The
Product Safety Engineering Newsletter

Vol. 9, No. 4 - December 2013

What's Inside

President's Message

Hello Fellow PSES Members!

I thought I would use this opportunity to talk a little about the 2014 Symposium, for which I am General Chair.

The 2014 Symposium will bring us back to the Santa Clara Valley, where the PSES and our annual Symposium began. An exciting event is in the works, building on the successful 2013 Symposium while adding some new twists!

For 2014, the first new twist is the time of year. We had received a lot of comments about travel difficulties for our fall symposium schedule, since company travel budgets tend to be frozen by that time of year. So we listened to our members and moved it to May. I suspect this will create other conflicts, not the least of which is that the 2014 date will be relatively soon after the 2013 Symposium. We will give the spring schedule a try for a few years and see if it helps. Let us know about the timing and please share any other input you may have either directly or through the Symposium surveys.

A second difference is the new planning session. We held one at the 2013 Symposium to get your thoughts about what you would like to see at the Symposium, and we will likely make that a standard Symposium activity. This gives us not only your feedback about the current Symposium, but also your forward thoughts for ways to do things better the next time.

While attending the Symposium is valuable, presenting a paper is even more rewarding. Peer review and lively discussion during the presentation provide a great opportunity for professional growth/learning, and of course a nice addition to your resume.

As always, the Symposium will continue to be an outstanding place to gather and network with others with similar interests and to share your knowledge

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The
Product Safety Engineering Newsletter

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IEEE PSES Web Sites

http://www.ieee-pses.org/
http://psessymposium.org/
http://product-compliance.oc.ieee.org/
http://www.ieee-pses.org/emc-pstc.html
http://www.ieee-pses.org/newsletters.html
http://www.ieee-pses.org/pses.html

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and learn. And of course you can visit all the exhibitors in one easy location. We are considering adding an employment needed/opportunities board, virtual exhibitors, and booths from other related Societies.

I look forward to your volunteering to help or simply attending. Each and every person's presence at the symposium will help to make it a fine success; the more who help and participate, the greater the rewards for all. Get involved and realize the benefits of membership in the IEEE and the PSES! To learn more, go to the Symposium website (www.psessymposium.org).

Sincerely,

Kevin Ravo
Kevin.L.Ravo@ul.com

Special Free Offer

Starting in January, PSES members will get the award winning CE Magazine for 2014 free of charge. CE Magazine is published by the IEEE Consumer Electronics Society and its mission is to educate, inform, and entertain members on technology, events, industry news, and general topics.

The Product Safety Engineering Society and Consumer Electronics Society are considering an arrangement that would put feature technical articles relating to Product Safety and Compliance Engineering in CE Magazine. We would appreciate your feedback once you begin receiving the magazine. You can contact Dan Roman (dan.roman@ieee.org) or Kevin Ravo (Kevin.L.Ravo@ul.com).

Past-President's Message

Call for PSES Board of Directors Nominations

Candidate nominations are now being accepted for the 2014 IEEE Annual Elections ballot for Director-at-Large positions on the IEEE Product Safety Engineering Society (PSES) Board of Directors for a three year term, beginning January 1, 2015. In accordance with the bylaws, nominations may be made by the Nominations and Appointments (N&A) Committee or by petition by individual voting members.

Candidates who plan to run should contact the N&A Committee Chair (e-mail: eb.joffe@ieee.org) as soon as possible and provide their full name, IEEE # and Grade.

Candidates should possess professional stature and significant technical skills in product safety and compliance engineering. They must have adequate financial support outside the Society and have the approval of their organizations or employers to actively participate in the Board meetings and contribute to its activities. Duties include attendance at three (3) of four (4) Board face to face meetings per year as well as our monthly BoD telecons. In addition, members are expect to actively participate in BoD committees.

To be eligible for consideration, candidates must be full, **higher grade members** (i.e., excluding those of students and affiliates) of the IEEE and members of the PSES **in good standing** (i.e., dues paid).

Elected Directors must serve a three-year term commencing January 1, 2015. Attendance at the last meeting of the 2014 year is also desirable. No member can serve more than two (2) consecutive three-year terms, including partial terms.

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Nominations shall be submitted to the N&A Committee. All candidates willing to run and serve are required to submit to the N&A Committee a **BoD Candidate Nomination Form,** including the following elections material for inclusion in the ballot:

(1) Personal biography – Technical and Professional Experience, not to exceed 125 words in length, intended to round out the profile of the Nominee's experience outside the IEEE and PSES activities.

(2) Factual summary of IEEE/PSES Activities, not to exceed 150 words in length, intended to summarize your current and past service to the IEEE and the PSES.

(3) A candidate photograph taken no earlier than 1 August 2012. A digital photograph can be submitted electronically in either TIF or high-quality JPEG format. The photo should be the original digital file, 300 dots per inch (dpi) resolution.

(4) Statement of candidacy, not to exceed 150 words in length

A Microsoft Word template for the petition and BoD Candidate Nomination Form is available on line, on the PSES web site <http://ewh.ieee.org/soc/pses/>.

Please submit the elections material, including the nomination form with digital photograph to the Nominations and Appointments Committee Chair:

Elya B. Joffe, e-mail: eb.joffe@ieee.org

Qualifying nominations and all supporting documentation shall be provided to the N&A Committee **with a date-tag of no later than May 30, 2014**.

For answers to any question please contact Elya B. Joffe or any member of the Board of Directors.

Elya Joffe
Immediate Past-President IEEE PSES

Award Nominations Open

At the ISPCE2013 in Austin, Texas, new IEEE Product Safety Engineering Society Awards were presented:

Certificates of Achievement were awarded to past presidents, Mark Montrose, Henry Benitez and Jim Bacher.

Certificates of Achievement were also awarded to:

Gary Weidner – For his work as Editor in Chief of the PSES Newsletter since 2005.

Jim Bacher – For his work in layout and editing of the PSES Newsletter since 2005.

Chapter of the Year (2012) was awarded to the Santa Clara Valley Chapter.

Nominations are now open for IEEE Product Safety Society Awards to be presented at the ISPCE2014 in San Jose, California in May, 2014 (http://www.psessymposium.org).

Our Society Awards are:

Appreciation Award

This award is given to members of the IEEE Product Safety Engineering Society in appreciation for performing a service to the Society.

Recognition Award

This award is given to nonmembers of the Society in Recognition of contributions to the Society.

Chapter of the Year Award (for Activities in 2013)

This award is given to the most outstanding Society chapter in recognition of their contributions to and promotion of the Society through

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its meetings, programs, and member services. This Award includes $250 for a chapter celebration.

Appreciation and Recognition Award candidates should be submitted to our chapter committee (Murlin Marks – murlinm@ieee.org; Juha Junkkarinen – juha.j@comcast.net; Grant Schmidbauer – Grant.Schmidbauer@nemko.com) Note that due to the change in conference dates, the submittal time is short: please provide submittals no later than January 15, 2014.

Mike Nicholls (mnicholls@a-m-c.com), our Chapter Coordinator, will be contacting all chapters to submit for 2013 Chapter of the Year. Note that this submittal is for the current year to be awarded at ISPCE2014. 2014 chapter activities will be submitted later in 2014 to be awarded at ISPCE2014. We encourage all chapters to consider their 2013 activities and make a submittal for 2013, and to start thinking about possible 2014 activities.

The IEEE PSES Awards are part of the hierarchy of IEEE Awards to build honor and distinction for our Society and its members. It is important to recognize individuals and chapters that have made important contributions, and to encourage future activities to help build a great IEEE Society.

Murlin Marks
Past-President IEEE PSES
murlinm@ieee.org

Chapter Safety Probes

To see current chapter information and people looking to start chapters please go to the Chapter page at: http://www.ieee-pses.org/Chapters/index.html

IEEE PSES Santa Clara Valley Chapter Activities Q3 – Q4!

The following provides some highlights from the SCV Chapter for the last part of 2013.

September – For September we held our annual business and planning meeting. Incuded were invitations for nominations for Chapter Officers, in addition to the nominations we already had received.

We also discussed potential technical meeting topics, perhaps moving the meeting to the third Tuesday of the month so we don't conflict with the IEEE CE Society (a number of our members would like to attend both meetings) and how we would help with 2014 Symposium.

October – we had a great topic and speaker October:

Topic - Supply Chain Resiliency - Years of globalization, lean adoption, and extensive outsourcing have resulted in supply chains that are complex, global, fragile and highly dependent on sub-tier suppliers. The session will discuss supply chain resiliency concepts and approaches including: risk quantification and measurement; global multi-tier supply chain mapping for parts-level insights; identification of single points of failure and global hotspots; supply chain event monitoring, and risk mitigation tactics. Industry examples will be provided during the session.

