# The Product Safety Engineering Newsletter

Vol. 1, No. 1 September 2005


## What's Inside



# President's Message

### A Home for Safety Engineers

After nearly 18 years, the desire for a professional organization representing product safety engineers worldwide has come to fruition. However, the process of being a professional Society has just begun. We are now recognized by the IEEE as a professional Society, so what else do we need or want? Achieving recognition as a professional Society is one thing, but actually executing a business plan that provides benefits to members is quite another. The next phase is critical because the number one question most people ask when joining a Society is, "What can this group do for me?"

On 1 January 2004, the Technical Activities Board (TAB) of IEEE gave birth to the PSES. We are unique because we are the first society in nearly 20 years to be established from a technical committee of an existing Society. (EMC sponsored us since 1991.) The traditional manner of establishing a Society is to have multiple Societies with a mutual interest in a particular field of engineering form a Council. The Council receives financial support from member Societies, develops a Journal with experienced editors, hosts conferences with no direct financial liability, and is governed by a Board of Directors (BOD) containing senior administrators appointed by member Societies.

PSES was born with no money, no publication, no conference, a BOD comprised of individuals not familiar with IEEE politics and administration, no policies and procedures, no history, no professional affiliation with non-IEEE entities, and no governance. We had to establish an infrastructure without help from

*The*
**Product Safety Engineering Newsletter**

The Product Safety Engineering Newsletter is published by the IEEE Product Safety Engineering Society. No part of this newsletter may be reproduced without written permission of the authors. All rights to the article remain with the authors.

Opinions expressed in this newsletter are those of the authors and do not necessarily represent the opinions of the Society or any of its members. Indeed, there may be and often are substantial disagreements with some of the opinions expressed by the authors.

Copyright 2005 IEEE Product Safety Engineering Society.

# Newsletter Committee

Editor:

| | | | |
|---|---|---|---|
| Gary Weidner | 1-563-557-0717 (v) | 1-563.557.0725 (fax) | gweidner@ieee.org |

Co-Editors:

| | | | |
|---|---|---|---|
| Michael S. Morse Ph. D. | | | mmorse@sandiego.edu |
| Richard Nute | | | rich.nute@hp.com |

Institutional Listings:

| | | | |
|---|---|---|---|
| Your Name | 1-xxx.xxx.xxxx (v) | 1-xxx.xxx.xxxx (fax) | xxxx@xxxxxx.com |

News & Notes:

| | | | |
|---|---|---|---|
| Your Name | 1-xxx.xxx.xxxx (v) | 1-xxx.xxx.xxxx (fax) | xxx@xxxxxx.com |

Acitivities Editor:

| | | | |
|---|---|---|---|
| Your Name | 1-xxx.xxx.xxxx (v) | 1-xxx.xxx.xxxx (fax) | xxx@xxxxxx.com |

Page Layout:

| | | | |
|---|---|---|---|
| Jim Bacher | 1-937.865-2020 (v) | 1-937.865.2048 (fax) | jbacher@speakeasy.net |

# IEEE PSES Officers

| Executive Committee | Name | Term |
|---|---|---|
| President | Mark Montrose | (04-05) |
| President Elect | Henry Benitez | (05) |
| Secretary | Murlin Marks | (04-05) |
| Treasurer | Dan Arnold | (04-05) |
| Vice President - Communications | Jim Bacher | (04-05) |
| Vice President - Member Services | Daniece Carpenter | (04-05) |
| Vice President - Technical Activities | Richard Pescatore | (04-05) |
| Vice President - Conferences | Elya Joffe | (04-05) |

Directors At Large

| Term Expires 12/05 | Term Expires 12/06 | Term Expires 12/07 | Ex Officio (without vote) |
|---|---|---|---|
| Gerry Blessing | Daniece Carpenter | Jim Bacher | Chapter Chairs |
| Jack Burns | Ted Freeman | John Freudenberg | Standing Committee Chairs |
| Murlin Marks | Richard Georgerian | Bansi Patel | IEEE HQ |
| Richard Pescatore | KRS Murthy | Dan Roman | IEEE TAB Division VI Director |

# IEEE PSES Web Sites

http://www.ieee-pses.org/
http://www.ieee-pses.org/symposium/
http://www.ieeecommunities.org/emc-pstc
http://www.ieee-pses.org/emc-pstc.html
http://www.ieee-pses.org/newsletters.html
http://www.ieee-pses.org/pses.html

any sister Society, including EMC. It takes time to learn how to walk. Although still in the infant stage, we have a dedicated board of directors—all volunteers—most of whom pay their own way to attend board meetings and related activities.

Year one of PSES existence saw these accomplishments: development of a conference structure and format; creation of a communication system between IEEE, PSES and members; establishment of relationships with sister Societies; development of a proposal for a Journal; and beginning development of a Policies and Procedures Manual. In addition, BOD members had to learn how to govern a professional society under the not-for-profit laws of the State of New York, where IEEE is incorporated.

In year two, programs identified by the BOD as critical to the success of the society are being implemented, again with limited money in the bank. TAB management is surprised that we can provide member services with limited resources. *The secret is that we can achieve everything we want by remaining a virtual Society, something other Societies and councils wish they could become.*

If members feel that paying a Society membership fee and sitting on the sidelines entitles them to demand instant gratification, we will not achieve our goal of delivering products such as an on-line journal, newsletter, tutorials, and employment services. For PSES to become successful, members need to see the potential payback of supporting it.

The financial cost of PSES involvement is negligible compared to the intangible, and eventually tangible, benefits. As we strive for critical mass, the support of many individuals is necessary. If you do not join PSES because we have few benefits today, we may never be able to provide them, because it takes financial resources to develop benefit programs and publications.

