

# ICCN Newsletter

**Act now! Special offer to first-time utility attendees to the ICC Fall meeting – ten complimentary registrations! Please contact [thomasarnold@pesicc.org](mailto:thomasarnold@pesicc.org).**

## From the ICC Chair



As we prepare for the Fall ICC meeting at Disney World, I'm reminded that, in 1992, my family started an annual tradition of visiting this world-famous resort. At that time, the U.S. utility industry was transforming itself from a highly regulated monopoly to a competitive business environment, where robustness in operation, engineering personnel and design were replaced with a lean period of downsizing and belt-tightening driven by competition. As utilities limited spending and cut operation and engineering personnel, reliability predictably suffered.

In 2003, a massive blackout affecting portions of the United States and Canada epitomized the downside of avoiding maintenance and investment in new infrastructure. The 2005 Energy Policy Act shifted control of the utility regulation from the Securities and Exchange Commission to the Federal Energy Regulatory Commission, and FERC began requiring utilities to meet certain normal and contingency reliability and redundancy

criteria, spurring significant investments in underground power cable systems that have impacted all of the ICC. Environmental concerns about greenhouse gases were growing, so renewables – particularly wind and solar – saw increased demand for new cable systems. This increase was also driven by the tragic events of the Fukushima Daiichi power plant disaster, as utilities reconfigured power systems in an effort to move away from nuclear energy.

One result of all these trends: an exciting time for our industry, with many new underground cable projects throughout the world, including an increasing emphasis on applying HVDC underground power transmission. Today, North America has several new cross-linked polyethylene transmission cable factories owned by various companies. While much of the FERC-motivated utility reinforcement is starting to wane, there are many new challenges facing our industry of insulated conductors and power cables. The Fall 2018 meeting is the perfect opportunity for the industry to address those challenges. I look forward to seeing you all there!



*Earle C. (Rusty) Bascom, III*  
Electrical Consulting Engineers, P.C.

## Fall 2018 Education Session – Medium Voltage Cable Manufacturing

*By Rachel Mosier, Education Session Chair, PDC and Jared Jajack, Education Session Vice Chair, AEP*

Delving deep into the essentials of manufacturing high-quality medium-voltage cables, the Fall 2018 education session is not to be missed! We'll hear from the industry's experts on raw materials, cable core extrusion, cable production, and quality control including production testing. To wrap things up, our panel of experts will answer any questions you've always wanted to ask!

Please join us at the Swan Hotel in Orlando, Florida on Wednesday, October 31 from 1:00 – 5:00 p.m. (No tricks, only treats!)

### **ICC Newsletter Team**

Harry Orton, ICC Communications Chair  
Wim Boone, ICC Communications Vice Chair  
Ram Ramachandran, AC Task Force Chair

## ICC Awards

By Lauri Hiivala, ICC Awards Chair

Certificates of Appreciation (COAs) were awarded for the best presentation at a subcommittee, working group, discussion group or educational program meeting for the Fall 2017 meeting:

- Stephen Hoskins, Subcommittee B Meeting, *Transition Joint Installation for 450 MCM Low-Pressure Gas-Filled Cable to 3500 kcmil XLPE Cable*
- Tommi Virta, Subcommittee B Meeting, *Transition Joint Installation for 450 MCM Low-Pressure Gas-Filled Cable to 3500 kcmil XLPE Cable*
- Charles Darnell, Subcommittee C Meeting, *Cable Protection – Beyond the Time-Current Curve*
- Craig Ajello, Discussion Group C31 Meeting, *Pumping Plant Replacement Project*
- Victor Antonello, Discussion Group C31 Meeting, *Pumping Plant Replacement Project*
- Gabriel Taylor, Subcommittee D Meeting, *Fire-Retardant Cable Coatings – A Fresh Look into Their Thermal and Electrical Response for Performance-Based Applications*

- Jean-Francois Drapeau, Subcommittee F Meeting, *Pushing the Interpretative Value of Diagnostic Tests Based on Dielectric Loss Measurements: Exploration Beyond the Classic Criteria of VLF Tan Delta Diagnostic Features*

COAs were also presented to all outgoing subcommittee, working group and discussion group chairs and vice chairs, or upon publication of their IEEE standard or guide:

