TRANSFORMERS COMMITTEE

September 10, 2009

Dear Committee Members and Guests:

You and your spouse or companion are cordially invited to attend the Fall 2009 Meeting of the IEEE/PES Transformers Committee to be held **October 25-29, 2009** in Lombard, Illinois (a suburb of Chicago). It is my pleasure, and the pleasure of Commonwealth Edison Company (ComEd) to be your host for this event.

The location for our meeting is the **Westin Lombard Yorktown Center**, 70 Yorktown Center, Lombard Illinois (www.westinlombard.com). The hotel is located next to Yorktown Center, with a host of shops and fine dining. The group rate for guest rooms is US$139 (single and double occupancy). Rooms are reserved under the group name "IEEE Transformers" and can be reserved from a link at the Committee's website, or by calling (630) 719-8000, or toll-free at (800) 937-8461 from the US & Canada. The room-block cut-off date is October 2. On that date, remaining rooms will be released to the public, but ... it is expected that the hotel will sell-out before that date, so make your reservation soon! Self-parking at the hotel is free; valet parking for a small fee.

Lombard is located 18 miles from **O'Hare** (ORD), and 25 miles from **Midway** (MDW) international airports. A public taxi to/from Lombard cost US$50-70 one-way. **American Chauffeur** has offered our group a fixed-rate fare, one-way in a Lincoln Town Car, for up to 4 people per car -- US$30 to/from O'Hare, US$35 to/from Midway (includes taxes & tolls, driver gratuity not included). Advance reservation is necessary. Call (630) 241-2323 or email info@corporatecarrier.com. Mention the group name "IEEE".

Come early and stay late! Check-out the technical tours before you book your flights. We have scheduled some outstanding tours on Sunday morning and Thursday afternoon, and also Monday and Tuesday Evenings. In addition, there is so much to do in Chicagoland that you'll want to arrive prior to Sunday and stretch your visit into the following weekend. Here are just a couple of things you can do on those spare days:

- **Downtown Chicago**: Take the Metra train to "the Loop". The Lombard train station is located 4 miles from the Westin. Ask the hotel for a free shuttle ride to the train station (tip the driver well please). A weekend, multiple-ride train ticket is only US$5. Metra system map & schedules are available at www.metrarail.com.

- **Fermilab** high-energy physics laboratory is located in Batavia, Illinois, about 45 miles west of Chicago. It is open to the public 7 days a week from 8 am until 6 pm. www.fnal.gov

- **Drury Lane Theatre** in nearby Oakbrook will be performing "Thoroughly Modern Millie". This humorous story of a young girl from Kansas who takes New York City by storm as she flaps, taps and Charlestons her way into the Roaring '20's. Enjoy dinner and a play. www.drurylaneoakbrook.com

Weather: The weather in mid-October can vary greatly from day to day. We may experience unseasonably warm summer-like days or crisp cool fall days. A light jacket is a must and let's hope a warm coat will not be needed! Temperatures range from an average high of 61°F (16°C), to an average low of 38°F (4°C).

ON-LINE REGISTRATION

We have intentionally planned a busy meeting schedule, to allow you to maximize your experience in Chicagoland. Use the on-line registration system to register for tours and social events. The on-line registration system can be accessed at www.transformerscommittee.org. Register before October 2 to receive the US$50 early registration discount. The on-line registration system will be disabled on October 21 to print name badges and to finalize counts. Note that the cost for walk-up registration for the meetings at the hotel is substantially higher than for registering on-line in advance.

SPECIAL EVENTS

Sunday Evening Reception, October 25 - We will gather in the Jr. Ballroom of the Westin Hotel at 6:00 pm for quality time of renewing friendships and forming new ones. Hors d'oeuvres and a cash bar will be available. Please indicated your intention to attend during the on-line registration process.

Tuesday Speaker Luncheon, October 27 - Our guest speaker will be Rick Bush, Editorial Director of *Transmission & Distribution World* magazine. Never at a loss for words, this time Rick won't be limited to a page or two editorial in the magazine. The title for his presentation is "The Dumb Grid, Connecting Generators and Refrigerators in the Era of Green".

Wednesday Evening Dinner Social, October 28 - Enjoy a delicious meal and step back in time with two historical museums at Cantigny. One museum displays life in the 1930's and 40's at the mansion owned by one of the most powerful newspaper editors of the era. The other is the First Division Museum that provides a history of "The Big Red One" from the Revolutionary War through Desert Storm. www.cantigny.org

TECHNICAL TOURS

Sunday, Oct 25 – S&C Electric Complex and Advanced Technology Center, Chicago, IL **
Monday, Oct 26 – MacLean Power Systems, Franklin Park, IL (MOV arrester factory) **
Tuesday, Oct 27 – EO Schweitzer Manufacturing, Lake Zurich, IL (by invitation only) ***
Thursday, Oct 29 – S&C Electric Complex and Advanced Technology Center, Chicago, IL **
Waukesha Electric Systems, Waukesha, WI (by invitation only) ***

****** - Due to limitations (one busload per day), this tour is only open to Committee Members and Active Participants, and their spouses/companions.
*** - EO Schweitzer & Waukesha Electric tours are by invitation only. See Meeting Schedule for more info.

COMPANION TOURS

Monday, Oct 26 – Chicago Highlights Tour. A guided tour of the finest sites, with multiple stops and lunch
Tuesday, Oct 27 – Bus transportation to Chicago's Downtown Shopping District or the Museum Campus
Wednesday, Oct 28 – Shopping at Oakbrook Center, with optional lunch at Maggiano's Little Italy

ADDITIONAL INFORMATION

Along with this Invitation Letter, the following information comprises Meeting Invitation Package. All meeting information can be downloaded from the Committee's website at www.transformerscommittee.org.

1. Meeting Registration Form. This document is primarily used for those who do not have access to the Internet or need to pay by paper check or money order. It also makes a good guide to review the fees before you begin the on-line registration process. On-line registration is highly encouraged.
2. Detailed Meeting Schedule. An updated schedule will be posted on the Committee's website approximately one week before the meeting.
3. Information Flyers:
   - Tuesday Speaker Luncheon
   - Spouse/Companion Tours
   - Wednesday Evening Dinner Social
   - Technical Tours (two flyers): S&C Electric; MacLean Power Systems
     Note: Waukesha Electric and EO Schweitzer tour info will be sent directly from those companies.
   - Monday/Tuesday Technical Presentations (two flyers)

We look forward to seeing you in Lombard in October!

Thomas Callsen
Host, Fall 2009 Meeting

ComEd
An Exelon Company

Register on-line for the meeting using a credit card at: www.transformerscommittee.org (preferred method).
Use this form only if you do not have access to the Internet, or need to pay by check or money order.

IEEE/PES TRANSFORMERS COMMITTEE
Fall 2009 Meeting; October 25-29
Lombard, Illinois USA

Name of Attendee _____

Company / Institution _____

Street Address _____

City _____ State / Prov. _____ Postal Code _____ Country _____

Telephone _____ Email _____

PES Member? ☐Yes ☐No IEEE Standards Association Member? ☐Yes ☐No IEEE Membership #: _____

Will a companion accompany you? ☐Yes ☐No Full name of companion (for nametag) _____

Indicate if vegetarian meal(s) are required for: Attendee: ☐Yes ☐No Companion: ☐Yes ☐No

Other special requirements (special diets, wheelchair, etc.): _____

Attendee Registration Fee Includes: Meeting Attendance, Sunday Evening Reception, breaks, and 4 breakfasts (M, T, W, Th)
Companion Registration Fee Includes: Sunday Evening Reception and 4 breakfasts (M, T, W, Th)

-- Refund provided **ONLY** if the request is received **by October 21** (by confirmed email, see below) --
-- There is a US$25.00 service charge for a refund of the entire registration (US$10 for a partial refund) --

NOTE: Complete meeting registration (with fees) is necessary to attend ANY event (including socials & tours)

Meeting Registration Fees (all fees in US$ funds)	**On or Before October 2**	**After October 2, on or before October 21**	**On-site, at the Meeting**	**Total**
Attendee - IEEE Member (will be verified with IEEE)	$200	$250	$350	
Attendee - not IEEE member	$225	$275	$375	
Attendee - IEEE Life or Committee Emeritus (will be verified)	$50	$100	$200	
Spouse or Companion, and children age 10 and over	$75	$125	$225	

Note: A Companion is a "significant other", boy/girl friend, attending for non-commercial reasons (not attending technical meetings, etc.). Spouses/companions & children must be registered for the meeting (with above fees) to attend any tour or social event.

