

## Elihu “Hugh” Hoagland IV, B.A., CESP



### Education

B.A. Kentucky Wesleyan College, 1983  
Postbaccalaureate and Graduate Work, University of Louisville, Pre-Medical 1985-1987

### Continuing Education

Rutgers University Medical School Respiratory Protection Seminar 1995  
Attended & taught at Clemson University Protective Clothing Continuing Ed. Conference 1998-2001  
Attended or taught at North Carolina State University Protective Clothing Conference 2000-2003  
American Society of Safety Engineers 1997- Present  
National Safety Council 1996 - Present  
Edison Electric Institute – Safety & Industrial Health Committee  
IEEE Electrical Safety Workshop 1999-Present  
Research in electric arc 1994 - Present; over 100,000 electric arc tests

### Professional Service Positions

Associate Editor of the *IEEE Transactions on Industry Applications* for the IEEE Electrical Safety Committee

US National Committee of the International Electrotechnical Commission

- Expert on IEC TC 78 WG 13 and WG 15, International Arc Flash Testing Standards

American Society for Testing Materials Member since 1995

- F-18 Electrical Protective Equipment for Workers
  - Co-Chair, ASTM F-18 Rainwear Taskforce
  - Chair, ASTM F-18 Eye Protection Taskforce
  - Chair, ASTM F-18 Glove Testing Standard
  - Chair, ASTM F-2621 Mannequin Testing
  - Secretary ASTM F1959 Open Arc Rating Standard
  - Secretary F-18 Protective Clothing Testing Taskforce
  - Co-Chair Insulating Rubber Protective Sheeting Taskforce
- F-23 Protective Clothing Committee
- D-13 Textiles Committee Member

National Fire Protection Association Member since 1997

- Flash Fire Clothing for Industrial Workers Standards 2112 & 2113
- NFPA 70E DC Voltage Taskforce

Canadian Standards Association Member 2001-2015

- Z96 High Visibility Clothing for Workers Former Member
- Z462 Electrical Safety in the Workplace (NFPA 70E Mirror Standard) Former Member

American National Standards Institute (ISEA Committee Member for High Visibility Clothing)

- ANSI 107-1999 Member

ISSA (International Social Security Association [Europe])

- Working group on Work Clothing and the Electric Arc Member

IEC (International Electrotechnical Commission) Live Working Group TC78

- PT Member IEC 61482-1-1, -1-2, IEC 901
- PT Leader IEC Arc Flash Glove Test

IEEE (Institute of Electrical and Electronics Engineers) Full Member since 1997; Senior Member 2013

- P1584 Standard Electric Arc Hazard Assessment Committee
- PCIC (Petrochemical Industrial Conference) Presenter
- Rural Electric Power Systems Conference Presenter
- International Control & Power Systems Conference Presenter
- Electrical Safety Workshop Presenter and Former Committee Chair
- Electrical Safety Committee Steering Committee Member IEEE-IAS Liaison

## Professional Experience

**e-Hazard** – Sr. Managing Partner 2004 - Present

Offers training and arc hazard analysis to customers for electric arc under NFPA 70E, NESC, IEEE 1584 and OSHA 1910.269. Over 20,000 workers trained per year.

**ArcWear** – President 1997 - Present

Offers consulting to electric utilities and clothing, textile and PPE manufacturers on clothing and materials used in electric arc. Offers hazard assessment services through engineering group to utilities and large electrical customers. Personally, trained over 40,000 line workers and management working for electric utilities and larger electrical users including: Dow Chemical, Dupont, GM, Toyota, 3M, Akzo Nobel, Rohm & Haas, Cintas, Aramark, Workrite, Bulwark, Square D, Southern Company, Duke Power, LG&E, ConEd, ComEd, BG&E, Constellation Energy, PP&L, PECO, Pepco, Allegheny Power, National Grid and many others. Professional consultant to ERI Safety Videos for their arc flash training videos.

**NASCO Industries, Inc.** – R&D Director 1997-2000

Inventor of Electric Arc Resistant raingear and materials and arc resistant face shield material. Directed testing and material development for use in electric arc, chemical and flash fire. Developed most of the arc flash suits for industry leaders.

**Louisville Gas & Electric Company** – Technical Safety Consultant 1994-1998

Technical Writer and Safety Consultant. Began researching electric arc in 1994 and performed LG&E Testing and consulted with electric utilities.