Speaker - Bindiya Vakil, CEO, Resilinc

Bindiya Vakil is CEO and founder of Resilinc and is a recognized thought leader in the area of supply chain risk management. She has been a practitioner in high-tech supply chain management with companies including Flextronics, Cisco and Broadcom. Ms. Vakil has a master's degree in supply chain management from MIT and her research focus has been on risk quantification and product resiliency. Ms. Vakil's concept of "Design for Resiliency" is being widely adopted as a best practice in the industry. Ms. Vakil was named a Top Female Supply Chain Executive in 2013 by Supply & Demand Chain Executive.

We also got to see a lot of you at the 2013 Symposium in Austin – it was a great success!

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Most Exciting – we announced that the SCV Chapter won the Chapter of the year award for 2012! Not only did we get this nice Certificate, but we also received $250 to use for the Chapter!!!
We challenge all the other Chapters to submit for the 2013 Award and try to take it away from us!

November/ December -
First – we had our elections for new officers following the October meeting and the following were elected – let's see if you can match the names (numbers) to the pictures (letters) – the first to get it right gets a 10$ Starbuck gift card!

Azim Karimi, Chair

Aziz Orumbaev, Vice Chair

Michael Cassidy, Secretary

O'Lanre Owoborode, Treasurer

Next – our November and December Meetings will be combined and we will have a presentation by one of the local candidates for office – Ro Khanna, Candidate for Congress 17th District. This will include a presentation by the candidate as well as a Q/A and we will be providing Pizza as well (some of our Chapter of the Year award $$$).

Some Final Thoughts – As usual, all our presentations are on the website and available to PSES members! If you would like to get on our chapter mailing list, please contact Kevin Ravo at kevin.l.ravo@ul.com.

With Best Regards,
Kevin Ravo
SCV Chapter Vice Chair

Central Texas Chapter

The Central Texas Chapter held a meeting in December. The topic was a review of the Symposium recently held in Austin.

Vancouver Chapter

Peter Lim provided some pictures taken during PSES workshop held at UBC on June 21st.

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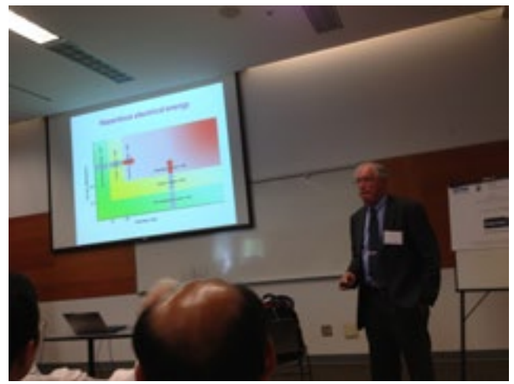

TAC News

ITE Safety

The IEEE Product Safety Society Technical Activities Committee for Information Technology Products met on October 8, 2013, following the Tuesday session of the IEEE Symposium on Product Compliance Engineering. The meeting was held in joint session with the Product Safety Technical Committee 2 of the Information Technology Industry Council. Twenty persons attended. Topics discussed included various technical issues related to the new standard for Information Technology Equipment and Audio/ Video Equipment, IEC 62368-1, the 2nd Edition of which is expected to be published early next year. Also discussed were opportunities for cooperation between the two groups. The Vice-President of PSES Technical Activities, Mr. Ivan VanDeWege, gave a brief overview of all the technical committees.

The ITE TAC meets every third Monday of each month at 3PM Central time via teleconference to discuss technical issues of interest to the IT industry. Standing agenda topics include the status of IT standards IEC 60950-1 and IEC 62368-1 and certification challenges to the IT industry in countries like India, Brazil and Russia. Recent technical topics have included super capacitors, optocouplers, wire ampacity requirements, and IT battery standards. Persons interested in joining the ITE TAC should contact the committee Chair at Gary_Schrempp@dell.com.

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Telecom Safety

The TAC is currently discussing the following topics:

- New ATIS Standard for Ethernet protection which is in progress. It is an Ethernet only standard, purely Ethernet and POE, with references to GR-1089-CORE and ITU K.44.
- AC Power Cross Considerations for Non-Telecom Signaling Lines (e.g. Ethernet, Alarms) run in Outside Plant.
- ATIS is working on a new standard for 400 V dc powering.

Don Gies
Vice Chairman

See http://ewh.ieee.org/soc/pses/technical.html for more information on all the PSES Technical Committees.

PSES Jobs Web Page

PSES has a web page for employers and job seekers at http://www.ieee-pses.org/jobs.html. Employers may post jobs seeking regulatory or compliance-related personnel free of charge. Job postings will remain on this web site for a period of 6 months but may be removed earlier by request of the employer.

Job postings **must** include the name and location of the employer and a method for an applicant to respond to the listing. We will **not** accept or post job listings from professional recruitment firms or job placement services working on behalf of a client that is not identified, and we will not include job listings for positions that require the candidate to pay a placement fee.

See http://www.ieee-pses.org/jobs.html for full posting policy and how to submit requests.

E-Mail List: http://www.ieee-pses.org/emc-pstc.html
Virtual Community: http://product-compliance.oc.ieee.org/
Symposium: http://psessymposium.org/

Membership: The society ID for renewal or application is "043-0431".

Advantages of Membership in the IEEE PSES

Makes you part of a community where you will:

- Network with technical experts at local events and industry conferences.
- Receive discounts on Society conferences and symposiums registration fees.
- Participate in education and career development.
- Address product safety engineering as an applied science.
- Have access to a virtual community forum for safety engineers and technical professionals.
- Promotion and coordination of Product Safety Engineering activities with multiple IEEE Societies.
- Provide outreach to interested engineers, students and professionals.
- Have access to Society Publications.

News and Notes

Globespace 2014 dates have been changed

Elya B. Joffe, Symposium General Chair, has announced that the dates of the 2014 Global Symposium on EMC, Safety and Product Compliance Engineering (GLOBESPACE2014) have been changed from 3–6 March, 2014 to 1-4 December 2014.

Says Mr. Joffe, "The original symposium schedule did not allow sufficient time for paper submissions, and due to many requests to extend the paper submission period, the Technical Program committee has agreed to move to the later date in 2014.

"By holding GLOBESPACE2014 in December we can provide authors with the time they require and also ensure that this does not affect their potential submissions for other related events taking place over the course of the year."

The IEEE Product Safety Engineering Society is a technical co-sponsor of the GLOBESPACE2014 Symposium. More information will soon be available at www.globespace.org.

Risk Assessment/Hazard Analysis Workshop offered

The Saint Louis University John Cook School of Business Center for Supply Chain Management, In cooperation with ADK Information Services, LLC will offer a two-day workshop on risk assessment/hazard analysis February 4–5, 2014. Since recent trends at the CPSC include requiring a formal compliance plan as part of some civil penalty settlement agreements, and based on recent interest within the Commission to include requiring compliance plans as part of voluntary product recall corrective action plans in the future, this workshop may be of special interest at this time.

Course outline:
All sessions are held at Saint Louis University's John Cook School of Business. Time allocations are approximate.

Day I:

1. **Safety Process Overview:** This section will review the Risk Equation and its application to business. Risk assessment tools and processes will be studied as well as the application of risk assessment techniques to current business models. (*1.5 hours*)
2. **Data Analysis:** Analysis of data as part of risk assessment will be discussed. Sources of data include product recall announcements, CPSC injury data, and other data sources. (*0.5 hour*)
3. **Foreseeable Use:** Definitions from a legal and practical viewpoint will be introduced, as well as how to approach foreseeable misuse. Product attractiveness and characteristics as well as the role of caregiver and vigilance will be considered, as well as the application of Foreseeable Use to

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risk assessment processes. A short hands-on workshop is included in this module. (*2 hours*)

4. **Hazard identification I:** Hazard identification process based on asphyxiation from airway obstruction. Includes anatomy review, injury and fatality data sources, mechanism of injury and models for prevention. A short hands-on workshop is included in this module. (*2 hours*)
5. **Hazard identification II:** Hazard identification process based on asphyxiation from suffocation, strangulation and drowning. Includes anatomy review and discussion of injury and fatality data sources. Describes the mechanism of injury and models for prevention. (*1 hour*)

Day II:

1. **Hazard Identification III:** Hazard identification process based on physical/mechanical hazards. Includes kinetic energy hazards (e.g. impact, falls, explosion), mechanical hazards (e.g. laceration, puncture, entrapment, pinching, strain) and other physical hazard types (e.g. sound hazards). A short hands-on workshop is included in this module. (*2.5 hours*)
2. **Hazard Identification IV:** Hazard identification process based on other physical effects. Includes thermal effects (flammability and fires, thermal burns and other temperature effects), electrical hazards and radiation (e.g. light hazard). (*1 hour*)
3. **Hazard Identification V:** Hazard identification process based on chemical hazards. Includes discussion on toxicity and other chemical effects. (*1 hour*)
4. **Testing and Production Control:** Discussion of basic compliance testing and how to incorporate higher-level test methods like Test to Failure in risk management strategies. (*1 hour*)
5. **Supply chain management:** Role of the supply chain in the design and production of products. How production issues, materials, and logistics factor into hazard analysis. (*1.5 hours*)

To register of for more information, visit education.adksafetyinfo.com or call 314-977-3617.