Sunday Evening Reception (event included in above fee) Attendee: ☐Yes ☐No; Companion: ☐Yes ☐No **-0-**

Monday Standards Luncheon: all SC/WG/TF leaders are encouraged to attend # ____ @ $20 _____

Tuesday Luncheon: Speaker - Mr. Rick Bush, T&D World Magazine # ____ @ $30 _____
Indicate selection for Tuesday Luncheon: Beef ____, Chicken ____, Vegetarian ____

Spouse/Companion Tours: Monday - Chicago Highlights Tour, with lunch # ____ @ $110 _____
Tuesday - Chicago Museums & Shopping District (transportation only) # ____ @ $25 _____
Wednesday - Shopping at Oakbrook Center (without group lunch) # ____ @ $0 _____
Wednesday - Shopping at Oakbrook Center (with group lunch) # ____ @ $25 _____

Wednesday Evening Event: Dinner Social at Cantigny, with McCormick & First Division Museums # ____ @ $70 _____
Indicate selection for Wednesday Evening Dinner: Beef ____, Seafood ____, Vegetarian ____

Technical Tours: S&C Complex, limited attendance ** ☐Sunday Morning ☐Thursday Afternoon # ____ @ $0 _____
MacLean Surge Arrester Facility, Monday evening, limited attendance ** # ____ @ $0 _____

** "Limited attendance" tours are open to only Transformer Committee Members and Active Participants.
For tours at E.O. Schweitzer and Waukesha Electric, contact these companies directly.

Note: Meeting Minutes in paper format is no longer available. The primary source for Meeting Minutes is downloads from the Committee's web-site.

TOTAL REMITTED -- US$ _____

METHODS OF PAYMENT: 1. Register on-line with a credit card (preferred). 2. Mail paper form with check or money order to:
IEEE/PES Transformers Committee; 13110 Birch Drive, Suite 148, PMB 330; Omaha, Nebraska 68164 USA
email: transformers@ieee.org. Cancellation by email is not considered accepted unless confirmed by return email.

Check or money order - Make payable to: **"IEEE Transformers Committee"**
Funds not from a US Bank must add US$25.00 for processing fee.

Mailed registrations without proper payment will not be accepted.

US Tax ID No. 13-1656633, Canadian Business No. 12563 4188, Euro Tax Registration No. EU826000081

IEEE/PES TRANSFORMERS COMMITTEE

www.transformerscommittee.org
Fall 2009 Meeting; 25-29 October 2009
Hosted by Thomas Callsen and ComEd, an Exelon Company
The Westin Lombard Yorktown Center; Lombard, Illinois USA

NOTES: See Page 5 for a key to abbreviations. A vertical line in the left margin indicates a noteworthy revision since last revision.

DATE/TIME	ACTIVITY	SUB-COM	ACTIVITY CHAIR	ROOM CAP/ARR/AV	MEETING ROOM (Floor)
Saturday, October 24					
	No Meeting Registration, No Transformer Committee Meetings, No Social Events				
Sunday, October 25					
8:00 am - 12:30 pm	Technical Tour: S&C Complex and Advanced Technology Center (similar tour on Thursday afternoon, Oct 29) Indicate your desire to attend while registering on-line for the Committee Meeting. Limited attendance. Bus will depart the Westin at 8:00 am and return before 12:30 pm. Box breakfast provided on the bus. Contact Michael Kilpatrick at 773.338.1000 x2306 or <mkilpatrick@sandc.com> for more details.				
1:00 pm - 5:30 pm	Meeting Registration				Jr. Ballroom Foyer
2:00 pm - 5:30 pm	Administrative SC -- closed meeting, by invitation only	Admin.	T. Prevost	24 US (w/snack buffet)	Magnolia A
2:00 pm - 5:30 pm	NEMA Transformers -- closed meeting, by invitation only	++	C. Drexler	15 US (w/beverages)	Magnolia B/C
6:00 pm - 8:00 pm	Welcome Reception			350 Reception	Jr. Ballroom A/B/C
Monday, October 26 -- Monday Breaks Sponsored by OMICRON electronics ***					
7:00 am - 5:00 pm	Meeting Registration				Jr. Ballroom Foyer
7:00 am - 6:00 pm	Internet Cafe'			12 SQ	Oak
7:00 am - 7:50 am	Newcomers Orientation Breakfast Mtg (arrive early!) -- Newcomers & Guests are encouraged to attend!		E. Smith	50 CL	Grand Ballroom J
7:00 am - 7:45 am	Distribution SC Leaders Coordination Meeting (by invitation only)		S. Shull	14 CONF	Water Wall Room in Holy Mackerel
7:00 am - 8:00 am	Breakfast - Attendees (no spouses/companions please)			250 RT (8/tbl)	Grand Ballroom F
8:00 am - 9:00 am	Breakfast - Spouses/Companions (no meeting attendees please)			75 RT (8/tbl)	Sheffield Room in Harry Caray's Private Ballroom
9:15 am - 4:30 pm	Spouses/Companion Tours: "Chicago Highlights Tour". Includes lunch at Blueprint Restaurant. -- Advance registration required. Bus departs the Westin Hotel at 9:15 am and returns around 4:30 pm.				
8:15 am - 10:45 am	IEC TC-14 Technical Advisory Group (all interested individuals welcome)	++	P. Hopkinson	50 CL	Magnolia A
8:00 am - 9:15 am	WG Dry-Type Reactors C57.16	Dry	R. Dudley	40 CL	Magnolia B/C
8:00 am - 9:15 am	WG 3-ph Underground Distribution Transformers C57.12.24	UTNP	G. Termini	40 CL	Cypress A/B
8:00 am - 9:15 am	(TBD)			80 CL	Lilac A/C
8:00 am - 9:15 am	TF DPV Grid Transformers	Power	H. Shertukde	80 CL	Lilac B/D
8:00 am - 9:15 am	TF Electrical Partial Discharge Measurements Guide C57.113	DiTests	E. Lemke	100 CL S3	Jr. Ballroom C
8:00 am - 9:15 am	WG Transformer Monitoring C57.143	Power	D. Chu	150 CL S3	Jr. Ballroom A/B
9:15 am - 9:30 am	*Break (beverages only)*			Jr. Ballroom Foyer	