We have gained some momentum. Do not let it die due to apathy or unwillingness to join the society because it costs a few dollars. A suggestion: don't rely on your employer to pay your IEEE fees. The fact is that most members pay Institute and Society fees from their own wallets because they believe in this Society.

The PSES goal is to serve members. Please tell us what you want and how we can achieve this together. E-mail comments and suggestions to m.montrose@ieee.org. We were created for you, and the only vision of the BOD is to serve our membership. We need your comments and ideas regarding Society programs and benefits. The more input we receive, the better the society becomes.

Mark I. Montrose
IEEE Product Safety Engineering Society President, 2004-2005

## 2005 IEEE Symposium On Product Safety Engineering 3-4 October 2005

http://www.ieee-pses.org/symposium/

The IEEE Product Safety Engineering Society is holding its second annual Symposium on Product Safety Engineering on 3-4 October 2005 in Schaumburg, IL (a suburb of Chicago). The venue will be: Hyatt Regency Woodfield, Schaumburg, IL 60173 USA

### *The Value of this Symposium:*

The IEEE PSES Symposium provides attendees an interactive experience on the latest advancements of product safety engineering. Through multi-disciplinary presentations and cross-functional dialogue. First time and veteran attendees can take away the tools necessary to meet today's challenges. Both IEEE and non-IEEE members are encouraged to attend.

### *Who Should Attend:*

The symposium is a forum for exchanging ideas, practical experiences, work experiences and business cards. The target audience includes, but not limited to, those involved with safety engineering.

For additional information and the for the very latest details about the symposium, please visit our symposium website.

# Chapter Safety Probes

## Central Texas Chapter

Chairman : Daniece Carpenter
daniece_carpenter@dell.com

The Central Texas Capter meets on a monthly basis with presentations on product safety related as well as general interest issues. Some of the recent presentations have been: "Product Safety 101: A Primer", "RFID", and "Power Cords 101". Upcoming presentations include presentations on the Hot-Flaming Oil test, a presentation from a Product Liability Lawyer, and a presentation on NRTL (Nationally Recognized Testing Laboratory) selection.

## Santa Clara Chapter

Chairman : Tom Burke
Thomas.M.Burke@us.ul.com

Next meeting is scheduled for Tuesday evening, September 27th, (subject to change).
Date: Tuesday, September 27, 2005, 7:00pm
Place: Applied Materials, Bowers Cafe, 3090 Bowers, Santa Clara, CA
Presenter: Ashley Harkness, ETI Conformity Services
Topic: Circuit breakers (and overcurrent protection devices)

## Oregon Chapter

Chairman : Henry Benitez
h.benitez@ieee.org

We had an excellent 2004/2005 PSES season with the local Oregon and SW Washington Chapter. We had 7 chapter meetings from September and May.
A very successful colloquium was held in April. We had ~70 people, a full ballroom of exhibiters and generated a surplus for the chapter of ~$8000.

Chapter officers were as follows:
Chair - Henry Benitez, ElectroMagnetic Investigations, LLC
Vice Chair - Barry Mroz, Intel Corporation
Treasurer - Art Henderson, Compeer Group
Secretary - Al Warren, Safety Thru Design
Communications - Dean Jurgensen, Logitech
Membership - Juha Junkkarinen

For 2005/2006, Dean Jurgensen was elected Chair and Ali Elmi will takethe Communications position.
We look forward to an exciting new season of Chapter meetings and excellent speakers.

## Chicago Chapter

Chairman : Ken Tomas
kthomas@globalsafetysolutions.net

The Chicago chapter of the Product Safety Engineering Society welcomes everyone to the 2005 Product Safety Engineering Society Symposium. We look forward to seeing you there!

In November we will be having our local quarterly meeting. All are welcome. We will have an open question and answer session with the General Manager of UL Northbrook. During the meeting, UL will discuss recent organizational changes, UL's focus for the future, and answer questions from the audience.

All are welcome to the meeting. IEEE membership is encouraged but not required. Exact date and location to be announce on the Chicago chapter PSES website at http://ewh.ieee.org/r4/chicago/pstc/ .

## Rochester NY Chapter

Chairman : James Shipkowski
james.shipkowski@kodak.com

## Central New England Chapter

Chairman : John Freudenberg
jmfreudenberg@excite.com

## Orange County Chapter

www.ieee.org/oc-pses

Chairman : Charlie Bayhi
CPSM Corporation
bayhi@cpsm-corp.com

Vice-Chairman
Paul Herrick
Product Safety Consultant
jpherrick@yahoo.com

Secretary
Randy Flinders
Emulex Corporation
rflinders@ieee.org

Treasurer
Thomas Ha
G&M Compliance.
tom@gmcompliance.com

Next Meeting:
September 27th, 1:30pm - 5:00pm
Presentation on RoHS and WEEE
Location: Alcon Surgical in Irvine, California
Contact Randy Flinders at rflinders@ieee.org for additional information.

# IEEE PSES International Chapters

## Taipei Taiwan Chapter

Chairman : Zenon Wang
Zenon_Wang@DELL.com

See Report on Page 22

## Vancouver Chapter

Chairman : Mohamed Omran
mohamed.omran@csa-international.org

## Israel Chapter

Chairman : Moshe Henig
moshe_h@itl.co.il

The Israeli preborn PSES Chapter started its activity with a seminar that was held in Tel Aviv University on July 21 2004, with the sponsorship of Tel Aviv University, UL Italia, and ITL (Product Testing) Ltd. trying to promote the preborn Chapter. The meeting main presentations were: UL 60950 Safety Challenges Practical look at typical challenges in safety design.
Product Safety Certification: Constraint or Resource?
Telecommunication requirements (ACTA Part 68 & NEBS) safety aspects.
There was a nice show up despite the short warning.