The following future courses are planned:
Product Safety Management (revised): April 22 & 23
Regulations & Compliance: May 21 & 22
Product Safety Program Development: June 25-26
Advanced Product Safety Management: Sept. 22-26

Compliance News Shorts

December, 2013

Taiwan – New Battery Regulations

A preannouncement was released in July, 2013 with the requirements for regulation of secondary Lithium Cells and Batteries effective March 1, 2014.

Effective June 1, 2014, a BSMI Certificate will be required for an Lithium Cell / Battery employed within a device or accessory for all end product submittals to BSMI. .

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EU - RoHS

The EU Commission recently proposed a ban of four new substances, HBCDD, and three phthalates, DEHP, DBP, and BBP. Under consideration is a fifth phthalate, DIBP.

Australia / New Zealand – Consolidated Compliance Mark

ERAC has announced that the date for registration of Level 3 equipment for the Consolidated Compliance Mark has been extended to March 1, 2014.

Taiwan – Regulation Change to DoC

The Bureau of Standards, Metrology & Inspection, BSMI, the Taiwanese authority, announced that the regulation will change from requirement for Registration of Product Certification (RPC) and/or Type Approval (TA) for several items to a DoC process. The change will be effective on January 1, 2014.

BSMI Notification No. 10230020150, published on December 5, 2013, included the following items:

Magnetic or optical readers, Turntables, Magnetic tape recorder/player, Radio Cassette Player, Electrical Machines with Translation or Dictionary functions, wired Keyboards.

India – Safety Product Registration

DEiTY has again postponed the enforcement date for registration to January 3, 2014. Registrations are now progressing through the process, although at a slower pace than desired by the manufacturers..

South Korea – EMC Regulation

South Korea announced a reorganization of many of their agencies and ministries. RRA, the national Radio Research Agency, is the certification authority responsible for issuing certificates to EMC, wireless, and telecom standards. RRA is now reporting under a new ministry, MSIP, Ministry of Science, ICT & Future Planning, per their Notification No. 2013-5, Conformity Assessment for Broadcasting & Telecommunication equipment effective July 1, 2013.

This impacts products in a Certification / Registration numbering rule change requiring the new ministry, MSIP, to replace the KCC noted as an element of the Mark. Products with a valid KCC Certificate issued before July 1, 2013 may retain the KCC element of the Mark, and will not need to submit for a new MSIP certificate. A transition period until January 1, 2014 for certification for power supplies used in workstations and servers will be allowed..

Chile – Safety Certification

Chile has introduced regulations for safety and energy efficiency requirements for printers and imaging equipment effective January 1, 2014.

Standards Roundup

US - IEC 60601-1 3rd Edition

Recently announced by the U. S. FDA in August, 2013, is an extension of the transition date for IEC 60601-1 3rd Edition to December 31, 2013. FDA will accept pre-market submissions with test reports assessed to IEC 60601-1 2nd Edition through the end of 2013.

The IEC announced in 16-Nov-2013 the publication of the first globally relevant Technical Specification (TS62700: DC Power supply for notebook computer) for a single external charger for a wide range of notebook computers and laptops.

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This new IEC Technical Specification covers critical aspects of external chargers for notebook computers, their connector and plug, as well as safety, interoperability, performance and environmental considerations.

The IEC Technical Specification 62700: DC Power supply for notebook computer, has been accepted by the National Committees participating in IEC TC (Technical Committee) 100: Audio, video and multimedia systems and equipment. IEC Technical Specification 62700: DC Power supply for notebook computer, will be available in early 2014.

11th Annual IEEE Symposium on Product Compliance Engineering – *Back to the Future!*

Save the Date – Note New Time of Year!!! **May 5 – 7, 2014**

See Call for Papers on Page 24!

Location – Where it all Started – San Jose/Santa Clara Valley…..

Double Tree by Hilton Hotel San Jose
2050 Gateway Place, San Jose, California, 95110, USA
TEL: 1-408-453-4000 FAX: 1-408-437-2898

IEEE Code of Ethics

The IEEE Code of Ethics and YOU (and ME)

by Murlin Marks, Life Senior

As we sign up for our IEEE membership, we all agree to follow the IEEE Code of Ethics. I think all of us are generally aware of this code and don't give it much thought beyond "trying to do the right thing." In responding to an incident at the ISPCE2013 in Austin, your Board of Directors had to consider and deal with certain aspects of the Code. It's really important that we draw attention to these aspects in order to maintain the integrity of our IEEE society and its members – us.

Most of my work experiences at UL was associated with the first part of the Code dealing with accepting responsibility, avoiding conflict of interest, being honest, rejecting bribes, etc. (see http://www.ieee.org/about/corporate/governance/p7-8.html for the full Code.) For product safety and compliance engineers, the question of ethics becomes most complicated and relevant in maintaining a balance between representing a concern about a hazard and management's (and our company's) need to market profitable products.

In fact, the IEEE Code of Ethics extends well beyond that. Looking at the Code, we may identify four distinct aspects addressed in it:

- Performance as Professionals (clauses 1-4)
- Role in Society (clause 5)
- Personal Obligations (clause 6)
- Interaction with other Professionals (clauses 7-10)

The incident which occurred in Austin falls within the scope of the last four clauses and offers us all a "teachable moment" to be more aware of how IEEE membership and its Code of Ethics may go beyond certain "normal" and accepted practices of our dealings with others. Specifically, our Board had to deal with the following part of the IEEE Code:

We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

…

7. to seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;
8. to treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;
9. to avoid injuring others, their property, reputation, or employment by false or malicious action;
10. to assist colleagues and co-workers in their professional development and to support them in following this code of ethics. [01 http://www.ieee.org/about/corporate/governance/p7-8.html downloaded on 16 October, 2013]

What this is saying is that we must deal with others respectfully and in a manner that will not harm them. We should interact with others in a manner that will not embarrass them or harm their reputations. We must "seek… honest criticism of technical work," but avoid "injuring other['s]… reputation … by malicious action," and "to assist colleagues … in their professional development." What this boils down to is that we MUST be considerate even when we have a criticism. Stated more positively, we MUST create a positive, supportive environment so we may work together to help our colleagues improve professionally.

For some of us, this may not be Standard Operating Procedure. I can say that during my career, I saw and knew certain individuals who were famous for publicly tearing into people. It wasn't pretty; nor do I think the behavior served any constructive purpose. One of the reasons I joined IEEE is that as a professional organization it nurtures all its members and does not allow them to be demeaned. As IEEE PSES members, you should know that your Board of Directors takes its duty seriously to maintain a positive, constructive environment at our conferences, chapter meetings and other activities. Anything less is unacceptable. Our executive committee confidentially addressed the Austin incident with sensitivity for all parties, and had a goal of finding a fair resolution that would resolve the matter and move on having learned how better to avoid such situations in the future.

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Mentoring

Mentoring—A great opportunity!

by Doug Nix

Among the many reasons people join IEEE are the opportunities to both share and learn, and there are abundant opportunities. Volunteering with your local chapter, working with a student chapter in the local college or university, or getting involved with your society are all great ways to share. Publishing papers on work you are involved with is an excellent way to share technical information with colleagues and advance your own career. Webinars, seminars, chapter meetings, and conferences like the annual ISPCE are ways to learn, keeping your skills up to date. But what if you are looking for something a bit lower key, something one-on-one? Have you considered becoming a mentor?