- Frank Frentzas, Chair, Insulated Conductors Committee Spring 2016 – Fall 2017
- Frank Petzold, Chair, Subcommittee G *Transnational* Spring 2014 – Fall 2017
- John Merando, Standards Coordinator, Fall 2008 – Fall 2017
- Nimesh Patel, Chair, Working Group C25, *IEEE 442-2017 Guide for Thermal Resistivity Measurements of Soils and Backfill Materials*
- Sudhakar Cherukupalli, Vice Chair, Working Group C25, *IEEE 442-2017 Guide for Thermal Resistivity Measurements of Soils and Backfill Materials*
- Don Koonce, Vice Chair, Working Group C31, *High Pressure Fluid Filled (HPFF) and High Pressure Gas Filled (HPGF) Pipe Type Cable Systems*

- Ajit Gwal, Vice Chair, Working Group D10, *Class 1E Cables for Nuclear Plants (IEEE 383)*
- Ajit Gwal, Chair, Working Group D13, *Ampacity Derating of Fire Protected Cable (P848)*
- Vern Buchholz, Chair, Working Group F07, *Guide for Assessment, Mitigation, and Control of Corrosion of Metallic Shields for Extruded Dielectric Cables Rated 5 kV to 46 kV*
- Grace Jiang, Chair, Discussion Group F10, *Diagnostic Testing for Cable Joints & Terminations*

Joseph Zimnoch Sr. received the Dr. George H. Bahder Memorial Award for contributions to the understanding of manufacturing, installation and operational issues of high-pressure pipe-type, self-contained liquid-filled and extruded dielectric cable technologies.



Dr. George H. Bahder Memorial Award recipient Joseph Zimnoch Sr.

## Knifeless Cable Preparation

By Aaron Norris

BC Hydro began investigating knifeless cable preparation techniques in 2013, with the goal of improving safety and workmanship. When workers use specialized tools instead of knives, they typically achieve a higher quality and more consistent end product that should last longer and fail less unexpectedly, and are much less likely to injure themselves.

Over the past decade, we have endeavored to reduce craft sensitivity of cable work. Through product improvements/simplifications and worker training/certification, we identified tools as one area for improvement. Our goal was to come up with safe and effective alternatives

to the knife for every step of medium-voltage cable preparation.

We followed a two-step process. First, we conducted research on commercially available tools globally to identify promising products. Second, we purchased all of the viable tools and conducted shop trials to understand the advantages and limitations of each device.

Following the completion of this process and the selection of suitable tools, the implementation process in 2015/2016 involved purchasing approximately 100 tool kits to equip our underground crews. Some highlights:



Plier-type LACT shield removal tool

- Detailed instructions on tool setup and use were added to our construction standards.
- A “soft implementation” encouraged the use of alternative tools through “best practice” rather than a rule-governed approach.
- New tools were integrated into worker training curriculum.

*Knifeless*, continued on page 4

# Intelligent Undergrounding at San Diego Gas & Electric

By Jon Erickson

To help serve its 1.4 million electric customers with 10,500 circuit miles of medium-voltage underground distribution cable, San Diego Gas & Electric has rapidly expanded its underground cable system. About 62 percent of the electric distribution system is underground. California initiated an overhead-to-underground conversion program in 1969 and, in 2003, the city of San Diego initiated an expedited program, with a plan to convert all overhead lines within about 50 years. The city requires all new developments to be served underground.

**Proactive Cable Replacement:** The utility installed several thousand miles of unjacketed cable from 1963 to 1985. This cable began to fail at an increasing rate in the late 1980s and early 1990s. In response, a proactive cable replacement capital budget was established in 1994 and continues today. An extensive cable failure database was also established in the early 1990s. Cable failure rates and poor performing vintages have been determined. An estimated 100 – 150 cable failures per year have been prevented through proactive cable replacement.

**Water Filtration Sleeve:** Water in underground structures can extend out-ages due to the time it takes for pumping trucks to arrive and remove water from the structure prior to fault location. An existing procedure required water testing prior to pumping through a sleeve; however, in 2016, the utility collaborated on the development of a new sleeve. The filtration method has been approved by the Environmental Protection Agency and the testing of the water prior to pumping is no longer required.