Another meeting of the group took place in May 10 2005 trying to form the chapter (note that we were 11 for nearly a year) and to organize the next seminar

# People Looking To Start Chapters

## Denver Colorodo

Richard Georgerian
voice: (303) 417-7537
fax: (303) 417-7829
e-mail: richard@ieee.org

## Dallas Texas

Mike Cantwell, PE
Sr. Account Representative
Intertek ETL SEMKO
420 N. Dorothy Dr.
Richardson, TX 75081
Tel: 972-238-5591 x107
Fax: 972-238-1860
e-mail: mike.cantwell@intertek.com

# The Role of Persuasion in Product Safety

*by Robert Pater*

*Ed. note: We claim Samuel F.B. Morse as the father of the telegraph, even though he was not the first to experiment with such a device. Morse was, in fact, an artist, and painter. Most of the technical innovations of his early telegraph are attributed to advisors, partners, and employees. Morse is described as "warmly sociable,", "a natural leader," and his invaluable contribution was to persuade a skeptical and indifferent populace and Congress of the telegraph's potential. Product safety professionals often need to also persuade people. This article highlights reasons why factual information alone often fails to persuade.*

Persuasion is the name of the big game in organizations. Product safety professionals' effectiveness can ultimately depend on their ability to persuade others.

According to Marty Walsh, Director of Product Safety for BSH Home Appliances Corp., persuasion challenges can encompass:

- "Influencing mid-level managers to make products and literature available for review by the Product Safety Professional in a timely manner;"
- Persuading "line managers to implement changes made to avoid low-level or unlikely hazards;"
- Affecting "Marketing/Publications to get valid, appropriate and consistent cautions and warnings into all of the product literature;"
- Having Marketing/Publications schedule into a development cycle appropriate safety reviews for all product manuals.

The Director of Engineering of an NRTL mentions these persuasion concerns:

- Influencing management to allow technicians and engineers sufficient time to adequately test products and document findings;
- Getting engineers and techs to agree on a consistent interpretation of product requirements;
- Having senior executives provide resources;
- Lawyers to listen and make better decisions in the product safety arena;
- Customers to positively accept expertise.

Persuasion entails eliciting approval, reducing "them vs. us" mentality, helping resistant people change, and influencing others to think of product safety as critical, rather than extraneous or a bother to their "real job." Premier safety professionals are agents of change. Raising an organization to the highest level of concern for product safety entails getting and maintaining others' attention and motivating them to change. People are usually under pressure to work harder and faster. They would prefer to continue doing the same things in the same ways they always have. In contrast, a prime directive of the product safety professional is to help everyone see potential risks and future consequences. And, we are striving to get the attention of everyone from executives to mid-managers to line staff¾within a climate of multiple distractions.

Not all communication (i.e. persuasion/influencing) opportunities are created equal. The highest leverage persuasion points are group presentations or conferences where the safety initiative (and you) are on display, individual meetings with key staff, program introductions, and briefings to management. Too often, these opportunities to address safety concerns fizzle. But with a practical strategic approach and suitable skills, product safety professionals can increase their persuasion productivity. There are many ways to persuade. This article provides an overview of principles you might use to heighten your persuasive powers, whether communicating "up," "down," or "sideways."

**Persuasiveness**

Why bother spending time attempting to influence others? Especially when you're dealing with hardheaded managers, know-it-all engineers, cynical supervisors, who-cares employees or I-want-everything customers? Working through them helps us accomplish our mission. And, the good news is, experience shows it is possible to turn around even the most resistant, overwhelmed, and skeptical.

Boosting your powers of persuasion will:

- Improve your safety communications;
- Elevate acceptance of safety, moving from "that's unrealistic", "this just slows us down, gets in our way" or "ho-hum" to "the company is genuinely concerned;"
- Save you from having to say the same things multiple times;
- Reduce frustration;
- Engender more positive and pleasant interactions

with everyone;
- Accelerate acceptance of new ideas;
- Gather support for new programs;
- Enhance your reputation as a leader and provide luster to your career prospects.

Probably many product safety professionals would privately admit that their "people skills" are only so-so, that they cannot see themselves becoming skilled motivators. Others show skepticism to the concept of persuasion, as if being persuasive is inherently at odds with being "professional." I invite you to consider abandoning binary thinking. Life doesn't have to be either/or. It is possible to be scientifically cogent and also be skilled at communicating your knowledge in a way that induces change.

Some professionals presume that people act rationally: "If they understood the potential impact of their choices, they would surely act differently." This assumption goes against my experience. What I've seen is that information itself¾even the best, most scientifically-accurate¾doesn't necessarily induce change. If information caused change, few would smoke, and people would be in good shape, eat healthily, manage stress well, and take all reasonable safety precautions. I suggest that people operate from an emotional component and pre-set attitudes and habits; that it is critical to sell them on programs and desired behaviors to adopt, not simply "inform them." How you communicate, how you package your information can make the difference between your being ignored or mocked on one end or reaching and sparking change on the other.

The key to persuasion is to engage yourself and then others. Have you seen the results of ineffective attempts at persuasion?
- Confusion, as people get mixed messages;
- Intimidation, people saying, "I understand" when they don't, because they feel they ought to;
- False commitment, halfhearted promises;
- Unanswered objections or concerns that prevent wholehearted alignment;
- Rebelliousness, refusal and resistance;
- "Work to rule" (or, "I'll do exactly what you say, to the letter of the law, to show you how unrealistic this is.");
- Misunderstood priorities, which can lead to "putting the cart before the horse;"
- Lack of future judgment (e.g. saying, "I'm right because I'm the Director of Engineering" doesn't help the next time the person has to make a decision.);
- Low morale, resulting from feeling "set up" or that leaders don't care;
- Negative view of product safety;
- Poor reputation of product safety professional;
- Unresolved conflict;
- Stony reactions;
- Budget cuts;
- Lack of buy-in to proposed programs or initiatives;
- Loss of future influence opportunities;
- Loss of job.