**Safety-Kleen** – Chemist 1986-1992

Specialization in calorimetry, gas chromatography and qualitative analysis

**Publications**

- "Secondary FR Garments: Practical Solutions for Protection," by Hugh Hoagland and Stacy Klausing, M.S., *Incident Prevention*, September-October 2017.
- "Arc Flash Pressure Measurement by the Physical Method, Effect of Metal Vapor on Arc Blast," Hugh Hoagland, Claude Maurice, Andrew Haines and Andre Maurice, *IEEE Transactions on Industry Applications*, vol. 53, no. 2, pp. 1576-1582, March-April 2017.
- "Maximizing Your Arc-Rated Gear," by Hugh Hoagland and Stacy Klausing, M.S., *Incident Prevention*, January-February 2017.
- "A method to measure the application of the incident investigation process for electrical incidents," by Zarheer Jooma, Jessica Hutchings, Hugh Hoagland & Ian Jandrell, *Electrical Safety Workshop, 2017 IEEE IAS*, 28 Jan.-3 Feb. 2017.
- "The Analysis of an Incident Investigation System," by Zarheer Jooma, Jessica Hutchings, Hugh Hoagland & Ian Jandrell, *IEEE Transactions on Industry Applications*, Vol. 52, No. 6, pp. 5235-5240, Nov/Dec. 2016.
- "Case History: Arc flash Incident on a Locked Out (LO/TO) 3.3-kV-Fused Contactor," by Zarheer Jooma, Jessica Hutchings, Hugh Hoagland & Ian Jandrell, *IEEE Transactions on Industry Applications*, Vol. 53, No. 2, pp. 1583-1588, 2017.
- "Measurements, Observations, and Implications of Moving Electrical-Arc Behavior and Effect of Reclosure Events on Overhead Lines and Worker Protection," Hugh Hoagland, Mikhail Golovkov, Claude Maurice, Ken Sellars and Stacy Klausing, *IEEE Transactions on Industry Applications*, vol. 52, no. 4, pp. 3501-3507, July-Aug. 2016.
- "Recent PPE Changes and 2015 Trends," Hugh Hoagland and Stacy Klausing, M.S., *2015 Incident Prevention*, January-February 2015.
- "The Development of Questions to Determine the Effectiveness of the Incident Investigation Process for Electrical Incidents," by Zarheer Jooma, Jessica Hutchings & Hugh Hoagland, *IEEE Transactions on Industry Applications*, Vol. 51, Issue 5, Sept./Oct. 2015, pp. 4245-4254.
- "Measurements, observations and implications of moving electrical arc behavior and effect of reclosure events on overhead lines and worker protection," by Hugh Hoagland, Mikhail Golovkov, Claude Maurice, Ken Sellars & Stacy Klausing, *Electrical Safety Workshop, 2015. IEEE IAS*, 26-30 Jan. 2015, pp. 1-7.
- "The development of questions to determine the effectiveness of the incident investigation process for electrical incidents," by Zarheer Jooma, Jessica Hutchings & Hugh Hoagland, *Electrical Safety Workshop, 2015. IEEE IAS*, 26-30 Jan. 2015, pp. 1-14.
- "Clothing in Arc Flash: Four Types of Arc Exposure and the Effect of Moisture on Garment Appearance After an Arc Event," *IEEE Transactions on Industry Applications*, Vol. 50, No. 4, July/August 2014.
- "Bridging the Protection Abyss: Arc Rated Gloves and the New ASTM Test Method," *HSME Magazine*, March/April 2014.
- "Using ASTM F2677 Standard Specification for Electrically Insulating Aprons, by Hugh Hoagland & Tom Rege, *Electrical Safety Workshop, 2014. IEEE IAS*, 4-7 Feb. 2014, pp. 1-2.
- "Gloves, Arc Flash, and the New ASTM Test Method," *IAEI News*, September-October 2013.
- "Gloves, Arc Flash, and the New ASTM Test Method," *Occupational Health & Safety*, August 2013.
- "Arc-Flash PPE Research Update," by Hugh Hoagland, *IEEE Transactions on Industry Applications*, Vol. 49, Issue 3, May/June 2013, pp. 1177-1187.

