senior Transformer Designer GE Energy Connections Ken develops designs for remanufactured transformers ranging up to 300MVA and 345kV and provide engineering solutions to upgrade the transformer to modern design standards as well as increase efficiency or power handling as required. He began his career with GE in 1989 as a transformer design engineer in Rome, GA, after four years of prior design experience at outside firms. He holds a BSME from NCSU.

DP 8:00 AM – 9:45 AM

Differential Protection Application and Testing Procedures: SEL 487

Karl Zimmerman

SEL

TP 8:45 AM - 9:45 AM

Calculating Probability of Failure (POF) for Transmission Assets: Challenges and Methodology

G. Matthew Kennedy, Solution Director, Enterprise & Data Technology
Doble Engineering Company

G. Matthew Kennedy is Doble Engineering Company's Solutions Director: Enterprise and Data Technology, overseeing the complete software and cloud product vision of the company. During his time at Doble, Mr. Kennedy has had leading roles in the innovation and development of products such as the M-Series (M4, M5, M7), DTA, dobleARMS™ and dobleDATABASE™. With a keen interest in diagnostic technology, Mr. Kennedy has authored diagnostic analysis sections for international standards in addition to numerous papers, journal and magazine articles for the power industry. He holds a BS in Electrical Engineering from the University of California, Santa Barbara where he studied signal and digital signal processing. His post graduate studies continued with the US Navy: Nuclear Power School, University of Idaho in Electrical Power Engineering and Cornell University in Product Design and Development. He is a member of IEEE, IEC, USNC, and ISO.

TP-A 8:45 AM – 9:45 AM

LTC Maintenance Requirements and Steps for In-Tank LTC

Bernhard Kurth, General Manager

Paul Shuttleworth, Senior Area Sales Manager

Reinhausen Manufacturing Inc.

Bernhard Kurth was born in Quito, Ecuador on June 29, 1960. He received a M.S. degree in Electrical Engineering from Rhineland Westphalia Technical University at Aachen, Germany in 1987 and has been around On-Load and Off-Circuit Tap Changers for his entire career. He has been President of Reinhausen Manufacturing in Humboldt, TN since its foundation in 1991. Before joining Reinhausen Manufacturing, Mr. Kurth worked as Area Sales Manager at Maschinenfabrik Reinhausen GmbH in Regensburg, Germany, being then transferred as President of Reinhausen Canada Ltd. to Toronto, Canada in 1990.

9:45 AM – 10:00 AM

Break

TP 10:00 AM – 10:45 AM

Strategies for Transformer Replacement Prioritization

Alex Salinas, Principal Manager

Ben Almendarez, CBM Risk and Strategy Project Manager



Life of a Transformer™ Seminar

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February 20-24, 2017 | Huntington Beach, California USA



Southern California Edison

Alex Salinas has been an employee with Southern California Edison (SCE) for over 33 years within various field and management groups. As a current Principal Manager within the Substation Construction and Maintenance department, he is responsible for asset management, infrastructure replacement, regulatory compliance, work methods, and maintenance programs including condition based maintenance strategies. He has also been an active participant in several working groups which include, CIGRE, IEEE, Doble, CPUC, FERC, NERC, WECC, CALISO, EPRI and NEMA; and has presented papers on a variety of topics. He is the Chairman of the Doble Advisory Committee and has served as Chairman of the Circuit Breakers Committee. He earned a BA degree in Business Administration and MBA degree from the University of La Verne, and also received a MS degree in Advanced Management from Claremont Graduate University.

Ben Almendarez joined Southern California Edison in 2012. He currently is the Condition Based Maintenance, Risk and Strategy Project Manager in Substation Construction and Maintenance. He is responsible for the Condition Based Maintenance program for substation assets as well as the data analytics and reporting for substation asset management. Prior to this role he supported distribution, transmission, and grid operations resource planning and performance management. He has over 10 years' experience in streamline processing and both business and operations analytics. Mr. Almendarez earned a bachelor's degree in business administration from the California State Polytechnic University, Pomona and an MBA from the University of La Verne.