A mentor is an experienced and trusted adviser [1]. Anyone can become a mentor, as long as they meet a few simple requirements. IEEE offers members the opportunity to become mentors and protégées (sometimes called "mentees") through the IEEE Mentoring network. Mentoring is an opportunity for you to offer one-on-one help to another member in an area where you have expertise. This needn't be limited to technical topics. Mentors often provide guidance on career development, leadership, writing skills, and many other areas. Protégées can ask for assistance with any aspect of their career they wish. The mentor and the protégée come to an agreement on a meeting schedule and the topics to be discussed, and the process runs independently after that.

IEEE has specific requirements for mentors. Prospective mentors must be IEEE higher-grade members (above Student member grade) who are [2]:

- willing to give time and effort to the mentoring partnership (a minimum of two hours per month is suggested);
- able to communicate effectively with others;
- willing to share some career successes and failures;
- individuals who may be or have been executives, consultants, or in middle or upper management, or in research;
- individuals who may be or have been educators, entrepreneurs, or self-employed;
- individuals who may be or have been proven leaders offering inspiration and insight;
- individuals who may be or have been IEEE officers or volunteers;
- willing to review an orientation session to learn guidelines, tools of the program, and the protégée's and the mentor's role and responsibilities.

That's it! Not too hard to do. Two hours a month comes down to two one-hour meetings each month. These can be teleconferences, web meetings or in-person, whatever works best for both people involved.

What about becoming a protégée? Prospective protégées must be IEEE higher-grade members (above Student member grade) who are [2]:

- new professionals in their first or second job or considering entering graduate programs;
- recent graduates entering the professional workforce for the first time;
- professionals making a career move or career change;
- passionate for learning;
- willing to give time and effort to the mentoring partnership (a minimum of two hours per month is suggested);

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- willing to identify and clarify their developmental goals;
- interested in learning from another professional "who has been there;"
- willing to participate in a protégée orientation session to learn guidelines and tools of the program and their role and responsibilities as a protégée.

Mentors and protégées are expected to make a commitment to the process. The commitment is usually formalized in a "mentoring contract." The contract lays out the goals and objectives for the relationship, and defines the responsibilities of both people involved.

Mentoring is a great opportunity, one that opens possibilities for both individuals involved. This is a simple, rewarding way for you to get involved, make a contribution, and keep your time commitment small. Ready to get involved? There are two places to go: To get more information, see the IEEE Mentor Centre web page, www.ieee.org/membership_services/membership/mentoring/index.html. To set up an account to become a mentor, a protégée or both, visit http://mentoring.ieee.org/ementor/. Finally, if you want to discuss any specific questions, feel free to contact Doug Nix, dnix@ieee.org.

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PSE History

Let's Remember Before It's Forgotten

by Murlin Marks, Life Senior

The main purpose of this essay is to motivate you and your companies to publish articles and papers about the history and background of product safety engineering. One of the most interesting courses I took in college was "History of Science and Technology in the U.S." Because of my career at UL, I have a general awareness of the history of PSE at Underwriters Laboratories and in the U.S. But it stops there. I know that other agencies, such as CSA and VDE have long and interesting histories of how they got started and what issues/technologies they were involved with. I think it's important for the younger folks getting involved with product safety and compliance engineering to have a feeling about what many of us "old timers" have experienced. And even the background upon which even our careers were based – going back to the latter part of the nineteenth century – before my time is hidden away, sitting lonely in the dusty closets of agencies.

Many of you know my PSES background from my previous articles when I was PSES president. In the late 1980's, my boss at UL (Mike DeMartini) encouraged me to attend the monthly "product safety" meetings that were held in an HP conference room. I served for two years each as secretary, vice-chair and chair of the Santa Clara Valley "chapter" of the EMC society TC-8, which was the EMC society's technical committee for product safety. For fifteen years, we functioned as a twilight zone group that considered ourselves to be "members" of an EMC Society Technical Committee. For ten years, we had a Newsletter. (see http://ewh.ieee.org/soc/pses/newsletters.html - with a bonus of a 30 year old photo of Rich Nute) We had a half dozen chapters that had regular meetings and other activities.

We should be forever grateful for EMCS support over those years. We were active with annual EMC Symposium Product Safety Workshops and local colloquia. In the late 1990s, I became active in the "national" TC-8, ultimately taking over its chair-

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manship from Brian Claes. Around that time, we formed a steering committee to become an IEEE society. The rest is pretty well documented in our PSES Newsletter and in an excellent paper by Mark Montrose (see http://ewh.ieee.org/soc/pses/history/History_PSES.pdf)

What many of you do not know is that I had a much earlier background in product safety. My first experience was with a train set solenoid that switched track. It was supplied by a low-voltage transformer and connected to binding posts with magnet wire. As an eight-year old, I thought it would work much better if I put it into the wall socket, which happened to be 220 volts. Fortunately, I didn't burn down our apartment, but I did learn that enameled wire would flame quite nicely.

My second product safety experience that I recall, was when I lived in Asunción, Paraguay in the late 1950s. Hot water was a novelty in the bathroom and it was truly exciting when the local electrician installed an instant water heater to the showerhead. The 220-volt supply connected to exposed binding posts at the back of the showerhead. It was unwise to touch anywhere on the showerhead. In fact, you would get an increasingly strong tingle in the water spray as you got closer to the showerhead. But the hot water was great!

One more example of my pre-UL experience with product safety engineering was much later, after getting my engineering degree and serving in the Peace Corps in Photharam, Thailand. My room was in the converted library in a wood structure school. The room had had no electric outlets, so they ran a wire (essentially 20 AWG speaker wire) from the hallway fluorescent ceiling lights over the wooden wall and down the wooden post to a new 220-volt plug that I was to use for my electric fan and hot plate. They used staples with a bit of paper over them to hold the wire onto the wall. I remember using digital technology to determine the "safety" of this arrangement. That is, I put my finger on the supply wire when the fan and hot plate were on to determine that the supply wire didn't get too hot to the touch.

Needless to say, when I interviewed with Jack Hogg, Harry Kavanagh and Wally Wedekind at UL, I was very interested in the work they did and felt that I had found my calling. I had seen the "UL" on numerous products, such as portable lamps and radios. How had UL been a part of the explosion of reasonably safe electrical products since the late 19th century?

At our first PSES symposium in Santa Clara, we had a popular session of anecdotes from the audience. Our conference schedule is now too busy to accommodate such a session, and we really need more permanent documentation. We really owe it to younger folks coming from a global audience to share PSE history. Thls can be from individuals, agencies (UL, CSA, VDE, the TUVs, NEMCO and the many others that I apologize to for not mentioning) and other companies involved in product safety and compliance engineering. Also government organizations charged with developing and implementing safe products and systems for their citizens. The background is interesting, and can be helpful in understanding why things are the way they are after more than a century of development.

I'll refer to the first half of the famous sentence that begins Charles Dickens' *A Tale of Two Cities*, "It was the best of times…" and stop there. It is now "the best of times": We have a young IEEE Product Safety Engineering Society and many exciting challenges for the future, ranging from driverless cars to internet security to global warming. We are at a kind of crossroads where all the high tech developments of the last generation are creating myriad challenges and opportunities. But the younger generation is quickly moving away from the days of vacuum tubes and (smelly) silicon rectifiers. We will all be richer having access to our history. Our PSES Newsletter can serve as the venue for this background. Before it's forgotten.

Out-of-Tolerance

Editor's note—the problem described in this article is a very real one that hides behind the calibration label that indicates a piece of test equipment is currently within its calibration period. A real-life example as related by an industry veteran: "My last employer…never did any verifications of test equipment before doing a test. Right before I quit their spectrum analyzer came back from calibration with a report that the front end was defective and was giving lower readings. They had no idea when this happened, and didn't care."

As-Found: Out-of-Tolerance…What to do next?

by Phil Mistretta

When calibrated test equipment is found in an out-of-tolerance condition, there is additional risk to all products on which it was used. It is important to understand the magnitude of the potential risk because it can lead to dangerous consumer situations and additional business costs. Typically quality systems have a procedure for handling non-conforming material, however, this is non-conforming instrumentation used in a process, not material produced by a process. There is little guidance available describing how to evaluate out-of-tolerance conditions, leaving engineering and quality personnel to develop their own process. When faced with an As-Found: Out-Of-Tolerance (OOT) condition, a systematic approach to identify what the out-of-tolerance values were and when, where, and how the OOT unit was used, will help concentrate your efforts to identify those areas that will need further analysis.