**Two-way Communication for Persuasion**

Communication can make or break a program. Effective communication can make product safety interesting, heal minor problems before they loom larger, and elicit support. It is the carrier wave for changing others' knowledge, beliefs, attitudes and values.

I suggest thinking of two types of persuasive communication:
1. *Projective*, where you actively attempt to change people's behavior, attitude or skills;
2. *Receptive*, where you help reduce blockages to change, facilitate gathering of needed information, show interest in others point of view, surface underlying problems, or support a problem-solving process.

In my experience, most people think of "persuasion" as solely a projective process: I talk and others listen; I tell and they do. This was perhaps more the case during command-and-control periods of history. But we no longer live in an era of obedience. Higher levels of education and dissemination vehicles such as cable TV and the Internet have leveled the information fields. For a variety of reasons, trust in authority appears to be plunging. This is neither positive nor negative but a factor to acknowledge and work with. Fighting the way things are is a losing battle; the result is a disconnection that makes it even more difficult to align others to the desired course.

But a purely "receptive" approach seems to lack leadership and be haphazard and arbitrary. It is unlikely to focus people toward a common safety mission.

"Both" beats "either-or." Critical keys to strong persuasion include being able to do three things:
a. Recognize the times to be projective;
b. Identify when it is better to be quiet and listen;
c. Actually be able to shift from second (talking, pro-

jecting) to neutral (receptivity) at will.

**Projecting While Minimizing Pushback**

Giving out information is critical in product safety. As technology, requirements, standards, and expectations change, it's important to get these changes across to everyone. How you communicate can make all the difference in whether information is accepted on one hand, or rejected on the other.

For example, if you work in an atmosphere where there is suspicion of authority, it is not good strategy to play "the expert"¾"I'm the product safety professional with a degree and/or lots of experience and I know, and you don't." This usually results in others laying in wait for you to make a mistake, or their just ignoring or resisting.

How you phrase things makes a significant difference. Better to say, "This is what I've found¼" or "In my experience¼" rather than "This is the right way¼" or "This is scientific fact¼" I remind myself that it matters less what I know than what others accept and do. And, the tone of voice I use has to be consistently appropriate. "Suggesting" or "offering" in an authoritative tone of voice undoes my attempt at effective persuasion.

I'd offer the observation that "the right way" and "scientific facts" change as new studies come out. For example, I remember as a Boy Scout being taught that medical experts said to never loosen a tourniquet. A few years later the direction was to loosen it every so often to prevent loss of that limb. But a few years after that, medical experts were saying to never use a tourniquet. When projecting, it's always best to honestly caveat your suggestions. Examples: "Based upon what we see now¼", "As things currently stand¼", etc. In the same vein, even when you want to make a strong statement of commitment, it's still a good idea to reduce potential future pushback (and not appear to be a "liar") by changing definite, forever statements to ones that say, "for now", "at this time" or "through the next quarter."

To get the most out of projective communication, you might keep in mind:

- Use words that are personal. "In my experience¼" or "What I've found¼" are less likely to be resisted than "This is the way it is."
- Offer, don't push. Better to say, "You might consider" than "You should," "You must," or "You have to."
- Take time to make contact with the other person, prior to projecting ways you'd like them to consider changing. There are several ways to make initial contact, such as taking a few moments to ask about something of personal interest to the other person or group, matching their initial "pace," or making strong eye contact.
- Vary projective communication with receptivity. In other words, take time periodically to stop talking and ask for questions. Watch facial expressions and body reactions for signs of disagreement, lack of understanding, tuning out. A communications expert once said that he watched a person's face for the quality of their reaction and their body, especially their hands, for the quantity of that reaction.
- Pass along what you do know, rather than keeping people in the dark until all plans are settled.

**Boosting Your Reception**

While many associate projective communication with being a strong leader, charismatic, and an influence agent, projection is not enough. It's critical for safety professionals to actively solicit information, and do it in a way that puts people at ease.

Receptive communication gives you information you need about the perspective of those whose behaviors you would hope to see changed. Receptive communication is most useful for:

- Eliciting objections;
- Gathering information you might not have considered;
- Helping people get concerns off their chest so they are in more of a position to consider a new way of acting;
- Getting buy-in;
- Defusing anger and other strong emotions that can otherwise get in the way of considering new ideas or procedures;
- Giving you feedback on your ideas and programs for change.

Selecting a receptive mode is useful for listening to and acknowledging criticisms and concerns. But these kinds of situations can potentially be explosive. How can you put the odds greatly in your favor of getting the benefits from receiving less-than-positive responses without throwing fuel on the fire and blemishing your credibility (especially in a tenor of uneven trust or morale)?

- Prepare yourself in advance to not show defensiveness. Reacting with anger or justification ("We have

# Technically Speaking

**Watch this space for the return of Rich Nute's column!**

## 2005 IEEE Product Safety Engineering Symposium
## 3-4 October 2005

rules we have to follow!" or "I'm working my utmost for safe products, and all anyone does is complain!") shuts down your receptivity and can send the message you really weren't interested in listening to what they had to say. Next time, they'll likely not tell you what they're thinking. You might remind yourself that, for many people, letting their hair down requires trusting you to a certain degree. This can be a good sign. Sometimes, not revealing their concerns is more dangerous than letting you know.