TP-A 10:00 AM – 10:45 AM Commonly Overlooked Maintenance Items

Rick Youngblood, Consultant

Doble Engineering Company

Maintenance is a widely varying topic when it comes to transformers. The common list of items typically performed cover 90% of all transformers but it's the 10% of the items overlooked that can have the same catastrophic consequences. This paper is intended to make the reader think about the lesser maintained items and add them into the list of regularly performed maintenance and test tasks.

Rick Youngblood's engineering career spans more than three decades. After leaving active duty from the Air Force he joined Cinergy Corporation (then known as Public Service of Indiana) as an entry level engineer. After receiving his BSEE from Purdue University he was promoted to Project Engineer and then Manager of Technical Services in their Northern Division responsible for construction, maintenance and metering. After merging with Cincinnati Gas and Electric and forming Cinergy Corporation, Mr. Youngblood became Senior Engineer responsible for implementing their CMM System "Maximo" and developing their condition-based maintenance program. He went on to become Supervising Engineer for Substation Services. In 2004 Mr. Youngblood joined American Electrical Testing Company as Regional Manager of their Midwest office. He obtained his NETA 3 certification and went on to perform maintenance and testing in utility and industrial environments. He joined



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February 20-24, 2017 | Huntington Beach, California USA

Doble Engineering Company in 2010 as Principal Engineer in the Client Service group and remained at Doble until his retirement in 2015. Mr. Youngblood is currently a consultant.

DP 10:00 AM – 12:00 PM

LTC Controls & the Basics of Transformer Paralleling

Steve Larson, Manager, Substation Const. & Maintenance
Snohomish Public Utility District

Dr. Murty Yalla, President
Beckwith Electric

Steve Averitt, Senior Area Sales Manager - Automation & Control
Reinhausen Manufacturing

This presentation covers basic concepts of transformer parallel operations (including impact on LTCs). Several hardware/software solution providers will then present their implementation to accomplish effective, safe transformer paralleling (including effects & mitigation of LTC operations).

***Steve Larson** is Manager of Substation Construction and Maintenance at Snohomish County Public Utility District. He has a Master's degree in Electrical Engineering from University of Colorado and is a licensed Professional Engineer in Washington state. Steve is a Senior Member of IEEE, former Doble Circuit Breakers committee chairman, and is currently the Vice-Chairman of the Doble Advisory committee.*

***Dr. Murty Yalla** has been with Beckwith Electric Company since 1989 and presently holds the position of President. Dr. Yalla has a Ph.D. in Electrical Engineering from the University of New Brunswick, Canada. He has published several research papers in international journals on digital protection and holds five U.S. patents in digital controls and protective relays. He is the chairman of the International Electrotechnical Commission (IEC, Geneva, Switzerland) Technical Committee 95, a U.S. delegate to the International council on large electric systems (CIGRE) and a member and subject matter expert of the North American Electric Reliability Corporation (NERC) System Protection and Control Subcommittee (SPCS). Additionally Dr. Yalla was a past Chairman of the Rotating Machinery Protection Subcommittee. Presently he is secretary of the IEEE Power System Relaying and Control (PSRC) committee. He serves as chairman of several working groups which developed IEEE standards, tutorials and technical reports. He was the organizer of the IEEE PES Tutorial on Distribution volt var control and optimization which was presented during the July 2016 PES general meeting in Boston. Dr. Yalla was elected to IEEE Fellow in 2006. He received the IEEE Florida Council Outstanding Engineer Award in 2005, and the IEC 1906 Award in 2010 which honors the IEC experts around the world.*

***Steve Averitt, P.E.**, is with Reinhausen Manufacturing Inc. in his latest position as a Senior Area Sales Manager specifically with the Automation & Controls group in Humboldt, TN for more than 11 years. His past experience as a Senior Design Engineer with Westinghouse Electric Corporation and ABB Power T&D Co., Inc. designing transformer and circuit breaker bushings, control cabinets, tap changers and other power transformer components. He also has worked as a Distribution Engineer with Decatur Utilities, Decatur, AL from 1988 to 1991. He attended and graduated from Mississippi State University in 1985 with a BSEE degree emphasizing on*



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February 20-24, 2017 | Huntington Beach, California USA

high voltage power system design and insulation coordination. He is a registered Professional Engineer of Electrical Engineering with the State of Tennessee since 1996.