*** Contact Joe Watson (joe_watson@ieee.org) if you are interested in sponsoring coffee-breaks at a future meeting.

DATE/TIME	ACTIVITY	SUB-COM	ACTIVITY CHAIR	ROOM CAP/ARR/AV	MEETING ROOM
Monday, October 26 (continued)					
9:30 am - 10:45 am	WG Sealed Dry-Type Power Transformers C57.12.52	Dry	S. Kennedy	40 CL	Magnolia B/C
9:30 am - 10:45 am	WG Liquid-immersed Secondary Network Transformers C57.12.40	UTNP	B. Klaponski	50 CL	Cypress A/B
9:30 am - 10:45 am	WG Overhead Distribution Transformers C57.12.20	Dist	A. Wilks/ T.Cooper	80 CL	Lilac A/C
9:30 am - 10:45 am	WG Revision of C57.12.10	Power	G. Hoffman	80 CL	Lilac B/D
9:30 am - 10:45 am	TF Furan Tests	IL	K. Haggerty	100 CL S3	Jr. Ballroom C
9:30 am - 10:45 am	WG PCS Rev. to Test Code C57.12.90	PCS	M. Perkins	150 CL S3	Jr. Ballroom A/B
10:45 am - 11:00 am	*Break (beverages only)*			Jr. Ballroom Foyer	
11:00 am - 12:15 pm	TF IEEE-IEC Cross Reference	Stds	J. Sim	50 CL	Magnolia A
11:00 am - 12:15 pm	WG Dry-Type Gen. Require. C57.12.01	Dry	T. Holdway	40 CL	Magnolia B/C
11:00 am - 12:15 pm	WG Std Requires for Sec. Network Protectors C57.12.44	UTNP	B. Wimmers	50 CL	Cypress A/B
11:00 am - 12:15 pm	WG 1-ph Padmount Distribution Transformers C57.12.38 (12.21 & 12.25)	Dist	A. Ghafourian/ M. Faulkenberry	80 CL	Lilac A/C
11:00 am - 12:15 pm	WG Control Cabinets PC57.148	Power	J. Watson	80 CL	Lilac B/D
11:00 am - 12:15 pm	TF External Dielectric Clearances	DiTests	E. Davis	100 CL S3	Jr. Ballroom C
11:00 am - 12:15 pm	WG Thermal Evaluation of Power and Distribution Transformers C57.100	IL	R. Wicks	150 CL S3	Jr. Ballroom A/B
12:15 pm - 1:30 pm	Lunch Meeting: Standards Development Review -- All SC/WG/TF leaders are encouraged to attend. -- Advance reservation required ($20 for box lunch). -- No paper tickets. Admission verified at the door.		B. Bartley	120 (8/tbl)	Grand Ballroom F
1:45 pm - 3:00 pm	**SC HVDC Converter Transformers and Smoothing Reactors**	HVDC	R. Dudley	50 CL	Cypress A/B
1:45 pm - 3:00 pm	WG 3-ph Padmount Distribution Transformers C57.12.34	Dist	R. Stahara/ S. Shull	80 CL	Lilac A/C
1:45 pm - 3:00 pm	WG Tap Changer Performance C57.131	Power	W. Henning	80 CL	Lilac B/D
1:45 pm - 3:00 pm	WG Procedures for Harmonizing IEEE & IEC Standards	Stds	J. Puri	80 CL	Magnolia A/B/C
1:45 pm - 3:00 pm	TF Special Dielectric Test Issues	DiTests	B. Forsyth	100 CL S3	Jr. Ballroom C
1:45 pm - 3:00 pm	WG Frequency Response Analysis (FRA) Guide PC57.149	PCS	C. Sweetser	150 CL S3	Jr. Ballroom A/B
3:00 pm - 3:15 pm	*Break (beverages and treats)*			Jr. Ballroom Foyer	
3:15 pm - 4:30 pm	WG Dry-Type Test Code C57.12.91	Dry	D. Foster	50 CL	Cypress A/B
3:15 pm - 4:30 pm	WG Loss Evaluation Guide for Distribution Transformers	Dist	A. Traut/ D. Duckett	80 CL	Lilac A/C
3:15 pm - 4:30 pm	WG Transformer Paralleling Guide	Power	T. Jauch	80 CL	Lilac B/D
	TF PD in Bushings and PTs/CTs	DiTests	T. Hochanh	80 CL	Magnolia A/B/C
3:15 pm - 4:30 pm	TF Moisture in Oil (**New!)**	IF	B. Rasor	100 CL S3	Jr. Ballroom C
3:15 pm - 4:30 pm	WG PCS Revisions to C57.12.00	PCS	S. Snyder	150 CL S3	Jr. Ballroom A/B
4:30 pm - 4:45 pm	*Break (beverages only)*			Jr. Ballroom Foyer	
4:45 pm - 6:00 pm	Presentation: "Electrical Steel and Core Performance", by R. Girgis, M. Hastenrath, and J. Schoen. Sponsored by SC Performance Characteristics **			200 CL S3 (add 50-75 TH seats in rear)	Jr. Ballroom A/B
6:30 pm - 10:00 pm	Technical Tour: MacLean Power Systems Surge Arrester Facility; Franklin Park, Illinois -- Indicate your desire to attend while registering on-line for the Committee Meeting. Limited attendance. -- Bus will depart the Westin at 6:30 pm and return before 10:00 pm. Dinner will be served at the facility. -- Contact Paul Lindemulder at 847-451-2813 or <plindemulder@macleanpower.com> for more details.				

** Contact N. Kent Haggerty (n.kent.haggerty@ieee.org) if you are interested in making a technical presentation at a future meeting.

DATE/TIME	ACTIVITY	SUB-COM	ACTIVITY CHAIR	ROOM CAP/ARR/AV	MEETING ROOM
Tuesday, October 27 -- Tuesday Breaks Sponsored by TBEA Shenyang Transformer Group ***					
7:00 am - 12:00 pm	Meeting Registration				Jr. Ballroom Foyer
7:00 am - 6:00 pm	Internet Cafe'			12 SQ	Oak
7:00 am - 8:00 am	Breakfast - Attendees (no spouses/companions please)			250 RT (8/tbl)	Grand Ballroom F
8:00 am - 9:00 am	Breakfast - Spouses/Companions (no meeting attendees please)			75 RT (8/tbl)	Sheffield Room in Harry Caray's
9:15 am - 4:45 pm	Spouses/Companions Tour: "Chicago Museums & Shopping District ". Advance registration required. -- Bus departs Westin at 9:15 am and returns by 4:45 pm. Drop-off at "Museum Campus" (Shedd Aquarium, Field Museum, Adler Planetarium) and at Michigan Avenue & Chestnut. Pick-up at same location at Michigan & Chestnut at 3:00 pm, and at Museum Campus at 3:30 pm. Lunch and entry fees not included.				
	~~WG HV Instrument Transformer Tests~~	C57.13.5 document complete.			
8:00 am - 9:15 am	WG Oil Reclamation Guide PC57.637	IF	J. Thompson	50 CL	Cypress A/B
8:00 am - 9:15 am	WG Enclosure Integrity C57.12.28, C57.12.29, C57.12.31, C57.12.32	Dist	R. Olen/ D. Mulkey	80 CL	Lilac A/C
8:00 am - 9:15 am	TF Heating of Metallic Parts in contact with Insulation **(New!)**	IL	J. Ray	80 CL	Lilac B/D
8:00 am - 9:15 am	WG PC57.152 Field Test Guide	Stds	J. Verner	80 CL	Magnolia A/B/C
8:00 am - 9:15 am	TF Transf. Tank Rupture & Mitigation	Power	P. Zhao	100 CL S3	Jr. Ballroom C
8:00 am - 9:15 am	WG Switching Transients Induced by Transf./Breaker Interaction PC57.142	PCS	R. Degeneff	150 CL S3	Jr. Ballroom A/B
9:15 am - 9:30 am	*Break (beverages only)*			Jr. Ballroom Foyer	
	~~WG HVDC Bushings C57.19.03~~	Joint IEC-IEEE WG HVDC Bushings will meet on Saturday, 10/24			
9:30 am - 10:45 am	WG Terminal Markings C57.12.70	Stds	S. Shull	50 CL	Cypress A/B
9:30 am - 10:45 am	WG Neutral Ground. Devices PC57.32	PCS	S. Schappell	80 CL	Lilac A/C
9:30 am - 10:45 am	TF Functional Life Tests, De-energized Tap Changers (DETC)	Power	P. Hopkinson	80 CL	Lilac B/D
9:30 am - 10:45 am	WG Impulse Test Guide C57.98/138	DiTests	A. Molden	80 CL	Magnolia A/B/C
9:30 am - 10:45 am	TF DGA Natural Ester Fluids	IF	P. Boman	100 CL S3	Jr. Ballroom C
9:30 am - 10:45 am	WG Revision to Loading Guide C57.91	IL	D. Duckett	150 CL S3	Jr. Ballroom A/B
10:45 am - 11:00 am	*Break (beverages only)*			Jr. Ballroom Foyer	
11:00 am - 12:15 pm	WG Revision to IEEE 638	Power	C. Swinderman	50 CL	Cypress A/B
11:00 am - 12:15 pm	WG Voltage Step Regulators C57.15	Dist	Colopy/Kennedy	80 CL	Lilac A/C
11:00 am - 12:15 pm	(TBD)			80 CL	Lilac B/D
11:00 am - 12:15 pm	TF Tertiary/Stabilization Windings **(New!)**	PCS	E. Betancourt	80 CL	Magnolia A/B/C
11:00 am - 12:15 pm	WG Guide for DGA in LTCs C57.139	IF	F. Jakob	100 CL S3	Jr. Ballroom C
11:00 am - 12:15 pm	WG Temperature Rise Test Procedures in Section 11 of C57.12.90	IL	P. Powell	150 CL S3	Jr. Ballroom A/B
12:15 pm - 1:30 pm	Speaker Luncheon: Rick Bush, Editor in Chief, T&D World Magazine -- Topic: "The Dumb Grid, Connecting Generators and Refrigerators in the Era of Green". Advance registration is necessary. -- Paper tickets are not provided. Admission verified at the door.			200 (8/tbl) with elevated table for 5	Grand Ballroom F
	~~WG Dielectric Test Tables, Liquid-filled~~	Work is complete			
1:45 pm - 3:00 pm	WG Phase-shift Transf. Guide C57.135	Power	J. Sim	50 CL	Cypress A/B
1:45 pm - 3:00 pm	TF Transformer Efficiency and Loss Evaluation (DOE Activity)	Dist	P. Hopkinson	80 CL	Lilac A/C
1:45 pm - 3:00 pm	TF GSU Bushing Standardization	Bush	C. Hurley	80 CL	Lilac B/D
1:45 pm - 3:00 pm	WG Sound Level Measurement Guide	ASV	R. Girgis	80 CL	Magnolia A/B/C
1:45 pm - 3:00 pm	WG Revision to Gas Guide C57.104	IF	R. Ladroga	100 CL S3	Jr. Ballroom C
1:45 pm - 3:00 pm	WG Revision to Low Frequency Tests	DiTests	B. Poulin	150 CL S3	Jr. Ballroom A/B
3:00 pm - 3:15 pm	*Break (beverages and treats)*			Jr. Ballroom Foyer	