- Take along paper and pen. As early as possible, tell those you're listening to that you would like to take notes so you don't miss anything they say. Tell them you'll share these notes with them if they'd like. By taking notes, you'll not only capture more information, it will give you something positive to do rather than get defensive, send a message you value what they say, and provide a valid reason for not making continuous eye contact if you become nervous or reactive.

Develop your receptive ability to better read others. Practice in watching and listening will enable you to improve the quality of the feedback you receive and allow you to make adjustments in your communications midstream. For example:

- If you're "losing" them, re-explain last points, and ask if this is clear.
- If they're resistive, adjust your pace to match theirs, or ask if they see any problems/have any concerns.
- If they look quizzical, ask if they have questions.
- If they look bored, raise the energy level:
  - Be silent for a short time to get their attention;
  - Ask them if there's something on their mind;
  - Enlist/show a prop or visual aid;
  - Raise your own energy level¾move around, change your voice tone, volume, or speed;
  - Get them moving;
  - Suggest taking a break and get back to them later.

As others feel more listened-to and their thoughts truly considered, they will be more likely to hear and consider what you have to say. If you want others to listen to you, start by listening to them. If you want others to be influenced by you, you can take the lead by first showing you are open to being influenced by them.

We influence others all the time, not always consciously and not altogether positively. Our behavior broadcasts continuous messages. We persuade by:

- What we say;


## *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.

IEEE | PSES Product Safety Engineering Society

E-Mail List: http://www.ieee-pses.org/emc-pstc.html
Virtual Community: http://www.ieeecommunities.org/emc-pstc
Symposium: http://www.ieee-pses.org/symposium/

Membership: The society ID for renewal or application is "043-0431". Yearly society fee is US $35.

- What we hold back/don't say;
- How we say it (tone of voice, nonverbal communication);
- What we do¾even when we're not "on"/trying to persuade.

**The Power of Proximity in Persuasion**

There are many ways to influence others, whether it be up, down, or sideways. In general, persuasion is governed by the Gravitational Law: the closer two objects are, the greater the pull they exert on each other. Translated into persuasion terms, this "inverse square" law suggests:

- Face-to-face communications (one-on-one or meetings) have the greatest potential for persuasion because they are the "closest" kind of communication;
- Next in line of power for persuasion is communication by voice/phone;
- Last in potential persuasion power is written communication such as email or letters.

"Closer" communication vehicles require more time investment. Sending an email to a large group is certainly time efficient, but it has less potential for energizing change. There are situations where making a difference is more important than efficiency. Writing a report to persuade management to raise a budget you and others will live with for at least a year won't be as effective as delivering it in person with a strong presentation.

In addition to choosing the right medium (face-to-face, voice, e-mail), there are others ways you can use proximity to leverage your persuasion power. For example, in face-to-face communications, position yourself as close as practical to those you wish to influence without overstepping what nonverbal communications experts dub the others' "working distance." Just slowly close the gulf between you and the other person, watching their eyes to be sure they don't tighten up, indicating they feel their space "invaded." If they do tense, just back up half a step. Similarly, consider that in a group presentation, standing behind a podium creates distance between you and the group. Instead, try putting your notes on top of the podium and standing to its side.

The principle of proximity can also be used to boost persuasion with people in locations that are removed from you. Find ways to bridge the distance (e.g. site visit or other contact) prior to seeking to institute changes where others' buy-in is important. In general, closeness boosts persuasive power.

**Select an Influence Strategy**

Generally, influencing senior managers, who have the greatest chance to set and change direction, offers the most leverage in creating organizational change. But don't put all your influence eggs in one basket.

For perspective, one leader in the product safety field indicated he divided his persuasion time this way:

- 25 percent with mid-management;
- 20 percent working with line staff;
- 10 percent with senior management;
- 15 percent with other professionals;
- 15 percent with customers;
- 5 percent with lawyers;
- the remaining 10 percent among "all others."

In addressing different people within a company, it helps to make sure that the message is communicated in a way that will interest them. Much motivation is negative. ("Do this or else you will be written up," or "We'll look bad," or "I'll be on your back.") Focusing only negatively is limited and raises levels of pushback and conflict.

A more successful way to motivate people is to draw them to the desired action by offering benefits. Focus on what's in it for them to participate/take direction/do the project in addition to merely preventing something negative from happening that they may not believe will really happen. You might also ask yourself, "What are they afraid might happen? What do they want to happen? How can I help them improve in what's important to them?" This type of thinking can lead to employing off-work motivators such as family, improvement in their favorite activities, or being more like favorite sports heroes.

We've found this approach extremely successful in our work worldwide. The art of persuasion is vast. But by adjusting your approach to fit others, employing projective and receptive communication as needed, and using principles such as the power of proximity, you can significantly increase your ability to persuade others.