**Infrared Inspection:** Several years ago, the utility implemented an operating



New water filtration sleeve

practice that uses an infrared camera to check all cable connections in a man-hole/substructure prior to entering for any reason. This inspection is performed after proper venting of the substructure. This operating practice also established a response time to correct an elevated temperature issue. It is based on connector temperature compared to temperature rise above the cable temperature.

## Supervisory Control and Data

**Acquisition (SCADA):** The utility has greatly increased the use of the SCADA system throughout the overhead and underground electric distribution system in the past 30 years, allowing operators to remotely operate 1700 switching devices using a 900 MHz radio system to restore service faster. Seventy-two percent of the distribution circuits at the utility are SCADA-controlled. Ninety-one percent of the customers are electrically supplied from automated circuitry. Ninety-four percent of applicable distribution load curtailment circuits are SCADA controlled. Seventeen hundred devices are SCADA controlled.

Thanks in part to these procedures and programs, San Diego Gas & Electric has been named as the most reliable utility in the western United States for 12 years in a row. The utility will continue to look for ways to improve reliability in the underground electric distribution system as it expands.

## ICC Standards Corner

By Gary Clark, P.E., ICC Standards Coordinator

Since the Spring 2018 ICC meeting, standards activities have been ongoing to create, maintain, and revise PARs and standards. Working Group (WG) chairs have led numerous webcast and teleconference meetings, with members contributing critical comments, contributions, and votes.

Congratulations to WG B03W, led by Chair Todd Richardson and Vice Chair Sherif Kamel, for successfully completing a revision to IEEE 592 – “Standard for Insulation Shields on Medium-Voltage (15 kV - 35 kV) Cable Joints and Separable Connectors.”

There are currently seven PAR submissions under review by NesCom as listed below, which are expected to be approved before the Fall ICC meeting in Orlando. In addition, P1142 “Guide for the Selection, Testing, Application, and Installation of 300 V to 500 kV Cables Having Radial-Moisture Barriers and/or Longitudinal Water Blocking” has already been granted a PAR extension until December 2022 for WG A11W, chaired by Ken Bow.

- WG F04W, chaired by Jody Levine, P400.3 – “Guide for Partial Discharge Field Diagnostic Testing of Shielded Power Cable Systems”
- WG A07W, chaired by Paul Caronia, P532 – “Guide for Selecting and Testing Jackets for Power, Instrumentation, and Control Cables”
- WG D15W, chaired by Herb Stansberry, P1202 – “Standard for Testing Flame-Propagation and Smoke Generation of Cable or Splices/Connectors”
- WG D21W, chaired by James Conrad, P2412 – “Standard Test for Determining Circuit Integrity Performance of Fire Resistant Cable Systems in Passenger Rail and Road Tunnels”
- WG D23W, chaired by Gil Shoshani, P2789 – “Guide for the Selection and Application of Cables Used in Transit Infrastructure”
- WG A05W, chaired by Jim Guo, P1235 – “Guide for Identification Markings on the Jackets of Underground Power Cables and Ducts”
- WG B06W, chaired by John Makal, PC62.22.1 – “Guide for Connection of Surge Arresters to Protect Insulated Shielded Electric Power Cable Systems Up to 46 kV”

Thirteen standards are currently slated to be rendered inactive if not acted on by the end of 2018. Each has a technical and financial impact on our economy, environment, and society. We appreciate all of those that continue to participate in the standards development process and encourage ICC attendees to contribute to these working groups.

# International Events Calendar

Compiled by Harry Orton & Wim Boone

## WindEurope 2018

September 25-28, 2018, Hamburg, Germany  
[windeurope.org/summit2018](http://windeurope.org/summit2018)

## AWEA Offshore WINDPOWER 2018

October 16-17, Washington DC, USA [awea.org](http://awea.org)

## Offshore Energy 2018

October 23-24, 2018, Amsterdam, Netherlands  
[offshore-energy.biz](http://offshore-energy.biz)

## Wire & Cable Technology 2018

December 4-5, 2018, Frankfurt, Germany  
[wire-cable-tech.com](http://wire-cable-tech.com)

## Cabletech 2019

February 21-22, 2019, Bengaluru, India  
[cabletech2019.in](http://cabletech2019.in)

## Offshore Power Cable Engineering and Reliability Forum

February 27-28, 2019, Amsterdam, Netherlands  
[offshorepowercablereliability.com](http://offshorepowercablereliability.com)