- "Don't get burned: Implement NFPA 70E & NESC arc flash training changes," *Industrial Safety & Hygiene News*, February 2013.
- "Flame resistant textiles for electric arc flash hazards," in *Handbook of fire resistant textiles*, ed. F. Selcen Kilinc (Woodhead Publishing Limited, 2013), 549-580.
- "Study of effects of mining industry contaminations on protective properties of arc rated clothing using ASTM F1959," by Hugh Hoagland, Mikhail Golovkov, Robert Pailing, Lionel Smith, Cecil Burton & Claude Maurice, *Pulp and Paper Industry Technical Conference (PPIC), Conference Record of 2012 Annual IEEE*, 17-21 June 2012, pp. 1-4.
- "Shell of Protection: Arc-Flash PPE Research Update," by Hugh Hoagland, *Industry Applications Magazine, IEEE*, Vol. 18, Issue 3, May/June 2012, pp. 61-65.
- "Myths and facts in selection of Personnel Protective Equipment for arc flash hazard mitigation utilizing NFPA 70E and applicable ASTM standards," by Hugh Hoagland, *Industrial & Commercial Power Systems Technical Conference (I&CPS), 2012 IEEE/IAS 48<sup>th</sup>*, 20-24 May 2012, pp. 1-4.
- "What About My Hands?" *Industrial Safety & Hygiene News*, April 2012.
- "Study of effects of mining industry contaminations on protective properties of arc rated clothing using ASTM F1959," by Hugh Hoagland, Mikhail Golovkov, Robert Pailing, Lionel Smith, Cecil Burton & Claude Maurice, *Electrical Safety Workshop, 2012. IEEE IAS*, 31 Jan.-3 Feb. 2012, pp. 1-4.
- "Arc flash PPE research update," by Hugh Hoagland, *Electrical Safety Workshop, 2012. IEEE IAS*, 31 Jan.-3 Feb. 2012, pp. 1-13.
- "Gloves in Arc Flash: A Big Change in NFPA 70E," *Occupational Health & Safety*, January 2012.
- "Guideline for the Selection of PPE When Exposed to Thermal Effects of an Electric Fault Arc," ed: International Social Security Association / Section for Electricity, Gas and Water, 2<sup>nd</sup> Edition 2011.
- "Arc Flash: Feel the Heat," *Industrial Safety & Hygiene News*, November 2011.
- "Five PPE Safety Challenges," *Incident Prevention*, September-October 2011.
- "Making Sense of PPE," *Occupational Health & Safety*, October 2011.
- "Training Strategies: Preventing Electrical Fatalities," *Industrial Safety & Hygiene News*, May 2011.
- "Making Sense of Dielectric and Electrical Hazard Shoes," *Occupational Health & Safety*, April 2011.
- "Testing standards for arc rated garments - Part 2," by Hugh Hoagland & Zarheer Jooma, *Energize*, March 2011.
- "Arc flash PPE research update," by Hugh Hoagland, *Electrical Safety Workshop, 2011. IEEE IAS*, 25-28 Jan. 2011, pp. 1-12.
- "Seven Electrical Safety Habits for a Safer Workplace," by Al Havens & Hugh Hoagland, *Render*, October 2010.
- "Arc Flash Label Best Practices," *Occupational Health & Safety*, September 2010.
- "Arc Flash Training: NFPA 70E-2009 PPE Hazard Risk Categories Now Based on Arc rating cal/cm<sup>2</sup>," by Vickie Frost, Bill Shinn & Hugh Hoagland, *American Chronicle*, May 31, 2010.
- "Arc Flash Training: NO Energized Electrical Permit Required in NFPA 70E for Common Safety Tasks," by Vickie Frost, Bill Shinn & Hugh Hoagland, *American Chronicle*, May 31, 2010.
- "Choosing the Proper PPE for Electric Arc Exposure," *Electrical Construction & Maintenance*, March 2010.

- "Arc Flash Training: Flame Resistant, FR Clothing Vs. Arc Rated Clothing To Protect From Arc Flash," *American Chronicle*, February 2010.
- "Update of field analysis of arc flash incidents, PPE protective performance and related worker injuries," by Daniel Doan, Hugh Hoagland & Thomas Neal, *Electrical Safety Workshop, 2010. IEEE IAS*, 1-5 Feb. 2010, pp. 80-87.
- "NFPA 70E and Arc flash PPE update," by Hugh Hoagland, *Electrical Safety Workshop, 2010. IEEE IAS*, 1-5 Feb. 2010, pp. 120-124.
- "Common PPE Mistakes in Electric Arc Flash Training Programs," *Ezine Articles.com*, January 2010.
- "Arc Flash Training and Arc Flash Clothing Selection: What Arc Flash Calculation Studies Don't Say," *American Chronicle*, December 2009.
- "Arc Rated, Flame Resistant Clothing Care: Arc Flash Training For REAL Electrical Safety," *American Chronicle*, December 2009.
- "Arc Ratings ATPV vs. EBT: Best for Electric Arc Flash Protection: Training for Electrical Safety," *American Chronicle*, December 2009.
- "Shock and Awe," *Industrial Safety & Hygiene News*, November 2009.
- "Arc Flash Safety Hazard Warning Labels. NFPA 70E Compliance & Electrical Safe Work Practices Tips," *American Chronicle*, October 2009.
- "Global Arc Flash Safety Standards: Electrical Safety Industrial & Utilities Regulatory Compliance," *American Chronicle*, October 2009.
- "Arc Flash Training & PPE Protection," *Occupational Health & Safety*, August 2009.
- "Arc flash Protection" by Zarheer Jooma & Hugh Hoagland, *Energize*, July 2009.
- "PPE in the electric arc: A case for collaboration," *Electrical Safety Workshop, 2009. IEEE IAS*, 2-6 Feb. 2009, pp. 1-4.
- "High Visibility and Arc Ratings for Flame Resistance," *Incident Prevention*, January-February 2009.
- "How to Properly Care for Flame-Resistant Garments," *Welding Journal*, November 2008, Vol. 87, No. 11, pp. 38-40.
- "Arc Protection Around the World," *Occupational Health & Safety*, August 2008.
- "NESC 2007 Flame Resistant Clothing," *Incident Prevention*, January-February 2008.
- "Disposable FR Garments: What Are the Differences?" *Electrical Construction & Maintenance*, January 2008.
- "Arc Flash Safety: Know Which Standard You Should Be Using," *Industrial Safety & Hygiene News*, July 2007.
- "Disposable FR Garments: What Are the Differences?" *Occupational Health & Safety*, May 2007.
- "Arc Flash Hazard Assessment Requirements," by Gary Zahalka & Hugh Hoagland, *Rural Electric Power Conference, 2007 IEEE*, 6-8 May 2007, pp. C5 - C5-6.
- "Top Five PPE Mistakes: Identifying PPE Mistakes in Electric Arc Flash Programs," *Incident Prevention*, September-October 2006.
- "Arc Flash Protection: The NFPA 70E-2004 Standard Clearly States Ways to Protect Workers from Arc Flash Dangers," *Contractor Tools and Supplies*, September 2005.