*** Contact Joe Watson (joe_watson@ieee.org) if you are interested in sponsoring coffee-breaks at a future meeting.

DATE/TIME	ACTIVITY	SUB-COM	ACTIVITY CHAIR	ROOM CAP/ARR/AV	MEETING ROOM
Tuesday, October 27 (continued)			Work		
	~~WG Bushing Applic. Guide C57.19.100~~	Work is nearly complete.			
3:15 pm - 4:30 pm	TF Semiconductor Rectifier Transformers C57.18.10	PCS	S. Kennedy	50 CL	Cypress A/B
3:15 pm - 4:30 pm	WG Electronic Test Data Reporting C57.12.37	Dist	Hollingsworth/ Callsen	80 CL	Lilac A/C
3:15 pm - 4:30 pm	WG High Temp. Transformers PC57.154	IL	R. Marek	80 CL	Lilac B/D
3:15 pm - 4:30 pm	WG Revisions to Impulse Test Sections of C57.12.00 and C57.12.90	DiTests	P. Riffon/ P. Heinzig	80 CL	Magnolia A/B/C
3:15 pm - 4:30 pm	TF Guide for Field Application of Natural Ester Fluids	IF	J. Graham	100 CL S3	Jr. Ballroom C
3:15 pm - 4:30 pm	WG Transportation Issues Guide	Power	G. Anderson	150 CL S3	Jr. Ballroom A/B
4:30 pm - 4:45 pm	*Break (beverages only)*			Jr. Ballroom Foyer	
4:45 pm - 6:00 pm	Presentation: "Dielectric Frequency Response Testing (DFR)", by D. Chu, D. Kim, P. Patel, M. Perkins, P. Werelius. Sponsored by SC Dielectric Tests **			200 CL S3 (add 50-75 TH seats in rear)	Jr. Ballroom
6:30 pm - 10:30 pm	Technical Tour: E.O. Schweitzer Manufacturing Facility (a division of SEL); Lake Zurich, Illinois -- Restricted attendance; by invitation only (EOS will send invitations separately). -- Bus will depart the Westin at 6:30 pm and return before 10:30 pm. Dinner served at the factory. -- Contact Gayle Yauch at 847-540-8480 or <gayle_yauch@eosmfg.com> for more details.				
Wednesday, October 28 -- Wednesday Breaks Sponsored by HICO * **					
	No Meeting Registration, No Technical Tours				
7:00 am - 6:00 pm	Internet Cafe'			12 SQ	Oak
7:00 am - 8:00 am	Breakfast - Attendees (no spouses/companions please)			200 RT (8/tbl)	Grand Ballroom F
8:00 am - 9:30 am	Breakfast - Spouses/Companions (no meeting attendees please)			75 RT (8/tbl)	Sheffield Room in Harry Caray's
9:15 am - 4:00 pm	Spouses/Companions Tour: "Shopping at Oakbrook Center " -- Westin bus will shuttle throughout the day, beginning at 9:15 am, but advance registration required. -- See Bell Stand desk in the Westin lobby to request the shuttle. Shuttle will pick-up at Macy's. -- Optional lunch at Maggiano's Restaurant at 12:30 pm. Last shuttle departs Oakbrook Center at 4:00 pm.				
7:00 am - 7:45 am	**SC Meetings Planning** Get breakfast in Grand Ballroom F and take to Grand Ballroom G. Arrive early!	Meetings	G. Anderson	30 CL	Grand Ballroom G
8:00 am - 9:15 am	EL&P Delegation (Users only meeting)	++	S. Shull	50 CL	Lilac D
8:00 am - 9:15 am	**SC Instrument Transformers**	IT	J. Smith	100 CL S3	Jr. Ballroom C
8:00 am - 9:15 am	**SC Insulation Life**	IL	D. Platts	200 CL S3	Jr. Ballroom A/B
9:15 am - 9:30 am	*Break (beverages only)*			Jr. Ballroom Foyer	
9:30 am - 10:45 am	**SC Audible Sound & Vibration**	ASV	J. Puri	50 CL	Lilac D
9:30 am - 10:45 am	**SC Bushings**	Bush	F. Elliott	100 CL S3	Jr. Ballroom C
9:30 am - 10:45 am	**SC Distribution Transformers**	Dist	S. Shull	200 CL S3	Jr. Ballroom A/B
10:45 am - 11:00 am	*Break (beverages only)*			Jr. Ballroom Foyer	
11:00 am - 12:15 pm	**SC UG Transf. & Network Protectors**	UTNP	C. Niemann	100 CL S3	Jr. Ballroom C
11:00 am - 12:15 pm	**SC Dielectric Tests**	DiTests	L. Wagenaar	200 CL S3	Jr. Ballroom A/B
12:15 pm - 1:30 pm	Lunch (on your own)				
1:30 pm - 2:45 pm	**SC Dry Type**	Dry	C. Johnson	100 CL S3	Jr. Ballroom C
1:30 pm - 2:45 pm	**SC Power Transformers**	Power	T. Lundquist	200 CL S3	Jr. Ballroom A/B
2:45 pm - 3:00 pm	*Break (beverages and treats)*			Jr. Ballroom Foyer	

** Contact N. Kent Haggerty (n.kent.haggerty@ieee.org) if you are interested in making a technical presentation at a future meeting.
*** Contact Joe Watson (joe_watson@ieee.org) if you are interested in sponsoring coffee-breaks at a future meeting.

KEY

Note: A PC projector will be furnished in each meeting room. Arrive early to ensure that equipment operates/syncs correctly. Overhead projectors are available in the meeting registration area.