Non-compliance

What does out-of-tolerance mean? Calibration is a comparison of a metrology laboratory's standard, with a known value and uncertainty, to the unknown behavior of a unit submitted for calibration. When the unit under test (UUT) does not meet the expected test limits, it is considered to be Out-of-Tolerance. The type of measurement data and calibration information provided can vary widely, depending on the type of metrology laboratory performing the calibration. For instance in the U.S., at the National Metrology Institutes (NMI) such as NIST, the metrology laboratory may provide the comparison data only and not utilize any test limits and not make any statement of compliance. It is up to the instruments' owner to perform any analysis and determine the compliance status of each individual piece of calibrated equipment.

For the typical NMI customer, this process is relatively easy to handle because they are staffed with highly knowledgeable metrology professionals who are responsible for a limited quantity of lab standards. However, if this is the only information received by a manufacturing environment customer, who has significant quantities of test and measurement equipment, monitoring the behavior of each individual piece of equipment is impractical at best! Fortunately, the manufacturers of test equipment have done most of the analysis work. This is accomplished through the manufactures' published specifications which describe what type of behavior can be expected for the *majority* of the units manufactured, following a *typical* calibration interval.

It is from the Original Equipment Manufacturers' (OEM) published specifications that purchasing decisions are made. It is also from these published specifications that a commercial calibration provider will *most likely* determine the allowable tolerances, or test limits for the calibration process. Many commercial calibration providers offer a default service that uses the OEM's published specifications; however, it is the responsibility of both the customer and the calibration lab (internal or external), to agree upon the specifications which will be used in the calibration process. A customer can request their equipment to be calibrated against any specification they provide. Once the calibration specifications have been agreed upon, the laboratory can calculate the test limits against which the laboratory results can be compared and a statement of compliance can be determined.

Statement of compliance

Most commercial calibration customers are looking for the calibration laboratory to make a statement of compliance for the As-Found condition of the Unit Under Test (UUT). On the surface, making this determination appears rather straightforward and simple; however upon closer examination, it becomes more complex; there are no perfect instruments and no perfect measurements. All measurements have some degree of uncertainty, and how to deal with these uncertainties with respect to making a statement of compliance differs greatly. There are several different approaches which could be used when making compliance statements. Some labs will not make a statement at all; some labs will mark the data that does not meet the limits with an asterisk or some other means, but not make a compliance statement; still other labs will make a compliance statement, quantify the results with an uncertainty value and provide additional consumer risk information. In any case, it is critical for the customer to understand the decision rules used by the laboratory in making any compliance statements.

The statement As-Found: In-tolerance is generally assumed to mean that the entire instrument—all functions, parameters, ranges and test points—is within the calibration specifications at the time of calibration, for the stated conditions at the location where the calibration took place. An As-found: in-tolerance condition is a good indication the UUT was performing within expectations since the last calibration was completed. For the commercial calibration customer who has hundreds or thousands of calibrated items, the statement of compliance may be the single most important piece of information on a calibration certificate. In essence the metrology laboratory, staffed with measurement experts, has completed an initial data evaluation and concluded the unit to be performing within the agreed upon specifications so the customer does not have to spend very much additional time reviewing the calibration.

Likewise an As-Found: Out-Of-Tolerance (OOT) condition indicates that at least one data point in the data report drifted or shifted beyond the allowable tolerance limits and the measurements it was providing may not have been accurate at some point since the previous calibration. Again, the laboratory measurement experts have indicated that this unit had a problem and needs further analysis *by the customer*. The As-Found: Out-Of-Tolerance statement of compliance is the flag or trigger for many quality or manufacturing engineering departments to start an investigation, evaluation or analysis.

The Process

The object of the OOT evaluation process is to identify the at-risk products the Out-of-Tolerance units touched. The following approach is not very difficult and follows a logical thought process; however there are a few pitfalls to be aware of and to avoid. This is an investigation; I caution against having the end result already in mind. It is tempting to want the conclusion to show that there were no at risk products because of the work involved. The answers to the questions in the process will lead you to the appropriate conclusion. The approach here is to eliminate products without risk and to narrow down the pool of at-risk products.

What is Out-of-Tolerance?

The first thing to do when faced with an out-of-tolerance unit is to read through the calibration certificate and data to get a firm understanding of *what* specifically failed calibration. A *complete* set of As-Found and As-Left calibration measurement data is essential for a proper out-of-tolerance evaluation. A Calibration Certificate without data is never a good idea, but when faced with an out-of-tolerance unit, the lack of measurement data will significantly impact the ability to conduct an analysis and quantify any potential risk. If the metrology laboratory provides an out-of-tolerance report that only shows the out-of-tolerance data you have something on which to conduct an evaluation, but even this limited information does not provide a complete picture. A review of all the calibration data should be done to identify what functions,

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parameters, ranges and test points were found out-of-tolerance.

For example, let's say a voltmeter has a full scale range of 1000 V, a resolution of 1 V, and an accuracy of ± 5 V, and the unit was found to read 1006 V at full scale (out-of-tolerance) and in-tolerance at all the other readings which were taken every 200 V. This means that during the use of the voltmeter, over its most recent calibration cycle, any measurements between 800 V and the full scale 1000 V were likely giving erroneous values to the user of the meter for the measurements taken. Again, a full set of data will be very helpful at this point in answering questions like: how many points within a range were out-of-tolerance; was the entire range out of tolerance; were all the ranges even checked; was there a linearity issue; was only the zero out-of-tolerance; or only the full scale reading out of tolerance; were other relevant test points close to or at their limits? The quality of the calibration and quantity of data available can have a tremendous impact on narrowing the scope of the evaluation at this point.

When did it happen?

The next step should be to identify the *time frame* during which questionable measurements may have been taken. This objective is to identify a specific time when the instrument was last known to be taking correct measurements. Often, this is going to be the previous calibration date; the historical calibration certificate will have this date. Basically, the unit was known to be measuring correctly when it left the metrology lab through its As-Left measurement data on the most recent calibration certificate. This will provide a starting point to work from, and most likely the longest period to examine. If you are fortunate to have a well developed measurement assurance program, you might have collected additional data during the period in question which can reduce the evaluation time frame.

Most metrology laboratories follow good metrology practices (GMetP) and conduct mid-cycle checks, tests, and inter-comparisons, also called cross-checks, to determine the "health" of their measurement processes and provide confidence in the quality of the measurement process. If these checks are documented and have measurement data, you may be able to reduce the period of questionable measurements. For example, let's say the voltmeter in a production cell was found out-of-tolerance during its annual calibration, but you have a process where a precision voltage source is used to verify the performance of the voltmeter every quarter. A review of this data may allow you to conclude the voltmeter was performing accurately 3 months ago, so the questionable period is only going to be last 3 months instead 12 months which significantly reduces the pool of potential at-risk products. A schedule of cross-checks and inter-comparisons is often developed for critical measurements or high volume processes in order to reduce risk, liability, and evaluation time.

Where is it used?

The objective at this point is to identify *where* this instrument has been used during the questionable period. This is where the really big challenges can start. Typically, this is where the last link in the chain of traceability is often broken, linking the actual calibrated instrument to the processes, products and services provided. The ease of identifying potential impacted product depends upon the design of the end user's processes and systems. In a large facility test equipment can move around without tracking its location. This is especially true of handheld instruments and bench level instruments. A robustly designed system with strict instrument control procedures will be able to identify exactly where any given instrument was located for any given time frame. Nearly all companies have a system that assigns an identification number to each instrument, and some even track its assigned department or location, but few systems track the movement of equipment within the facility and even fewer log the date and use of instrumentation. The maintenance of such an instrument movement log must be strictly followed; any hole or missing location data will bring any evaluation to a halt. Imagine a facility with 50 identical instruments that move around different production cells without any

control. It would be impossible to identify what measurements or products it touched and what errors went undetected. With a robust tracking system that indicates if and when this instrument moved, you should be able to identify where this instrument was at any given time.

How is it used?

The last step in the out-of-tolerance information gathering process is to identify how the out-of-tolerance instrument was being used. Determine exactly what measurements were being made at a given location, during the time frame in question. This information will likely be found in the end user's procedures, or the operator's work instructions, or an engineering specification. The objective at this step is to determine whether the out-of-tolerance instrument *could* have affected any of the products manufactured or services provided by this instrument, in this time frame, in this location, for these measurements. This can be accomplished by reviewing the process documentation, and all revisions that were in effect during the time frame in question, for the out-of-tolerance measurements that were identified in the first step. Were any of the out-of-tolerance functions, parameters, ranges and test points used to make the measurements listed in the process documentation? If the answer is no, congratulations, your evaluation has ruled out the potential risk to product. Now you just have to completely document the steps you have taken, your conclusion and justification, as any auditor will tell you, if it isn't written, it didn't happen, you must product objective evidence.