TP 10:45 AM – 12:00 PM

Forensic Analysis

Part 1: Root Causes of Failures

Bill Griesacker, Principal Engineer, Consulting and Testing Services
Doble Engineering Company

Forensic examinations are conducted for a number of reasons; however, the end goal is typically to determine the root cause of the failure. Often this examination involves the review of historical operating conditions prior to the failure and the disassembly of the failed transformer in search of supporting evidence. Case studies will be presented.

***Bill Griesacker** is a member of Doble Engineering Company as a transformer engineer working on projects that include factory inspections, condition assessment, design reviews, failure analysis and general consulting. Mr. Griesacker holds an MS in electric power engineering from the Rensselaer Polytechnic Institute and a BS in electrical engineering from Gannon University. He is an active member of the IEEE, PES Transformers Committee where he holds positions in several working groups and subcommittees.*

Part 2: Forensic Decommissioning

Anne Bailey, Sales Manager
A-Line E.D.S.

Each transformer recycling project is unique based on the transformer design, location and circumstances for removal. This presentation will provide project examples to showcase on-site removal options and expectations as well as showcase the specialized equipment available to aide in the detailed assessment of power transformers. Project examples will include premature transformer failure assessment as well as procedures for obtaining samples during routine transformer replacement projects to aide in condition assessment initiatives.

***Anne Bailey** has been with A-Line E.D.S. managing transformer recycling projects for the past 10 years. She has experience contracting, evaluating and managing on-site transformer dismantling projects to provide turnkey services including the safe and environmentally sound disposal of power transformers including specialty services for forensic decommissioning.*

Part 3: Case Studies



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February 20-24, 2017 | Huntington Beach, California USA

TP-A 10:45 AM – 12:00 PM LTC Maintenance & Extending Maintenance Cycles

Jim McLean, Director of LTC Business
North American Substation Services

This presentation is centered on the maintenance of LTCs and what you can do to aid in extending your maintenance cycles. It will cover items such as; filtration, coke formations, contact upgrades, contact alignment and understanding your LTCs needs.

Jim McLean is the Director of LTC Business for North American Substation Services LLC. He has held key positions in the service, sales and marketing areas for Reinhausen Manufacturing and Waukesha Electric Systems. He has 30 years of experience in the service and support of manufacturing, maintenance and field operations. He has 16 years of experience in Field Service Management. He has traveled the United States, Canada, The Caribbean and Europe as a computer programmer specializing in interface and communications. He is a training class developer and instructor for LTC training classes where he has instructed over 120 classes and 950 students across the United States and Canada. He has traveled to Venezuela to lead in a LTC failure analysis. Jims enjoys working with youth sports and teaching proper techniques for football and basketball. He is the past President, V President and Senior Division V President for Medina Football & Cheerleading League where he lead in the activities of 12 youth league football and cheerleading teams. He has been a head basketball coach with the Boys & Girls Club of America in North Carolina. He is an active board member of the local high school athletic booster club. Jim is originally from North Carolina where he attended both Central Piedmont Community College and Gaston College.

12:00 PM – 1:00 PM

Lunch

TP 1:00 PM – 1:45 PM

Measuring and Locating Partial Discharge in Transformer in Service

Falk Werner, Sr. Field Engineer
Doble Engineering Company

Subject of the presentation is a transformer fleet PD assessment performed in the Caribbean in 2015. Measurement approaches and findings are laid out covering HFCT, RFI and acoustic PD testing. As a result of the assessment a transformer with defective cable L-bows was identified. In order to prevent failure of the equipment, those L-bows were inspected and significant deterioration was found within the connection.