> -- activity continued into another session / from another session
++ -- not a Transformers Committee activity TBD = "To Be Determined"
FC = flip chart; S1 = sound (see note)
S2 = stand mic in front only; S3 = one stand mic in front & stand mic(s) at mid-room
CL -- classroom seating (w/head table for 2-3)
TH -- theater seating (with head table for 2-3)
RT -- multiple roundtables (8-9/table)
US -- U-shape table

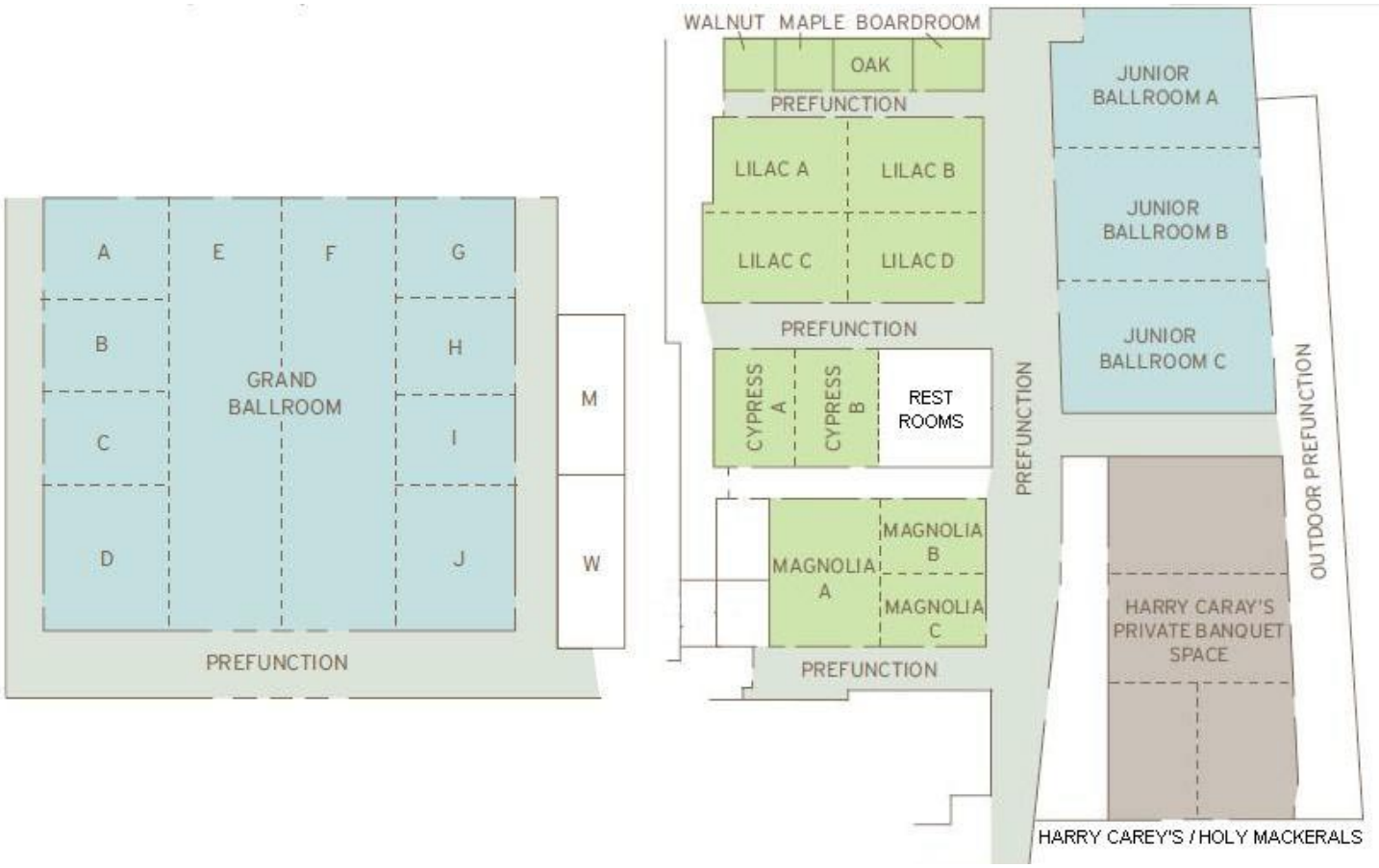
DATE/TIME	ACTIVITY	SUB-COM	ACTIVITY CHAIR	ROOM CAP/ARR/AV	MEETING ROOM
Wednesday, October 28 (continued)					
3:00 pm - 4:15 pm	**SC Insulating Fluids**	IF	S. McNelly	100 CL S3	Jr. Ballroom C
3:00 pm - 4:15 pm	**SC Performance Characteristics**	PCS	S. Antosz	200 CL S3	Jr. Ballroom A/B
4:15 pm - 4:30 pm	*Break (beverages only)*			JR. Ballroom Foyer	
4:30 pm - 5:30 pm	**SC Transformer Standards**	Stds	B. Bartley	100 CL S3	Jr. Ballroom C
6:30 pm - 10:00 pm	Dinner Social: "Cantigny; Robert R. McCormick Museum and Cantigny First Division Museum". -- Advance registration is necessary. Indicate meal selection when you register. -- Buses begin boarding at 5:45 pm. The last bus departs at 6:15 pm. All buses return before 10:00 pm. -- Paper tickets will not be provided. Admission will be verified with a registration list as you board the bus.				
Thursday, October 29					
	No Meeting Registration, No Spouses/Companions Tours, No Internet Cafe', No EPRI Meeting				
7:00 am - 8:00 am	Breakfast - Attendees (no spouses/companions please)			200 RT (6/tbl)	Grand Ballroom F
8:00 am - 9:30 am	Breakfast - Spouses/Companions (no meeting attendees please)			60 RT(8/tbl)	Sheffield Room in Harry Caray's
8:00 am - 9:45 am >	General Session, Transformers Committee -- All attendees are encouraged to attend. -- See separate document for meeting agenda.		T. Prevost	200 CL S1 75 TH elevat. table for 4	Jr. Ballroom A/B/C
9:45 am - 10:00 am	*Break (beverages only)*			Jr. Ballroom Foyer	
> 10:00 am - 11:30 am	General Session, Transformers Committee		T. Prevost	200 CL S1 75 TH	Jr. Ballroom A/B/C
12:00 pm - 7:30 pm	Technical Tour: Waukesha Electric Systems; Waukesha, Wisconsin Transformer Facility -- Restricted attendance; by invitation only (Waukesha Electric will send invitations separately). -- Bus will depart the Westin at 12:00 pm and return before 7:30 pm. Box lunches provided on the bus. -- Arrangements can be made with WES to provide transportation to Chicago airports after the tour. -- Contact Tammy Behrens at 262.513.5401 or <tammy.behrens@waukesha.spx.com> for more details.				
12:00 pm - 4:00 pm	Technical Tour: S&C Complex and Advanced Technology Center (similar tour on Sunday morning, Oct 25) -- Indicate your desire to attend while registering on-line for the Committee Meeting. Limited attendance. -- Bus will depart the Westin at 12:00 pm and return before 4:00 pm. Box lunches provided on the bus. -- Arrangements can be made with S&C to provide transportation to Chicago airports after the tour. -- Contact Michael Kilpatrick at 773.338.1000 x2306 or <mkilpatrick@sandc.com> for more details.				
1:30 pm - 5:00 pm	Joint WG HVDC Bushings IEEE PC57.19.03/ IEC 62199	Bush	J. Graham	40 CL	Magnolia A
Friday, October 30					
	No Transformer Committee Meetings, No Internet Cafe', No EPRI Meeting, No Tours.				