## International Conference on Electrical Materials and Power Equipment (ICEMPE)

April 7-10, 2019, Guangzhou, China [icempe.org](http://icempe.org)

## CIRED

June 3-6, 2019, Madrid, Spain [Cired2019.org](http://Cired2019.org)

## Jicable

June 23-27, 2019, Versailles, France [Jicable.org](http://Jicable.org)

## IEEE Electrical Insulating Conference (EIC)

June 16-19, 2019, Calgary, Alberta, Canada  
[ieeedeis.org/eic](http://ieeedeis.org/eic)

## International Symposium on HV-engineering (ISH 2019)

August 26-30, 2019, Budapest, Hungary  
[ish2019.org](http://ish2019.org)

## Upcoming ICC Events

### October 28-31, 2018

#### Fall ICC - Orlando, Florida

Visit [pesicc.org/ICCWP/meetings/fall-2018-icc-pes-meeting/](http://pesicc.org/ICCWP/meetings/fall-2018-icc-pes-meeting/) to view all Fall ICC presentations and activities or to register for the meeting, the Networking Luncheon and Transnational Lunch.

### April 7-10, 2019

#### Spring ICC - Savannah, Georgia

### October 21-23, 2019

#### Fall ICC, Scottsdale, Arizona

## Tell Us What You Think!

ICC welcomes your feedback. If you'd like to suggest topics for upcoming issues of the ICC Newsletter or add a colleague to our email database, please contact Harry Orton at [h.orton.1966@ieee.org](mailto:h.orton.1966@ieee.org).

## *Knifeless, continued from page 2*

- Field training instructors demonstrate tool use to workers in the field.
- Consumable items are stocked in line stores to eliminate supplier lead times.

## Some challenges:

- Budget constraints (however, if the tool avoids even one cable failure or injury, it will likely pay for itself).
- Communication and change management – because today's workers are saturated with notices, bulletins and advisories, it can be difficult to determine priorities and navigate around other initiatives.
- Training – workers need to be given time and resources to learn how to use new tools.
- Cable accessories – adjustments to cable accessory specifications and/or construction standards may be required to accommodate some tool designs.
- Workers will break/damage some new tools as they learn to use them.

## Repairing a 230 kV SCFF Cable Damaged by a Dig-In

By Karl Mai and Sudhakar Cherukupalli



One stage of the jointing operation

On Sept. 5, 2017, a direct-buried 230 kV self-contained fluid-filled cable was dug into by an excavator and sustained an internal single line-to-ground fault. The recorded fault current was 28 kA and the fault cleared in about 4.9 cycles (82 milliseconds). This cable system was installed in 1976 and most of the cable is direct buried in a trench with a 3-inch thick concrete sidewalls and cover, filled with graded crushed stone screenings. After locating the fault and stopping the oil leaks, the plan was to assess the damage to all three phases of the cable, estimate the amount of air intake due to cable damage, and construct a joint bay for repairs. Due to the age of the spares, there also was an urgent need to assess the condition of spare materials and place an order to procure missing materials.

One of the challenges we encountered was to determine if the damaged cable system sucked in moisture and to what extent (length). Fortunately, within BC Hydro we have adopted a test, originally prescribed by the manufacturer, called a Residual Gas Pressure (RGP) test to assess the condition of the oil in the system. The acceptance criterion for this test on an in-service cable was somewhat ambiguous. The damaged cable sections were flushed with degassed oil to lower the RGP values.

The cable sheath and semiconducting layers were carefully removed and exposed to reach the layer of factory insulation. New rolls of paper were applied over the joint, chamfered and covered with carbon black crepe paper tapes and tinned copper braid to achieve the desired insulation shield. The stainless steel casings covering the joint were slipped on with the sheath-sectionalizing insulators and the cable was repaired with two joints on each of the two damaged phases. Some of the lessons learned from this repair:

- For single-end supplied hydraulic sections, have contingency plans for restoring oil pressure if a section of cable becomes isolated from the source.
- All paper roll containers should have a bolted lid with two treating fittings.
- Ensure good communications during development of a repair strategy, with input from team members.
- Periodically verify condition of spares.
- Give prompt environmental attention to limit extent of damage.