Falk Werner studied Electronics and Information Technology with a focus on Telecommunication and Signal Processing at the University of Stuttgart in Germany. His final thesis was *Location of Partial Discharges by Means of Sensor Arrays*. Mr. Werner has in-depth knowledge of partial discharge (PD) diagnostics and measurement methods on high voltage insulation systems. At Doble Lemke in Germany he co-developed the PD solutions range. Mr. Werner has several publications to his credit and is currently a Doble Power Services Engineer at Doble Engineering Company focusing on partial discharge, diagnostics and solution development.

TP-A 1:00 PM – 2:45 PM

Establishing a Transformer Life-Cycle Maintenance Program

Tony McGrail, Solutions Director, Asset Management & Monitoring
Technology



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February 20-24, 2017 | Huntington Beach, California USA

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In today's modern utility, capital investments in transformers and other T&D assets can be on the order of billions of dollars. With all that spending, there is enormous pressure to implement optimized, intelligent substation maintenance program including creating maintenance & life cycle planning policies to ensure that we are making the right decisions with regard to managing risk and ensuring the reliability of our system. Expected program goals include reduction/optimization of substation asset maintenance costs, overall asset life-cycle cost optimization and maintenance resource optimization. Many utilities today however still successfully operates on a time-based approach that doesn't correspond with asset health or criticality and is adjusted periodically based on newer fault history, personnel availability and budget availability.

This session will discuss:

- Setting up an effective transformer maintenance management model
- Optimizing maintenance and inspection decisions
- Asset health indexing
- Optimizing repair, refurbishment and replacement decisions
- Design & implementation of required data management and IT decision support tools
- Assembling, presenting and justifying the optimal transformer maintenance management plan

Tony McGrail is Doble Engineering Company's Solutions Director for Asset Management & Monitoring Technology, providing condition, criticality and risk analysis for utility companies. Previously Dr. McGrail has spent over 10 years with National Grid in the UK and the US; he has been both a substation equipment specialist, with a focus on power transformers, circuit breakers and integrated condition monitoring, and has also taken on the role of substation asset manager and distribution asset manager, identifying risks and opportunities for investment in an ageing infrastructure. Dr. McGrail is a Fellow of the IET, Chairman of the IET Council, a member of the IEEE, ASTM, CIGRE and the IAM, is currently on the executive committee of the Doble Client Committee on Asset and Maintenance Management, and a contributor to SFRA and other standards. His initial degree was in Physics, supplemented by an MS and a PhD in EE and an MBA. Dr. McGrail has a commitment to lifelong learning and is an Adjunct Professor at Worcester Polytechnic Institute, MA, leading courses in power systems analysis and distribution fundamentals.

DP 1:00 PM – 1:45 PM

Automated Protection Data Management

Joe Stevenson, Sales Manager

Enoserve, a Division of Doble

Protection system data management is complex. Relay professionals operate with numerous and varied data sources between the office and field. This discussion highlights some common struggles of the typical power company in managing protection system information and presents a useful, how-to approach for automating relay data management with solutions available from Doble.

Joe Stevenson has worked in technical consultative sales in the electric power industry for the past 14 years during his career at ENOSERV, a Division of Doble. In his tenure, he has worked primarily with relay professionals who are directly involved with system protection and regulatory compliance from entities spanning all industry



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February 20-24, 2017 | Huntington Beach, California USA

segments. On countless occasions he has been involved with matters pertaining to system integrations and data-related process improvements for customers.

TP 1:45 PM – 2:45 PM

Developing Diagnostic Strategies through Understanding Field Test Results – Part I

Mark Lachman, Director of Diagnostic Analyses
Robert Brusetti, Director, Client Service Engineering
Doble Engineering Company

Mark F. Lachman, Ph.D., P.E., has been with the power industry for over 30 years. In 2005, he joined Delta Star in San Carlos, CA, where, as Test Manager, he was responsible for the test department operation. In 2011, he returned to Doble Engineering Company as Director of Diagnostic Analyses.