FUTURE COMMITTEE MEETINGS

SPRING 2010 - March 7-11; Houston, Texas. Hosted by Jeremy Kriska and Nynas USA
FALL 2010 - date and location to be determined

The Westin Lombard Yorktown Center

70 Yorktown Center; Lombard, Illinois 60148 USA



IEEE/PES TRANSFORMERS COMMITTEE

General Session - Fall 2009 Meeting
Thursday, 29 October 2009

Chair: Thomas A. Prevost Vice Chair: J. Edward Smith Secretary: Bill Chiu

1.	Chair's Remarks and Announcements		Thomas A. Prevost
2.	Approval of Minutes from Spring 2008 Meeting		Thomas A. Prevost
3.	Administrative Subcommittee		Thomas A. Prevost
4.	Vice Chair's Report		J. Edward Smith
5.	Transformer Standards		William H. Bartley
6.	Recognition and Awards		Donald J. Fallon
7.	New Business (continued below)		Thomas A. Prevost
8.	Report of Technical Subcommittees		
	8.1.	HVDC Converter Transformers & Reactors	Richard F. Dudley
	8.2.	Instrument Transformers	James E. Smith
	8.3.	Insulating Fluids	Susan J. McNelly
	8.4.	Insulation Life	Donald W. Platts
	8.5.	Performance Characteristics	Steven Antosz
	8.6.	Power Transformers	Thomas G. Lundquist
	8.7.	Underground Transformers & Network Protectors	Carl G. Niemann
	8.8.	Audible Sound and Vibration	Jeewan L. Puri
	8.9.	Bushings	Fred E. Elliott
	8.10.	Dry Type Transformers	Charles W. Johnson
	8.11.	Distribution Transformers	Steven D. Shull, reporting
	8.12.	Dielectric Tests	Loren B. Wagenaar
9.	Editor's Report		Edward G. teNyenhuis
10.	Meetings Planning Subcommittee		Gregory W. Anderson
11.	Reports of Liaison Representatives		
	11.1.	Standard Coordinating Committee No. 4	Paulette Payne Powell
	11.2.	IEC TC-14 Technical Advisor to USNC	Philip J. Hopkinson
	11.3.	CIGRE	Jean-Christophe Riboud
12.	Old Business		Thomas A. Prevost
13.	New Business (further discussion as needed)		Thomas A. Prevost

SPEAKER LUNCHEON
Tuesday, October 27, 12:15 pm

Speaker: Mr. Rick Bush
Editorial Director
Transmission & Distribution World magazine

Rick is the editorial director of *Transmission & Distribution World* magazine where he has worked since 1994. Rick is paid to express his opinions — something that got him in trouble in his earlier life as an engineer working in an investor-owned power company. He also has access to tap into thought leadership ideas driving the industry and will share his discoveries.

This year, Rick's duties are expanding as he works to direct the editorial efforts of the Penton Media portfolio of magazines to create an intelligent energy portal that includes energy generation, storage, energy consumption, energy load shaping, and even the selling of virtual energy. As to technical qualifications, Mr. Bush has a BSME and an MSME from Georgia Tech and is a senior member of IEEE.

Rick will share with us his perspectives on the megatrends that will drive our business and the fads that will cause our business to stumble:

- The legitimate need to retain dumb aspects of the grid.
- The impact of well designed pricing signals to set the drivers for sensible change.
- The likelihood of a canned utility demand side management initiative to make an order of magnitude of difference.
- Progress on interoperability standards on both sides of the meter.
- The ability of our grid to accommodate smart customers and smart generators.
- The inability of a delivery utility to remain dumber than generators or consumers.
- The role energy storage will play in the success or failure of the green energy movement.

Luncheon Registration

- Indicate your desire to attend the luncheon when you register on-line for the meeting.
- Indicate your meal selection (beef, chicken or vegetarian).
- Paper tickets will not be provided. Admission to the event and meal selection will be verified with a registration list at the door. We will begin seating around 12:05 pm.

Menu Options

Indicate your entrée selection when registering on-line for the meeting:

Beef: herb crusted strip beef loin
Chicken: flame grilled chicken breast with artichoke olive relish
Vegetarian*:* penne pasta with portabella mushrooms, oven dried roma tomatoes and spinach

Each selection is served with a classic caesar salad, chef's choice side vegetable and starch, freshly baked rolls and butter, caramel apple pie, and ice tea & coffee service.

Spouse / Companion Outings

Monday, Tuesday, Wednesday (October 26-28)

Monday, October 26: Chicago Highlights Tour

Travel through some of Chicago's finest sites and highlights, enjoying a professionally guided tour of all that Chicago has to offer. From Soldier Field to the Magnificent Mile, you will explore the many facets of the Windy City. The Loop, **Buckingham Fountain** and **Museum Campus** are just a few marvelous points to mention. Another famous stop at the Adler Planetarium will be made for a breathtaking view of Lake Michigan and the skyline. Several stops will allow you to step off the coach to take it all in and take advantage of a fantastic photo opportunity.

This Grand Tour of Chicago, full of interest, history and beauty, will take you through pristine parks, along the beaches that line Lake Michigan's shore, and all the beautiful and magnificent highlights along the way.

The tour will end at the amazing **Millennium Park**. Weather permitting; you will de-board for a short, guided walk through this new Chicago masterpiece. After the brief tour, you will board the motor coach and drive to one of the city's hottest new lunch spots, **Bluprint** at the famed Chicago Merchandise Mart. Enter a uniquely designed private dining room featuring tables of different heights and dine on a fabulous 3-course lunch.

This wonderful dining experience is followed by a mini-tour of the **Merchandise Mart**, so you can view some of the exhibitors housed in The Mart. Should time allow, you will have the opportunity to shop in the gallery district on Wells Street before boarding the coach to return to Lombard.

Tuesday, October 27: Chicago Museums and/or Downtown Shopping District

This day will allow you to experience a closer, more leisurely look at the sites you saw on Monday. A motor coach will provide you round-trip transportation from the Westin Lombard to downtown Chicago. You can choose to depart the coach at one of two locations. The first stop will be at the Museum Campus (Adler Planetarium, Shedd Aquarium, and Field Museum of Natural History). You can choose to get off the coach at this location or remain on the coach for the second stop, which will be the shopping mecca of Chicago: Michigan Avenue. The coach will pick-you up again at the same locations later in the day (see Itinerary).

Itinerary for Museums / Downtown Shopping

9:15 am – Bus departs from the front of Westin
10:00 am – Bus stops briefly at the Museum Campus
10:30 am – Bus stops at Michigan Ave. & Chestnut
3:00 pm – Bus pick-up at Michigan Ave. & Chestnut
3:30 pm – Bus pick-up at Museum campus
4:45 pm – Arrive at the Westin Lombard

Built in 1930, the **Adler Planetarium** was the first planetarium built in the Western Hemisphere and is the oldest in existence today.

The John G. **Shedd Aquarium** was opened in 1930 and at one time was the largest indoor aquarium in the world. There are several permanent exhibits including:

- The Amazon Rising exhibit is a walkthrough flooded forest recreation of the Amazon river and the surrounding jungle. This exhibit contains 250 different species.
- The Caribbean Reef exhibit includes a 90,000 US-gallon (340,000 liter) circular tank that allows for maximum walk-around viewing. A feature of this exhibit is a diver that interacts with the animals while talking with the people.
- The Oceanarium is split into two levels, above and below the waterline. Above the waterline, you can watch the dolphins perform. While below the waterline, you can see the beluga whales and dolphins up close.

Some prized exhibits in the **Field Museum** include:

- Sue, the largest and most complete Tyrannosaurus currently known.
- A comprehensive set of human cultural anthropology exhibits, including artifacts from ancient Egypt, the Pacific Northwest and Tibet.
- A diverse taxidermy collection, featuring many large animals, including two prized African elephants and the infamous Lions of Tsavo, featured in the 1996 movie "The Ghost and the Darkness".
- A large collection of dinosaurs in the Evolving Planet exhibit (formerly "Life Over Time").
- A large collection of Native American artifacts.

Wednesday, October 28: Shopping at Oakbrook Center (with optional lunch)

Oakbrook Center is one of the most prestigious and striking outdoor shopping destinations in the Chicago area. In fact, it's the largest open-air premier shopping center in the country! Always on the cutting edge of fashion, Oakbrook Center was voted the #1 shopping destination by Illinois shoppers. And no wonder. With six major department stores and over 160 upscale shops and restaurants – set amidst lush gardens and flowing fountains – it's a spectacular outdoor shopping experience.

Wednesday Lunch Menu

Appetizers: Sausage & Peppers and Crispy Zucchini Fritté

Salads: Choice of chopped or spinach

Pastas: Choice of Baked Ziti & Sausage or Mushroom Ravioli al Forno

Dessert: Vera's Lemon Cookies

You can schedule transportation at your own leisure via Westin's courtesy shuttle, but advance reservations with the Committee's meeting registration system is recommended. Reservations for an optional "family style" lunch have been made at 12:30 pm at **Maggiano's Little Italy** (on the east side of the mall next to Bloomingdales).
www.oakbrookcenter.com

Wednesday Dinner Social
Cantigny

Wednesday, October 28

www.cantigny.org

In addition to enjoying a wonderful sit-down meal at La Jardin, we will have exclusive access to explore Cantigny's two history-rich museums:

The **Robert R. McCormick Museum** depicts the country home of a family that made the Chicago Tribune the "World's Greatest Newspaper". The mansion was built in 1896 with a massive expansion in the early 1930's. It contains many amenities that were unique in that era.