*Robert Pater is Managing Director, Strategic Safety Associates (www.masteringsafety.com, 503-977-2094) He has a master's degree in Industrial Psychology and an undergraduate degree in Organizational Development.*

**Continued on Page 13**

**Bibliography:**


Gibb, Jack. *Trust: A New View of Personal and Organizational Development*, Guild of Tutors Press, 1978

Klein, Josephine. *The Study of Groups*, Routledge, London, 1978

Minter, Stephen. "Have You Heard About Safety?" (interview with Robert Pater), *Occupational Hazards*, October 15, 2003. http://www.occupationalhazards.com/articles/index.php?id=10727

Pater, Robert. *How to Make High-Impact Safety Presentations, Second Edition*, American Society of Safety Engineers. Des Plaines. 1995

Pater, Robert. *Leading From Within: Martial Arts Skills for Dynamic Business and Management*, Park Street Press, Rochester (VT). 1999

Pater, Robert. "Secrets of Involvement, Part I," *Occupational Health & Safety*, December 2000

Pater, Robert. "Secrets of Involvement, Part II," *Occupational Health & Safety*, January 2001

Pater, Robert. "Fighting the uphill battle: How to get managers to see the safety light," *Industrial Safety & Hygiene News*, July 1998

Pater, Robert. "Seeking safety leadership from the top: Five strategies for winning management support," *Industrial Safety & Hygiene News*, August 1998

Pater, Robert. "Paying Attention Leads to Better Safety, Productivity," *Professional Safety*, January 2001

Pater, Robert. "How to Make High-Impact Safety Presentations," *Professional Safety*, February 1988

Pater, Robert. "Leadership Skills for the 21st Century," *Occupational Health & Safety*, March 2002

Watzlawick, Paul. *How Real Is Real?: Confusion, Disinformation, Communication*, Vintage, 1977


## We are looking for Product Safety Articles!

Please send proposeals for articles to:


Gary Weidner
Editor, IEEE PSES PSE Newsletter
GW Technical Services Inc.
2175 Clarke Drive
Dubuque, IA 52001-4125
phone = 563-557-0717
fax = 563-557-0725
e-mail = gweidner@ieee.org


## Volunteers Needed!

*Copyright 2004 IEEE. Reprinted with permission of IEEE, EMCS, and the authors. This article originally appeared in Issue 203 of the EMC Society News/etter.*

# Practical Papers, Articles and Application Notes

*Robert* G. *Olsen, Technical Editor*

In this issue you will find one practical paper that should interest members of the EMC community. It is entitled, "The Jammed Wheelcha A Case Study of EMC and Functional Safety," by Dick Groot Boetle and Frank Leferink. In this paper, the authors note that it is not always straight forward determining which standard or standards apply when conducting EMC product safety tests. Further, they note that the answer to which one or ones apply can have a large influence on the parameters used for the testing. I think that the paper will cause all of us to think a bit harder before conducting product safety tests. The paper was originally presented at EMC Europe 2004.

The purpose of this section is to disseminate practical information to the EMC community. In some cases, the material is entirely original. In others, the material is not new but has been made either more understandable or accessible to the community. In others, the material has been previously presented at a conference but has been deemed especially worthy of wider dissemination. Readers wishing to share such information with colleagues in the EMC community are encouraged to submit papers or application notes for this section of the Newsletter. See page 3 for my e-mail, FAX and real mail address. While all material will be reviewed prior to acceptance, the criteria are different from those of Transactions papers. Specifically, while it is not necessary that the paper be archival, it is necessary that the paper be useful and of interest to readers of the Newsletter.

Comments from readers concerning these papers are welcome, either as a letter (or e-mail) to the Associate Editor or directly to the authors.

# The Jammed Wheelchair: A Case Study of EMC and Functional Safety

*Dick Groot Boerle[1], Frank Lejerink[1,2]*

*1 Thales Netherlands*
*P.O. Box 42*
*7550* GD *Hengelo*
*The Netherlands*
*dick.grootboerle@nl.thalesgroup.com*

Abstract: The assessment of the influence of electromagnetic phenomena on the functional safety of electric equipment can be improved. The product standards for electric equipment with safety relevant functions still focus on the functional behaviour. The EMC requirements are quite often composed by following the same approach as for the Generic Standards for the EMC Directive in which only two environments are taken into account. In order to explain this and to show a better approach, a case study has been carried out. The essence of this case is an accident with an electric wheelchair where the culprit was a GSM-phone booster. Point of interest is that the wheelchair did meet the relevant product standard for electric wheelchairs. The shortcomings of this standard with respect to EMC have been established. In addition, it is shown that an assessment should start with an inventory of the environments in which the product might be operated. This improved assessment is in line with the relatively new IEC Technical Specification 61000-1-2: 'Methodology for the achievement of functional safety of electrical and electronic equipment'.

*2 University ofTwente P.O. Box 214*
*7500 AE Enschede*
*The Netherlands*
*frank.leferink@utwente.nl*

## I. Introduction

*Figure* 1. *An ordinary street with cars and an electric wheelchair: one environment - different EMC requirements.*

The picture shows cars as well as electric wheelchairs. For cars we have to apply the word vehicle per Automotive Directive *95/476/EEC* [1].
This Directive has, unlike most other Directives, EMC immunity requirements included. Let us take just one example and look at the requirement for Radiated Immunity. In this standard we see that a car should not become unsafe at electric field strength up to 30 *Vim* in the frequency range 20 MHz to 1000 MHz. In practice, however, product standards like the SAE 1113 [2] or ISO 11452 [3] are used in which the field strength is 200 *Vim* for most frequencies.

Next we take a look at the wheelchair. At first we have to establish which Directive is applicable and for that reason we need the definition of a vehicle, coming from the former Vehicle Directive *70/156/EEC* [4], Article 1:

"For the purposes of this Directive, "vehicle" means any motor vehicle intended for use on the road, with or without bodywork, having at least four wheels and a maximum design speed exceeding 25 *km/h,* and its trailers, with the exception of vehicles which run on rails and of agricultural tractors and machinery. "

So, obviously, a wheelchair is not under the scope of the Vehicle Directive. Instead, the use of electricity makes EMC Directive *89/336/EEC* applicable. The standard to be used to refer to in the Declaration of Conformity is the product standard for electrically powered wheelchairs EN12184, 1999-11 [5]. This standard is currently under revision and will make a normative reference to ISO 7176-21 [6]. Moreover IEC 60601, Medical Electrical Equipment, [7] will include domestic electrical medical equipment and equipment for people with disabilities, thus electric wheelchairs will be included.