Robert Brusetti received his BS in Electrical Engineer degree from the University of Vermont in 1984 and a MBA from Boston College in 1988. He has been employed at Doble Engineering Company for twenty years and currently serves as Director of Client Service Engineering. Prior to his present responsibility he has held positions as Product Manager and Field Engineer. Mr. Brusetti is a licensed Professional Engineer in the state of Massachusetts.

DP 1:45 PM – 2:45 PM

Overview and Features of Doble Protection Suite Software – Part I

Ed Khan, Director of Protection Training
Doble Engineering Company

Ed Khan has been with Doble for more than 6 years working in various capacities including product manager for protection tested related instruments. Prior to Doble, Mr. Khan has worked for GE, ABB, SEL, KEMA and others in various capacities. He has over 30 years of experience in system studies, protection applications, relay design, power plant design, teaching and product management. He has a thorough knowledge about product development, protection, harmonic analysis, harmonic filter design, stability studies, Real Time Digital Simulations, generator protection and more. He has presented courses on behalf of Doble globally and has been an invited speaker for utilities and industrial customers in Southeast Asia, Middle East, Mexico, India and China. He is a member of CIGRE working group B56.5 focusing on the optimization of protection and controls.

2:45 PM – 3:00 PM

Break

TP 3:00 PM – 4:45 PM

Developing Diagnostic Strategies through Understanding Field Test Results – Part II

Mark Lachman, Director of Diagnostic Analyses
Robert Brusetti, Director, Client Service Engineering
Doble Engineering Company

TP-A 3:00 PM - 4:45 PM

Planning to Succeed – ‘Sustain’ Plans that Connect Engineering and Finance
Peter Jay, Principal Consultant
Woodhouse Partnership Ltd.



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February 20-24, 2017 | Huntington Beach, California USA

Managing aging assets is one of the most critical issues facing utilities struggling with competing priorities, constrained resources, a challenging regulatory environment and the difficulty of determining which projects, maintenance or asset replacement tasks are really worthwhile and when. Many electricity utilities struggle at rate reviews to win the funding they believe they need to maintain a sustainable business. Meanwhile there is an increasing expectation to use asset information to back plans and provide evidence. 'Health Indicators' are widely hailed as a panacea for managing aging assets – but are they credible and sound – how should they be used and derived?

ISO55000 is a relatively new international standard that describes a management system for asset management. This provides a structured framework for managing assets which was developed to promote good practice in managing assets – to maximize value. It is strong on the management of risk and the need to manage 'sustain' plans. It introduced a new term the 'Strategic Asset Management Plan' which many organizations struggle to understand.

This second session will discuss:

- Asset management in the context of a regulated utility.
- Bridging the communication gap between the worlds of engineering and finance.
- Long term strategic planning and the 'Strategic Asset Management Plan'.
- Life cycle strategies – documenting sound engineering.
- Developing meaningful health indicators for prioritizing plans.

Peter Jay is a Principal Consultant at TWPL. Chartered electrical engineer specialising in asset management, including whole life costing and risk assessment. Mr. Jay has led improvement initiatives with many organizations around the world, including major programmes to put in place effective asset management solutions compliant with ISO55001. Additionally, he has designed and implemented leading-edge criticality and performance analysis techniques. He worked for over 30 years in the electricity supply industry in the UK. Mr. Jay is a Life Fellow of the Institute of Asset Management, past chair of the Knowledge Committee and has been at the forefront of developing asset management good practice.