Upon his death, the Robert R. McCormick Charitable Trust established Cantigny as a public park and created a charitable trust to fund programs serving children, communities, and country.

First Division Museum: Explore American history as seen through the eyes of the First Infantry Division (The Big Red 1) and gain a renewed appreciation for those who serve to protect our freedoms. With more than 38,000 square feet, the First Division Museum provides an immersive and stimulating experience for visitors of all ages.

The museum tells the story of the First Division from the Revolutionary War to Desert Storm through interactive galleries. In the 2,700 square foot Temporary Exhibit Gallery, different exhibits are rotated. In the lobby, temporary exhibits can often be found. Some tell the story of the division today; others display interesting historic artifacts that have been donated to or acquired by the museum.

One of the newest additions to the First Division Museum is an LCVP (Landing Craft, Vehicle and Personnel). Made famous in the opening scene of the movie, Saving Private Ryan, more than 22,000 "Higgins Boats" were manufactured during WWII. Found rusting in a field in France, this newly restored LCVP is one of only twelve known in existence today.

Menu Options

Indicate your meal selection when registering on-line for the meeting.

Beef: Tender 8 oz. **filet of Black Angus beef** filet with haricot vert and wax beans, baby red twice baked potato and a boursin veal jus.

Seafood: Fresh **halibut encrusted in hazelnuts**, served with arugula and spaghetti squash. Finished with sunchoke beurre blanc.

Vegetarian: Artichoke and porcini **risotto** served with asparagus tips in a black mushroom furmet.

Itinerary

5:45 pm – Buses begin departure from the front of Westin
6:15 pm – Last bus departs for Cantigny
6:00 pm – Begin guided tours begin at the Mansion
– Open tours of the First Division Museum
– Cash bar cocktails available in La Jardin
(sorry, drinks are not permitted on the tours)
7:30 pm – Dinner served in La Jardin
9:00 pm – Begin boarding buses back to Westin

S&C ELECTRIC COMPANY

Excellence Through Innovation

S&C Electric Company cordially invites you and your spouse/companion to attend a tour of our world headquarters located in Chicago, Illinois.

Sunday, October 25th*
or
Thursday, October 29th

as part of the

Fall 2009 IEEE/PES
Transformers Committee Meeting

Transportation will be provided.

- Sunday, October 25th: Buses will depart the Westin Lombard Yorktown Center at 8:00am and will return by 12:30pm. A box lunch will be provided during the return trip to the Westin.
- Thursday, October 29th: Buses will depart the Westin at 12:00pm and will return by 4:30pm. A box lunch will be provided during the ride to S&C.

The technical tour will include an overview of our new Advanced Technology Center. This unique facility will enable S&C to accelerate the development and delivery of innovative electrical switching and protection products including the highly sophisticated products needed for the Smart Grid. At the heart of the new building is the high power test laboratory which will be capable of testing up to 100kA at distribution voltages. There will also be a lab demonstration of the IntelliRupter PulseCloser, a revolutionary new device which reduces the thru-fault current duration and magnitude on transformers during traditional reclosing operations. Finally, we will spend time in S&C's two Product Demonstration Centers viewing S&C's full array of switching and protection products.

Indicate your desire to participate in this tour when you register on-line for the Committee Meeting. Due to the limitations of this tour (only one busload per tour), only Committee Members and Active Participants and their spouses/companions are permitted.

* Subject to minimum group size

MACLEAN POWER SYSTEMS

MacLean Power Systems cordially invites you to tour our Franklin Park, Illinois manufacturing facility.

Monday evening, October 26, 2009

As part of the Fall 2009
IEEE/PES Transformers Committee Meeting

MacLean Power Systems is a leading manufacturer of products used by utilities for building transmission and distribution lines and substations. MPS product families include hardware and connection products as well as insulation and protection products. With global raw material sourcing capabilities, MPS produces over 10,000 items in six domestic production facilities. The MPS business model supports local manufacturing for high service levels, diversity development programs and also sustainability and green initiatives.

The Franklin Park factory tour will include the manufacturing processes for Arresters, Automatic Splices and Pole Line Hardware products. A brief presentation on transformer surge protection and arrester designs will conclude the tour.

Tour Schedule

6:30 pm: Bus departs the Westin Hotel
7:00 pm: Dinner provided at the plant and presentation
7:30 pm: Plant tour
9:00 pm: Technical presentation on Surge Protection
9:30 pm: Depart for the Westin Hotel
10:00 pm: Arrive back at Westin

Transportation will be provided. Spouses/companions are welcome. Indicate your desire to participate in this tour when you register on-line for the Committee Meeting. Due to the limitations of this tour (only one busload per tour), only Committee Members and Active Participants and their spouses/companions are permitted.

No cameras are allowed on the tour. Please wear your IEEE namebadge during the tour.

To reserve your place in the tour please indicate your desire to attend the tour when you register on-line for the IEEE Committee Meeting.

For more information or questions regarding the tour, contact Paul Lindemulder at plindemulder@MacLeanPower.com or call 847-451-2813.

Pre-registration is required – seating is limited

IEEE/PES Transformers Committee
Fall 2009 Meeting
Lombard, Illinois USA

"Electrical Steel and Core Performance"

-- Technical Presentation --
Monday, October 26, 2009

By Ramsis Girgis, Michael Hastenrath, Jerry Schoen

1. Abstract

A number of performance parameters of power and distribution transformers are determined by the magnetic, surface, and mechanical parameters of the electrical steel used in the core of these transformers. This tutorial has three parts. First, the process of manufacturing the different grades of grain – oriented electrical steel will be explained. This will be followed by a presentation of the parameters of electrical steel that determines the core loss, exciting current, noise level, and other performance parameters of power and distribution transformers. This part of the tutorial will also include quality requirements of electrical steel that are critical to transformers. Finally, the history of development of electrical steel will be presented along with an overview of possible future directions of new developments for improved performance electrical steels in transformers.

2. Learning Objectives

This tutorial is planned to:

- Provide background to what performance parameters of electrical steel influence performance of power and distribution transformers
- Explain the process of manufacturing the different grades of grain-oriented electrical steel
- Explain the measurements made on electrical steel before it is shipped to transformer plants
- Explain the relationship between performance parameters of electrical Steel and performance of transformers
- Explain quality requirements of electrical steel that are critical to transformers
- Present the history of development of electrical steel
- Give an overview of possible future directions of new developments for improved performance electrical steels in transformers

3. Learning Outcomes

As a result of attending this tutorial session, members will gain an understanding of the following:

- What performance parameters of electrical steel influence performance of power and distribution transformers
- The process of manufacturing the different grades of grain-oriented electrical steel
- Measurements made on electrical steel before it is shipped to transformer plants
- Relationship between performance parameters of electrical Steel and performance of transformers

- Quality requirements of electrical steel that are critical to transformers
- History of development of electrical steel
- Possible future directions of new developments for improved performance electrical steels in transformers

4. Presenters' Biographies

Dr. Ramsis Girgis: Ramsis is the R&D Manager at the ABB Power Transformer Division, St. Louis, Missouri. He is also the leader of the ABB's global R&D activities in the area of "Transformer Core Performance" and the co-leader of the global R&D activities in the area of "Transformer Noise & Vibrations". Most recently, he has been the project leader for developing the ABB technology for designing, manufacturing, and noise testing of ultra-low noise power transformers. Ramsis received his Ph.D. degree from the University of Saskatchewan, Canada, in Electrical Power Engineering in 1978. He has over 40 years of R&D experience in the area of power, distribution, pulse power, high-frequency transformers, and rotating machines. He has published and presented over 70 scientific papers in IEEE, IEE, CIGRE, and other international journals. He was awarded the IEEE Fellow Grade in 1986. Until recently, he was the Chairman of the Transformers Committee's Subcommittee on "Performance Characteristics". Dr. Girgis co-authored chapters in two electrical engineering handbooks on transformer design and transformer noise. He is the past Technical Advisor representing the US National Committee in the IEC Power Transformer Technical Committee (14).