If we again consider the requirement for Radiated Immunity we see in the ISO 7176, [6] the most severe requirement: the chair should not become unsafe at an electric field strength up to 12 *Vim* in the frequency range 26 MHz to 1 GHz. So if we compare the product standards we see a 24 dB difference in field strength. Still the car and the wheelchair are operated in the same environment!

In the Netherlands a couple of years ago, an electric wheelchair unintentionally drove off a subway-platform [8]. The driver was badly injured and her insurance company started an investigation with the help of an EMC laboratory. They found that the chair was activated by a field of only a few Volts/meter at a frequency of 1.89 GHz. The manufacturer of the chair did not accept his responsibility by arguing that his chair did meet the relevant product standard for wheelchairs. The radiated susceptibility test in this standard, however, did not go beyond 1 GHz. The judge decided that the manufacturer could have known that 1.89 GHz was a commonly applied frequency for the digital telephone network. The manufacturer was sentenced because he had put an unsafe product on the market. Based upon the cause of the accident, which has been taken as a starting point for this study, it is also interesting to take a look at the frequency bands prescribed in the standards. The product standards for electric wheelchairs, EN 12184[5] as well as ISO 7176 [6] have a clause on EMC, which in fact is taken over from the Generic Standard EN 61000-6-2, Immunity Requirements for the typical industrial environment [9]. The requirements for Radiated Immunity as well as for ESD are practically identical. For the electrical field this means a highest frequency of 1 GHz. Thus, the frequencies for mobile telephones above 1 GHz, like the 1.89 GHz, are not included. Instead, only in EN 12184 there is an informative, and thus not mandatory Annex F, which recommends advising the driver of the chair not to use a mobile phone while seated in the chair. This implies that the accident [8] might happen again, even today. Both standardisation and European Directives are introduced to guarantee the relatively safe participation of people in traffic. If one takes a closer look to the standards and directives, a huge variety appears to be available. If it was only the name of a standard or a directive there would not be questions, but the point is that we see quite different requirements. We also see different approaches in the way safety aspects are treated. The EMC Directive does not include safety aspects. The commonly applied Generic Standards under this Directive even explicitly exclude safety considerations. The reason is obvious; one cannot just add safety tests without knowledge of the product. Therefore, it is important to take a look at supplementary guidance for manufacturers of electric wheelchairs in order to extend their technical construction file with sufficient evidence that all possible measures were taken to avoid unsafe situations. The most suitable possibility is mentioned in [8] and [11], which is the application of IEC 61000-1-2: 'Methodology for the achievement of functional safety of electrical and electronic equipment' [10].

## II. Safety analysis methodology

One of the first steps of the methodology presented in IEC 61000-1-2 is to establish in which environments the product might be operated. The document gives recommendations for defining the electromagnetic environ-

ment and the corresponding recommendations for testing for safety. It is noted that environments are not stable and the influence of mobile electronics has to be taken into account. In this particular case, one might easily conclude that the automotive environment is applicable, although additional possibilities are the 'railway environment', since wheelchairs are allowed in most trains. However, establishing the proper test levels is not the first concern. The methodology includes more and the 'safety analysis' is essential.

The introduced analytical assessment method is based upon one of the "Dependability methods", namely the 'Fault Tree Analysis'. This method is a top-down method.

## III. Application of IEC 61000-1-2

According to clause 8.2, [10] the following steps have to be considered:

1. Aim and intended functions of the equipment
2. Hardware structure of the equipment
3. Software configuration, preferably with the same structure as the hardware
4. Electromagnetic environment and functional test levels
5. Purposes of the hazard and risk analysis (top events)
6. Fault tree analysis
   6.1 Construction of the Fault tree
   6.2 Evaluation of the Fault tree with regard to safety
7. Recommendations for the design of the equipment
8. Conclusions with regards to the test plan for safety:
   - which tests are relevant
   - which tests levels

## IV. Aim and intended functions

Obviously, the electric wheelchair controller is intended to control a wheelchair, which has to be regarded as safety-critical. The controller should carry out two main functions:

- Control the functions of the wheelchair
- Safeguarding

  i.e. check for one independent failure, which might cause an unsafe situation. If such a failure is detected, an independent shut down is necessary. This involves a sequential check for sleeping failures during power-up as well as continuous checking during "power on." Broadly speaking, the system can be in one of three states: off, standby and driving. In the standby state, the wheelchair is stationary with the solenoid brakes applied. Note: The solenoid brakes indicated in Figure 2 are not used for stopping the wheelchair normally. This is done by regenerating power from the motors back into the battery. The solenoid brakes are there as a backup in case the battery is disconnected. One could also regard these brakes as a "parking brake" facility and stop the chair in the event of power failure.

## V. Hardware structure

A typical hardware structure is shown in Figure 2.
General safety measures are related to the process (safety risks):

- Motor current feedback, to detect incorrect speed control and normal braking
- Motor voltage feedback
- Motor temperature feedback, to prevent damage by prolonged heavy use

Specific safety measures are related to the controller:

- Primary safeguards like the watchdog, a check of the watchdog for sleeping failures at power-up, power supply check, reset circuit and sensor checks. The watchdog as well as the processor can activate the solenoid brake driver in case a failure is detected
  Note: The single-fault criterion is normally applied for

wheelchairs, in combination with detection for sleeping failures. This is assumed to provide an acceptable safety level. Obviously, [lO] this is a lower level prescribed, for instance, than for electronic gas burner controllers which have to fulfil the two-failure criterion. This is not a point of criticism, it is just noted. The degree of safety remains an arbitrary and an ethical issue.