Analyzing the impact

If the process documentation indicates that measurements *were* taken using any of the out-of-tolerance functions or ranges, then you have to go further and quantify the severity of the impacted products or services. Now comes the most difficult part of the process, quantifying the impact on products and services. In order to effectively complete this analysis, a thorough understanding of the affected process is necessary and a working understanding of tolerances and the application of uncertainties is extremely helpful. Due to the wide variety of applications and situations possible, a few sample cases will be used to illustrate the analysis process for common situations likely to occur.

Case 1: (No Impact): Let's say the process documentation states that the voltmeter is used to measure 600 V on a product with a process tolerance of ± 10 V. Since our process measurement was *not* in the out-of-tolerance portion of the meter (800 V to 1000 V), we can conclude with reasonable confidence that no product was affected.

Case 2: (Impact Evaluation using ratios): In Case 2 we will use accuracy ratios in our analysis. An analysis by ratios can help quantify the potential impact by a rough order of magnitude, but may not be sufficient. For instance, a ratio change from 100:1 to 80:1 may be fairly insignificant, but a ratio change from 4:1 to 2:1 could have quite the impact on the end products. A ratio analysis may be a quick way to rule out potential recalls if the ratios involved are sufficiently high. However, if the ratios are low, then additional evaluation becomes necessary. This method may also be the only option available if there isn't any historical process measurement data to review. For example in this case, the process documentation states that the voltmeter is used to measure 1000 V on a product with a process tolerance of ± 50 V. Since our process measurement *was* in the out-of-tolerance portion of the meter (800 V to 1000 V), product *might* have been negatively impacted.

We need to go a step further and compare our process tolerance to the magnitude of the out-of-tolerance data. The process tolerance in this case was ± 50 V, so our process limits are 9950 V to 1050 V. The accuracy of the meter was ± 5 V which means the meter is 10 times more accurate than our process tolerance giving us a Process Accuracy Ratio (50 V / 5 V) of 10:1. Now the calibration report stated the meter was reading 1008 V when the calibration lab injected a precision 1000 V into the meter, which basically means the meter behaved as if it had an accuracy of ± 8 V which drops our Process Accuracy Ratio (50 V/ 8 V) to 6.25:1. Is the risk due to a reduced process ratio acceptable? That comes down to a business decision.

Case 3: (Impact Evaluation using as-found calibration data): In this case, the process documentation states that the voltmeter is used to measure 1000 V on a product with a process tolerance of ± 50 V. Since our process measurement *was* in the out-of-tolerance portion of the meter (800 V to 1000 V), product *might* have been negatively impacted. We need to go a step further and compare our process tolerance to the magnitude of the out-of-tolerance data. The process tolerance in this case was ± 50 V, so our process limits are 9950 V to 1050 V. The out-of-tolerance data indicated that the meter was reading 1008 V, or out of specification, beyond the upper tolerance limit of 1005 V, by +3 V. This additional 3 Volt error is well below our ± 50 V process tolerance, so there wasn't a problem…or was there? You might want to jump to that conclusion, and you would be correct as long as your process stayed centered on 1000 V, but what if your process moved around and didn't stay centered? Isn't that why process tolerances are created to begin with? To figure out what is going on here, go back to the fact that the meter was reading high by +8V; the meter has a total +8 V bias or offset. The meter was actually delivering process limits of 9958 V to 1058 V. Which means any measurements greater than 1042 V during the time frame in question actually exceeded the upper process limit. With this information, you should review any historical process measurement data you have and identify any products that had measurements greater than 1042 V. You have now identified the specific units that might have been impacted by the out-of-tolerance unit and may have to be recalled. But wait, there's more! Remember, no measurement is perfect, so what about the metrology lab's measurement data; doesn't that have some error in it too? Why yes, yes it does…

Case 4: (Impact Evaluation using as-found calibration data and the lab's uncertainty): Continuing with Case 3 information, let's say the metrology lab reported their uncertainty for the measurement: 1008 V ± 7.1 mV. That means the value they report lies somewhere between 1007.9929 V and 1008.0071 V. This additional uncertainty will carry on down to the process tolerance calculation. So in the worst case the meter was actually delivering process limits of 9957.9929 V to 1058.0071 V, which in our case is insignificant because the resolution of the meter is not sensitive enough to see this small difference in voltage.

It is interesting to note that in this situation the metrology lab had an uncertainty of ±7.1 mV for the calibration against the unit's tolerance of ± 5 V which provides a calibration Test Uncertainty Ratio of 704:1 (5 V / 7.1 mV) meaning the calibration lab standards were over 704 time more accurate than the meter being calibrated. Here is where the value of that pesky Test Uncertainty Ratio those metrology guys are always talking about comes into play. Had the metrology laboratory's uncertainty been ± 1.25 V, their reported measurement would have been 1008 V ± 1.25 V, and the TUR would have been 4:1 (5 V/ 1.25 V) meaning the meter would have actually been delivering process limits of 9957.675 V to 1059.25 V, which when rounded by the resolutions of the meter become 9958 V to 1059 V. Now this additional count might not seem like a big deal, but it does increase the size of the potential recall and increase the potential risk and cost.

Again, here is where a complete calibration report with As-Found and As-Left data becomes very helpful. This is also the point where the Test Uncertainty Ratio (TUR) and the Uncertainty of the Calibration Laboratory come into play and why all calibrations should include uncertainties for every measurement. The laboratory's uncertainty information on the measurements they provide will give you the information to further refine your evaluation and subsequent analysis. Every bit of measurement information at your disposal allows you to make additional distinctions, observations, calculations and improves the quality and confidence in your conclusions and recommendations for further actions. The cost of a single product recall will far exceed the additional cost associated with a complete calibration which includes

As-Found and As-Left data with uncertainties.

As cases 2, 3, and 4 illustrate, an out-of-tolerance instrument that could affect the end product or service can lead to a tremendous amount of work because the analysis will need to be completed for each product or service identified. This could lead to hundreds or thousands of calculations! As you can imagine, any effort spent in the four steps (what, when, where, and how) in the evaluation process which eliminates additional products to be analyzed is well worth the time. When faced with an As-Found: Out-Of-Tolerance (OOT) condition, a systematic approach to identify what the out-of-tolerance values were, when, where and how the OOT unit was used, will help concentrate your efforts to identify those areas that will need further analysis. The objective is to filter out as many possible items that do not need closer analysis so you can get to the ones where detailed analysis is required in order to quantify the impact to the products or services provided.

All this evaluation and analysis is a tremendous amount of work. However, it does not have to be difficult. A well thought-out electronic system linking instrumentation to processes and product traceability as part of a measurement assurance program can ease the burden of out-of-tolerance evaluations and analysis. A measurement assurance program is more than a calibration program; it is a thought process to link and relate measurements through the entire produce life cycle, from concept to end product. Hopefully this approach and general guidelines will ease the burden of solving one of the most dreaded situations in the measurement world: the evaluation of an out-of-tolerance instrument and its potential impact.

Phil Mistretta is a Metrology Manager for Transcat Inc. in Rochester, NY. He has a background in EMC/EMI compliance testing, lean manufacturing engineering and over 25 years of experience in the field of Metrology. He is member of IEEE and ASQ and is an ASQ-Certified Calibration Technician. He is a graduate of Central Texas College and pursuing a BS in Engineering Physics at the University of Buffalo New York on a part time basis.

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Interlock Architectures - Pt. 2

Editor's note—This is the second in a seven-part series of articles reprinted through the courtesy of Doug Nix from postings on the Machinery Safety 101 blog (http://machinery-safety101.com).

Interlock Architectures - Pt. 2: Category 1

by Doug Nix

In Part 1 of this series we explored Category B, the Basic Category that underpins all of the other Categories. This article builds on Part 1 by taking a look at Category 1. Let's start by exploring the difference as defined in ISO 13849-1. When you are reading, remember that "SRP/CS" stands for "Safety Related Parts of Control Systems."

> "SRP/CS of category 1 shall be designed and constructed using well-tried components and well-tried safety principles (see ISO 13849-2)." [1, 6.2.4]

Well-tried components
So what, exactly, is a "Well-Tried Component"? Let's go back to the standard for that:

> A "well-tried component" for a safety-related application is a component which has been either
>
> a) widely used in the past with successful results in similar applications, or
>
> b) made and verified using principles which demonstrate its suitability and reliability for safety-related applications.