Dr. Michael Hastenrath: Michael is Head of Customer Service of ThyssenKrupp Electrical Steel in Gelsenkirchen, Germany. He is responsible for the technical support of customers in using grain-oriented electrical steel in transformers and other electromagnetic devices. Michael joined the company in 1982 starting in the R&D department, where he worked in different projects on development of electrical steel in thinner gauges, domain-refinement by laser scribing and improvement of insulation properties. In 1991, he became Head of the quality department of Gelsenkirchen plant until 2001, when he changed to Customer Service. Michael had studied physics at the Technical University of Aachen, Germany, where he graduated in 1976 in solid state physics. In 1981, he received his Ph.D. with a thesis on micro characterization of materials for electrical engineering at the University of Duisburg, Germany. Dr. Hastenrath has published several technical papers mainly related to grain-oriented electrical steel.

J. W. Schoen: Jerry is a Principal Engineer in the Specialty Product Research & Applications Engineering Department at AK Steel's Research Center in Middletown, OH. He has over 30 years of experience in product R&D, engineering and applications working exclusively in electrical steels, primarily in grain-oriented types and, secondarily, non-grain oriented types. From 2000 to 2003, he was assigned to the Business Development department at AK Steel's headquarters. Prior to 2000, Jerry was a Principal Research Engineer, during which time he contributed to over 20 U.S. patents in the field of electrical steel, as well as a number of technical papers. Jerry received his BS degree (1977) in Metallurgical Engineering from the University of Pittsburgh, Pittsburgh, PA, the M.Sc. degree (1987) in Materials Science & Engineering from the University of Cincinnati, OH and is a member of ASM & AIST. In 1988, Jerry received the AIST's John Chipman medal for his technical publication on research into the physical mechanism of abnormal grain growth in silicon steels.

IEEE/PES Transformers Committee
Fall 2009 Meeting
Lombard, Illinois USA

"Dielectric Frequency Response Testing"

-- Technical Presentation --
Tuesday, October 27

By Donald Chu, Dong Kim, Poorvi Patel, Mark Perkins, Peter Werelius

1. Abstract

Several different dielectric frequency response (DFR) testing technologies have been developed over the past few decades to the point that they are presently being used by several manufacturers and utilities to aid in the identification of dielectric characteristics and problems in power transformers, bushings, instrument transformers and other electrical equipment. DFR, which is a type of dielectric spectroscopy, is an off-line electrical measurement of the capacitance and loss of the insulation similar to the power factor measurement, only taken at multiple frequencies, typically between 1 mHz and 1 kHz. DFR testing has several benefits over methods prescribed in standards, including accurate estimation of moisture content in cellulose insulation, and detection of contamination, carbon tracking or other defects that cannot be detected by other tests.

Several utilities are currently specifying that these tests be made in the factory in order to provide a baseline for future maintenance tests in the field. Potentially, DFR testing may be specified in standards in the future to augment or even replace currently specified methods.

2. Learning Objectives

The tutorial provides a technical introduction to the emerging technology of DFR testing, and emphasis will be focused on power transformers. This tutorial presentation concentrates on DFR technology currently being used, and technical aspects covered include history, theory and comparison of different technologies used, types of equipment used, benefits over conventional methods presently prescribed in IEEE C57.12.90, and case studies showing the problems and diagnosis resulting from the use of these technologies. Perspectives of these aspects will be presented by representatives of a DFR instrument supplier, a power transformer manufacturer/service provider, and two utilities that have used this technology in their maintenance programs.

3. Learning Outcomes

Attendees will gain the following information from their attendance at this tutorial:

- Background and benefits of the DFR technology
- Theory and principles of operation
- Different DFR methods and instrumentations
- Application in factory and field
- Information and preparation required for making meaningful tests
- Types of problems that can be diagnosed with DFR testing
- Examples of DFR testing with actual case studies

4. Presenters' Biographies

Donald Chu: Donald Chu is Section Manager of the Substation Equipment Engineering Section of Con Edison Company of New York. Donald has over 30 years of engineering and R&D experience in distribution and substation equipment. He is responsible for the development, design, engineering, construction, failure analysis, and maintenance support for all major electrical equipment in transmission and area substations. Donald received his BS degree (1975) and MSEE degree (1976) from Cornell University, New York, NY, both in electrical engineering. He is a registered Professional Engineer in State of New York and an active member of IEEE, EEI, CEATI and EPRI. He is presently the chairman of the Transformers Committee's working group on the development of the new "Guide for Application of Monitoring of Liquid-Immersed Transformers and Components, C57.143". He is a member of several working groups and subcommittees in the Committee.

Dong S. Kim: Dong Kim is an electrical engineer with 36 years experience in substation apparatus. Early in his career, he worked for General Electric Company for 13 years as an engineer and section manager. His main roles were HV testing, power transformer manufacturing, remanufacturing, and also some involvement with large motors. Dong later joined Southern California Edison Company (SCE), where he began his work as an application engineer in repairs, inspections, modifications and remanufacturing for power transformers. Up until now, he has worked as an apparatus engineer in the engineering section of SCE. As an apparatus engineer, he performs factory audits, qualifications, design reviews, inspections, load studies, overload studies, and specification requirements for power transformers. Now he is also the lead engineer for all substation apparatus in SCE. Dong has broad knowledge and experience with power transformer-related topics like manufacturing, inspection, root cause study, repair, modification, loading studies, load planning, and overloading.

Poorvi Patel: Poorvi Patel is a senior applications engineer in ABB's Transformer Remanufacturing and Engineering Solutions (TRES) group. Dr. Patel's has been the technical lead in coordinating development of the Dielectric Frequency Response technology and implementation of the ABB TEC on-line monitoring system for transformers in North America. She has a M.S. Degree from the Lulea University in Sweden, and a Ph.D in Mechanical Engineering from the Lund University in Sweden. She began her career with ABB in 1999 at the Corporate Research Center in Vasteras Sweden. She joined the ABB TRES group in St. Louis, Missouri in 2006. She is a member of the IEEE and several working groups in the IEEE Transformers Committee.

Mark D. Perkins: Mark Perkins is a principal engineer in ABB's Transformer Remanufacturing and Engineering Solutions (TRES) group. Mark participated in developing the ABB MTMP transformer risk & life assessment technology and advanced field & factory testing techniques; including DGA & oil analysis, FRA, and Dielectric Frequency Response. Mark began his professional career with Westinghouse at their Advanced Systems Technology Division in Pittsburgh, where he performed power system studies, transient analysis, and field testing. In 1988, Mark became a senior test engineer and later the test manager at the Westinghouse large power transformer plant in Muncie, Indiana. In 1998, he joined the development engineering team and later the TRES group at the ABB power transformer division in St. Louis, Missouri. He is the author of numerous technical papers and 4 US patents. Mark graduated from BYU in 1975 with a M.Sc. degree in Electrical Engineering.

Peter Werelius: Peter Werelius was born in Stockholm, Sweden and works as application expert and product manager at Megger Sweden. He has a M.Sc. in Electrical Engineering (1991) and a Ph.D. in Electrical Engineering (2001), both at KTH (Royal Institute of Technology) in Stockholm. He started his professional career starting up a spin-off company, WaBtech in 1996, manufacturing FDS/DFR (Frequency Domain Spectroscopy/Dielectric Frequency Response) test equipment for cables and power transformers. From 1999, Peter continued the work on the FDS/DFR application, within Programma Electric and later within GE Energy Services. In 2005, he and others founded Pax Diagnostics which was acquired by Megger in 2008. He has published a number of papers/articles related to FDS/DFR measurement techniques and application. He is member of IEEE and Cigré and actively participates in work groups and task forces, especially those related to FDS/DFR and SFRA.