- "High Energy Safety," *Industrial Safety & Hygiene News*, October 2004.
- "A Far Better 70E," by Hugh Hoagland, Bill Shinn & Victoria Reed, *Occupational Health & Safety*, August 2004.
- "Protecting Workers, Saving Lives: OSHA Apparel Standard 1994 to Today," by Hugh Hoagland & Victoria Reed, *Electric Energy*, May-June 2004.
- "Facing Up to the Arc Challenge," by Hugh Hoagland, Bruce Sannar, Kent Givens, John Winn & Luciana Galo, *Occupational Health & Safety*, June 2003.
- Appeared in and helped edit a 15 minute PBS special on arc resistant clothing aired on satellite for Bulwark Protective Clothing, Feb. 2003.
- "Looks to Live For," *Electrical Contracting & Engineering News*, January 2003.
- "Falling to Pieces," *Utility Safety Magazine*, June 2002.
- "Minimizing Burn Injury: Electric-Arc Hazard Assessment and Personnel Protection," by Richard L. Doughty, Thomas E. Neal, Genevieve M. Laverty & Hugh Hoagland, *Industry Applications Magazine, IEEE*, Vol. 8, Issue 3, May/June 2002, pp. 18-25.
- "Myths and Facts on Complying with NFPA 70E's Clothing Requirements," *Electrical Contracting & Engineering News*, February 2002.
- "Electric Arc Hazards and Clothing," by Hugh Hoagland, Thomas E. Neal & Stephen Cress, *Electric Energy*, Fall 2001.
- "Stepping into Safety in Dielectric Shoes," *Utility Safety*, March 2001.
- "STOMPING OUT Step Potential," *Utility Safety*, February 2001.
- "Electric Arc Hazard Assessment and Personnel Protection," by Richard L. Doughty, Thomas E. Neal, Genevieve M. Laverty & Hugh Hoagland, *Conference Record of the 2000 IEEE Industry Applications Conference*, Vol. 4, October 2000, p. 2782.
- "A History of Protective Clothing," Hugh Hoagland & Claude Maurice, *Utility Safety*, October 2000.
- "The Right Stuff," *Occupational Health & Safety*, October 2000.
- "Using Rainwear as Switching Jackets: A Reasonable Solution for Electric Arc Exposure," Hugh Hoagland & Bill Morrow, *IEEE Transactions on Industry Applications*, Vol. 36, Issue 5, Sep/Oct. 2000, pp. 1241-1246.
- "Well Suited for WET WEATHER," *Utility Safety*, April 2000.
- "Minimize Arc-Burning Incidents," *Electrical Contracting & Engineering News*, July 1998.
- "Face shields: When you're face to face with arcing hazards," *Electrical World*, June 1998.
- "Using Rainwear as Switching Jackets: A Reasonable Solution for Electric Arc Exposure," *Rural Electric Power Conference*, 1997. Papers Presented at the 41<sup>st</sup> Annual Conference, Apr. 20-22, 1997, pp. A-1 - 1-8.
- "Winterwear Must be Warm—It Must Also be Arc Protective?" *Electrical World*, August 1997.
- "Take the Guesswork Out of Arc-Protective Apparel," *Electrical World*, December 1996.