Newly developed components and safety principles may be considered as equivalent to "well-tried" if they fulfil the conditions of b).

The decision to accept a particular component as being "well-tried" depends on the application.

NOTE 1 Complex electronic components (e.g. PLC, microprocessor, application-specific integrated circuit) cannot be considered as equivalent to "well tried." [1, 6.2.4]

Lets look at what this all means by referencing ISO 13849-2 [2]:

Table 1 – Well-Tried Components [2, A.3]

Well-Tried Components	Conditions for "well-tried"	Standard or specification
Screw	All factors influencing the screw connection and the application are to be considered. See Table A.2 "List of well–tried safety principles".	Mechanical jointing such as screws, nuts, washers, rivets, pins, bolts etc. are standardised.
Spring	See Table A.2 "Use of a well–tried spring".	Technical specifications for spring steels and other special applications are given in ISO 4960.
Cam	All factors influencing the cam arrangement (e. g. part of an interlocking device) are to be considered. See Table A.2 "List of well–tried safety principles".	See EN 1088 (ISO 14119) (Interlocking devices).
Break–pin	All factors influencing the application are to be considered. See Table A.2 "List of well-tried safety principles".	—

Now we have a few ideas about what might constitute a "well-tried component." Unfortunately, you will notice that "contactor" or "relay" or "limit switch" appear nowhere on the list. This is a challenge, but one that can be overcome. The key to dealing with this is to look at how the components that you are choosing to use are constructed. If they use these components and techniques, you are on your way to considering them to be well-tried.

Another approach is to let the component manufacturer worry about the details of the construction of the device, and simply ensure that components selected for use in the SRP/CS are "safety rated" by the manufacturer. This can work in 80-90 percent of cases, with a small percentage of components, such as large motor starters, some servo and stepper drives and other similar components unavailable with a safety rating. It's worth noting that many drive manufacturers are producing drives with built-in safety components that are intended to be integrated into your SRP/CS.

Exclusion of complex electronics

Note 1 from the first part of the definition is very important. So important that I'm going to repeat it here:

> NOTE 1 Complex electronic components (e.g. PLC, microprocessor, application-specific integrated circuit) cannot be considered as equivalent to "well tried."

This little note is what prevents any safety system that incorporates a standard PLC from being considered anything more than Category B, regardless of redundancy and component selections for all other components. It's also important to realize that this definition is only considering the hardware; no mention of software is made here, and software is not dealt with until later in the standard.

Well-Tried Safety Principles

Let's have a look at what 'Well-Tried Safety Principles' might be.

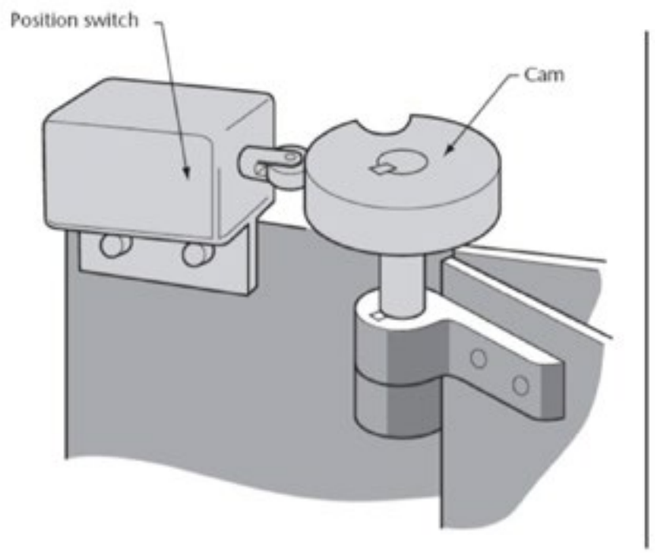
Table 2 – Well Tried Safety Principles [2, A.2]

Well-tried Safety Principles	Remarks
Use of carefully selected materials and manufacturing	Selection of suitable material, adequate manufacturing methods and treatments related to the application.
Use of components with oriented failure mode	The predominant failure mode of a component is known in advance and always the same, see EN 292-2:1991, (ISO/TR 12100-2:1992), 3.7.4.
Over–dimensioning/safety factor	The safety factors are given in standards or by good experience in safety-related applications.
Safe position	The moving part of the component is held in one of the possible positions by mechanical means (friction only is not enough). Force is needed for changing the position.
Increased OFF force	A safe position/state is obtained by an increased OFF force in relation to ON force.
Careful selection, combination, arrangement, assembly and installation of components/system related to the application	—
Careful selection of fastening related to the application	Avoid relying only on friction.
Positive mechanical action	Dependent operation (e. g. parallel operation) between parts is obtained by positive mechanical link(s). Springs and similar "flexible" elements should not be part of the link(s) [see EN 292-2:1991 (ISO/TR 12100-2:1992), 3.5].
Multiple parts	Reducing the effect of faults by multiplying parts, e. g. where a fault of one spring (of many springs) does not lead to a dangerous condition.
Use of well–tried spring (see also Table A.3)	A well–tried spring requires: use of carefully selected materials, manufacturing methods (e. g. presetting and cycling before use) and treatments (e. g. rolling and shot–peening), sufficient guidance of the spring, and sufficient safety factor for fatigue stress (i. e. with high probability a fracture will not occur). Well–tried pressure coil springs may also be designed by: use of carefully selected materials, manufacturing methods (e. g. presetting and cycling before use) and treatments (e. g. rolling and shot-peening), sufficient guidance of the spring, and clearance between the turns less than the wire diameter when unloaded, and sufficient force after a fracture(s) is maintained (i. e. a fracture(s) will not lead to a dangerous condition).
Limited range of force and similar parameters	Decide the necessary limitation in relation to the experience and application. Examples for limitations are break pin, break plate, torque limiting clutch.
Limited range of speed and similar parameters	Decide the necessary limitation in relation to the experience and application. Examples for limitations are centrifugal governor; safe monitoring of speed or limited displacement.
Limited range of environmental parameters	Decide the necessary limitations. Examples on parameters are temperature, humidity, pollution at the installation. See clause 8 and consider manufacturer's application notes.
Limited range of reaction time, limited hysteresis	Decide the necessary limitations. Consider e. g. spring tiredness, friction, lubrication, temperature, inertia during acceleration and deceleration, combination of tolerances.

Use of positive-mode operation

The use of well-tried principles in the components, as well as in the overall design of the safeguards is important. In developing a system that uses ‘positive mode operation’, the mechanical linkage that operates the electrical contacts or the fluid-power valve that controls the prime-mover(s) (i.e. motors, cylinders, etc.), must act to directly drive the control element (contacts or valve spool) to the safe state. Springs can be used to return the system to the run state or dangerous state, since a failure of the spring will result in the interlock device staying in the safe state (fail-safe or fail-to-safety).

CSA Z432 [3] provides us with a nice diagram that illustrates the idea of “positive-action” or “positive-mode” operation:

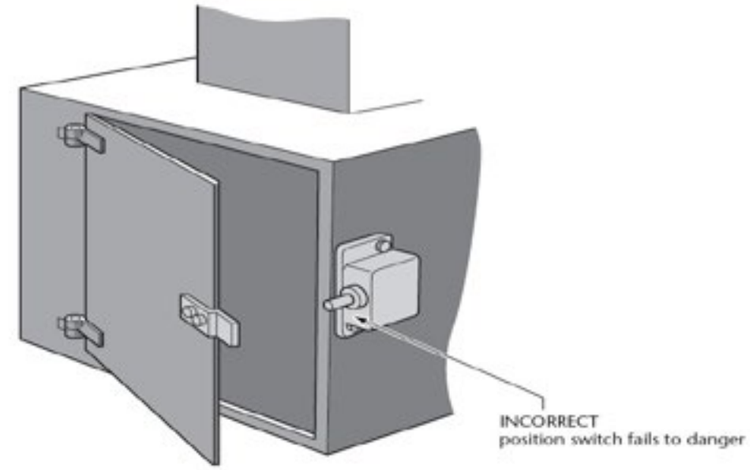


Note: *Position switch operates in the positive (or direct) mode, with a cam mounted on the door hinge, profiled so as to operate swiftly as the door is opened. The switch contacts are opened positively (directly) by the action of the cam profile and closed by spring action when the door is closed.*

Figure 1 – Position switches or valves actuated by rotary cams [3, Fig. B.10]

In Figure 1, opening the guard door forces the roller to follow the cam attached to the door, driving the switch contacts apart and opening the interlock. Even if the contacts were to weld, they would still be driven apart since the mechanical advantage provided by the width of the door and the cam are more than enough to force the contacts apart.