DP 3:00 PM – 4:45 PM

Overview and Features of Doble Protection Suite Software – Part II
Ed Khan, Director of Protection Training
Doble Engineering Company

ALL 4:45 PM – 5:30 PM

Ask the Experts Panel – Anything Transformer Related



Life of a Transformer™ Seminar

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February 20-24, 2017 | Huntington Beach, California USA

OPTIONAL LABORATORY SEMINAR

Friday, February 24, 2017

7:00 AM – 8:00 AM

Attendee Breakfast

7:00 AM – 4:30 PM

Registration & Information Desk Open

LS &

TM 8:00 AM – 4:30 PM

Transformer Condition Assessment Using Laboratory Diagnostics

Paul Griffin, Vice President Global Professional Services

Eileen Finnan, Director, Field Services

Doble Engineering Company

This one-day session provides students with a thorough understanding of how to assess the condition of electrical insulating materials and transformers.

Dissolved gas-in-oil analysis – This is the single most important diagnostic test for transformers. This presentation reviews how the test is performed, how to distinguish between normal gassing behavior and problems, and how to evaluate trends. Practical case studies and examples are used to illustrate theoretical concepts. Seminar participants will be quizzed (with class participation) on their understanding in diagnosing 12 cases.

Water in Transformer Oil – Assessing how dry a transformer is requires more than a water in oil test. Learn how to assess the wetness of the transformer insulation system and why you need to know the operating temperature at the time of sampling. This session discusses water migration in transformers and how water affects the ability to overload them. Examples are provided.

Condition assessment of cellulosic insulation – The analysis of the condition of the paper insulation has changed quite a bit in the past 10 years. Learn how the solid insulation ages and how to assess the condition of the paper and pressboard insulation and its remaining life. Case studies are given to illustrate the distribution of paper aging in transformers and how operation and maintenance can influence it.

Metals in oil – This presentation provides an understanding of the importance of metal-in-oil tests as a diagnostic. To be able to use the information, the correct test must be specified – learn the difference between dissolved and particulate metals and when to choose each test. Case studies are given.

Quality of new and service aged oils – Background information is provided on the properties of transformer oil. The presentation includes how to specify and evaluate new oils, what tests to perform and how to evaluate in-service oils.

Aging characteristics of insulating materials - Aging is discussed in sections on oil and paper which provides information on how to increase the life of transformers. There are a number of factors that accelerate the aging



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February 20-24, 2017 | Huntington Beach, California USA

of the insulation system that can be controlled. This session provides information on when to reclaim or replace oil and gives specifications for reclaimed oil.

Load tap changer and oil circuit breaker diagnostics – This presentation gives the latest information on diagnostics for load tap changers (LTCs) and bulk oil breakers. Case studies are provided.

Sampling – The presentation discusses how to save money on your sampling program through proper training and what common pitfalls to avoid. Proper sampling preparation, practices, and equipment are given.

Paul Griffin is Doble Engineering Company's Vice President of Global Professional Services. Mr. Griffin has been with Doble since 1979 and prior to his current role has held various positions including Laboratory Manager and Vice President of Laboratory Services. Since joining Doble, Mr. Griffin has published over 50 technical papers pertaining to testing of electrical insulating materials and electric apparatus diagnostics. He is a Fellow of ASTM and a member of Committee D-27 on Electrical Insulating Liquids and Gases. He was formerly ASTM Subcommittee Chairman on Physical Test, ASTM Section Chairman on Gases in Oil, and the Technical Advisor to the U.S. National Committee for participation in the International Electrotechnical Commission, Technical Committee 10, and Fluids for Electrotechnical Applications. Mr. Griffin is a member of the IEEE Insulating Fluids Subcommittee of the Transformer Committee.

Eileen Finnan is Director of Field Services, Doble Engineering Company. Ms. Finnan received her BS Degree in Physics and Chemistry from Trinity College Dublin, Ireland. She joined Doble as a Chemist in 1988 and held the position of Laboratory Manager from 1998-2003. She was a member of ASTM D27 on Electrical Insulating Liquids and Gases and has held a number of positions on its subcommittees. She is currently part of the Testing and Consulting group, focusing on condition assessment of electrical apparatus and asset health review and also has responsibility for managing the quality program at the Doble Laboratories.