Here’s an example of a “negative mode” operation:



Note: *This provides an example of incorrect application of a position switch as there is nothing to prevent wilful interference with its working. It would, moreover, fail to danger in the event of the switch stem failing to extend under the action of its return spring.*

Figure B.11
Plunger operated position switch A, operating in the non-positive mode, fitted to a door protecting a machinery hazard
(See Table A.6.)

Figure 2 - Negative mode operation. Plunger operated position switch fitted to machine guard. [3, Fig.B.11]

In Figure 2, the interlock switch relies on a spring to enter the safe state when the door is opened. If the spring in the interlock device fails, the system fails-to-danger. Also note that this design is very easy to defeat. A “zip-tie” or some tape is all that would be required to keep the interlock in the “RUN” condition.
You should have a better idea of what is meant when you read about positive and negative-modes of operation now. We’ll talk about defeat resistance in another article.

Reliability
Combining what you’ve learned so far, you can see that correctly specified components, combined with over-dimensioning and implementation of design limits along with the use of well-tried safety principles will go a long way to improving the reliability of the control system. The next part of the definition of Category 1 speaks to some additional requirements:

> The $MTTF_d$ of each channel shall be high.
>
> The maximum PL achievable with category 1 is PL = c.
>
> NOTE 2 There is no diagnostic coverage (DC_{avg} = none) within catego-

ry 1 systems. In such structures (single-channel systems) the consideration of CCF is not relevant.

NOTE 3 When a fault occurs it can lead to the loss of the safety function. However, the $MTTF_d$ of each channel in category 1 is higher than in category B. Consequently, the loss of the safety function is less likely.

We now know that the control reliability is better with a Category 1 system than with a B, since the $MTTF_d$ of the system has gone from a maximum of “b” to “c”. $PL_c \geq 10^{-6}$ to $< 3 \times 10^{-6}$ failures per hour. This is a pretty good result for simply improving the components used in the system!

To get a handle on what PL_c means, let’s look at our single and three shift examples again. If we take a Canadian operation with a single shift per day, and a 50 week working year we get:

$$7.5 \text{ h/shift} \times 5 \text{ d/w} \times 50 \text{ w/a} = 1875 \text{ h/a}$$

In this case, PL_c is equivalent to one failure in 533.3 years of operation to 1600 years of operation.

Looking at three shifts per day in the same operation gives us:

$$7.5 \text{ h/shift} \times 3 \text{ shifts/d} \times 5 \text{ d/w} \times 50 \text{ w/a} = 5625 \text{ h/a}$$

In this case, PL_c is equivalent to one failure in 177.8 years of operation to 533.3 years of operation.

When completing the analysis of a system, [1] limits the system $MTTF_d$ to 100 years regardless of what the individual channel $MTTF_d$ may be. Where the actual $MTTF_d$ is important relates to the need to replace components during the lifetime of the product. If a component or a sub-system has an $MTTF_d$ that is less than the mission time of the system, then the component or subsystem must be replaced by the time the product reaches it’s $MTTF_d$. The default mission time is 20 years, but you can choose a shorter or longer time span if it makes sense.

Remember that these are probabilities, not guarantees. A failure could happen in the first hour of operation, the last hour of operation or never. These figures simply provide a way for you as the designer to gauge the relative reliability of the system.

Well-tried components versus fault exclusions

The standard goes on to outline some key distinctions between “well-tried component” and “fault exclusion.” We’ll talk more about fault exclusions later in the series.

It is important that a clear distinction between “well-tried component” and “fault exclusion” [1, §7] be made. The qualification of a component as “well-tried” depends on its applica-

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tion. For example, a position switch with positive opening contacts could be considered as well-tried for a machine tool, while at the same time as being inappropriate for application in a food industry. In the milk industry, for instance, this switch would be destroyed by the milk acid after a few months. A fault exclusion can lead to a very high PL, but the appropriate measures to allow this fault exclusion should be applied during the whole lifetime of the device. In order to ensure this, additional measures outside the control system may be necessary. In the case of a position switch, some examples of these kinds of measures are

- means to secure the fixing of the switch after its adjustment,
- means to secure the fixing of the cam,
- means to ensure the transverse stability of the cam,
- means to avoid over travel of the position switch, e.g. adequate mounting strength of the shock absorber and any alignment devices, and
- means to protect it against damage from outside.

System block diagram

Finally, let's look at the block diagram for Category 1. You will notice that it looks the same as that for Category B, since only the components used in the system have changed, and not the architecture.

Key

i_m interconnecting means
I input device, e.g. sensor
L logic
O output device, e.g. main contactor

Figure 9 — Designated architecture for category 1

Figure 3 – Category 1 block diagram [1, Fig. 9]

References

[1] *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*. ISO Standard 13849-1, Ed. 2. 2006.
[2] *Safety of machinery — Safety-related parts of control systems — Part 2: Validation*. ISO Standard 13849-2, Ed. 2. 2012.
[3] *Safeguarding of Machinery*. CSA Standard Z432. 2004.

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2013 Symposium Review

Symposium Review

by Gary Schrempp

On October 7, 8 and 9, 2013, more than 180 compliance professionals attended the 10th Annual IEEE Symposium on Product Compliance Engineering. From its humble beginnings 10 years ago in Santa Clara California, the Symposium has grown into the signature and defining event for our compliance community.

With four concurrent tracks inclusive of more than 50 individual presentations and more than 20 exhibitors, the 10th annual Symposium was the biggest and most diverse yet.

The event was hosted at the Westin Hotel at the Domain, which proved to be a fine meeting venue with easy access to all the meeting facilities and excellent food choices. The Domain features more than 100 upscale and mainstream retail stores and restaurants, in an area that includes hotels, office space and residential units.

Gary Schrempp, Symposium Chair, presents Joe Bhatia with Keynote Speaker appreciation award.

Mr. Joe Bhatia, President and CAO of ANSI, gave the keynote address. He discussed the strategic value of standardization and the many ways that standards are critical to business success.

Mr. Rich Nute is presented the Symposium Best Paper Award.

Mr. Rich Nute received the Symposium Best Paper Award for his work on Hazard Based Safety Engineering and Risk Assessment. He had tough competition for the award as there were many fine papers presented.

IEEE PSES Presidents: Kevin Ravo, Elya Joffe, Murlin Marks, Henry Benitz, Jim Bacher, and Mark Montrose

The Symposium saw a rare meeting of all the IEEE Product Safety Engineering Society Presidents, past, present and future.

Continued on Page 42

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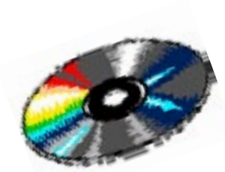

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Continued from Page 40

Enjoying box lunches.

The Symposium offered a great opportunity to visit with vendors of compliance products and services, and to network with other compliance professionals.

Mr. Elya Joffe, current President of the PSES, presented the Chapter of the Year for 2012 award to Kevin Ravo, incoming PSES President and Vice-Chair of the Santa Clara Valley Chapter.

Please note that the Symposium papers are available on the PSES website: http://ewh.ieee.org/soc/pses.

The 2014 Symposium is scheduled for May 5–7 in San Jose California. The Call for Papers has been issued and is available on the PSES website. We hope to see you all there.

The PSES Mascots – Longhorn and Monkey

Gary Schrempp, Symposium Chair, is Director – Global Regulations and Product Safety Investigations at Dell| Worldwide Regulatory Compliance.

New PSES Members

from 26 September 2013 through 17 December 2013

Our new members are located in the following countries: Australia, Belgium, Canada, Germany, Hungary, India, Korea (South), Malaysia, Mexico, Panama, United Kingdom, USA

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Ashok Kumar
Barry N Rodgers
Bhanu Pratap Sood
Bryan W Winningham
Chad Kious
Charlie Shaw
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Cristian Lambiri
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We invite applications for Institutional Listings from firms interested in the product safety field. An Institutional Listing recognizes contributions to support publication of the IEEE Product Safety Engineering Newsletter. To place ad with us, please contact Jim Bacher at j.bacher@ieee.org

The Product Safety Engineering Newsletter is published quarterly during the last month of each calendar quarter. The following deadlines are necessary in order to meet that schedule.

Closing dates for submitted articles:

1Q issue: February 1
2Q issue: May 1
3Q issue: August 1
4Q issue: November 1

Closing dates for news items:

1Q issue: February 15
2Q issue: May 15
3Q issue: August 15
4Q issue: November 15

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