## VI. Software configuration

For simplification in this example, only the safety related functions are considered herein.
There are two groups of safety functions to mention:

- Safety checks initiated after power on, sequential checks:
  battery-voltage, motor voltage, motor temperature
- Diagnostic self-checks, made continuously during the oper-
  ation of the controller and the wheelchair

## VII. EM-environment and functional test levels

The wheelchair is intended to operate in many environments. The corresponding EMC functional immunity and safety tests are specified in Table 1. For the automotive environment, higher immunity and safety test levels shall be considered. Note that not all the electromagnetic phenomena listed in Table 1 have been judged of being relevant for this kind of equipment.

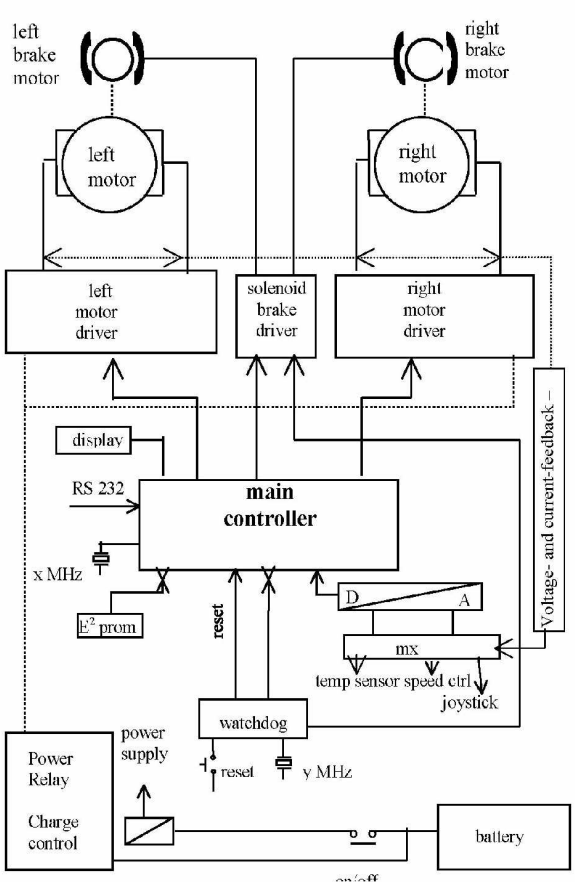



*Figure 2. Wheelchair controller: Hardware structure*

## VIII. Purpose of the hazard and risk analysis

The purpose of the hazard and risk analysis is for the undesirable safety risks or top events, to detect:

- Which electromagnetic phenomena can cause these risks or basic events
- At which places in the device, in order to take appropriate mitigation measures

For an electric wheelchair, four top events can be distinguished:

While driving:

1. Unable to stop
2. Incorrect speed control

In standby:

1. Release of brakes
2. Driven movement of motors

## IX. Fault tree analysis (FTA)

For the purpose of this example, only the case of "Unable to stop" is developed here. In practice, similar FTA's should be made for the other cases.

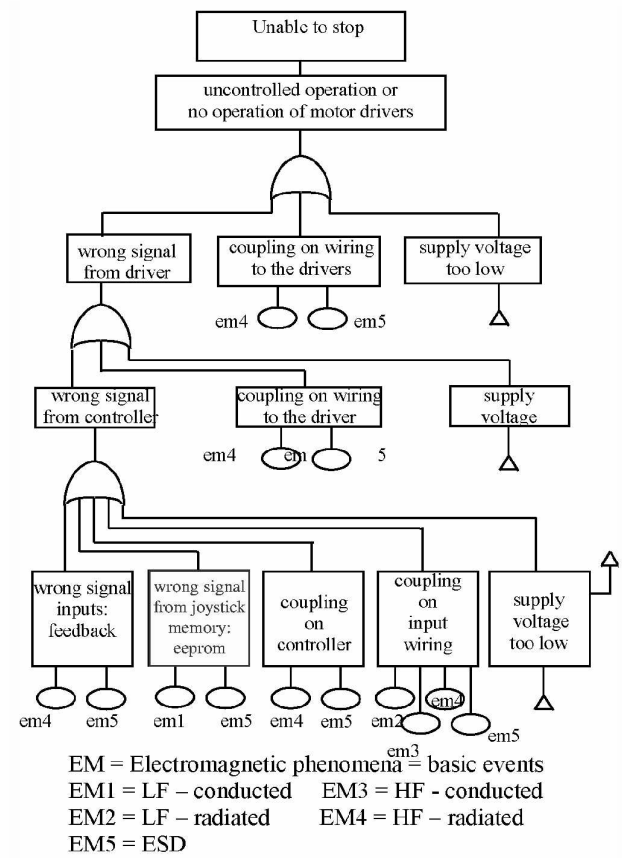



*Figure 3. FTA for the top event 'unable to stop'*

## X. Construction of the fault tree

| *Disturbance basic event* | *Immunity tests Typical functional test levels* | *Safety tests Typical safety test levels* |
|---|---|---|
| Mains-related phenomena | Not applied | Not applied |
| Oscillatory transients | Not applied | Not applied |
| Fast transients on control lines | 0,5 $kV_p$ | 1 $kV_p$ |
| Current injection 150 kHz - 80 MHz on control lines > 1meter | 3 $V_{emf}$ + 6 dB at ISM-frequencies | 10 $V_{emf}$ + 6 dB ISM-frequencies |
| Radiated immunity 20 MHz-18 GHz | 30 V/m | 100 V/m |
| ESD contact<br>air | 4 kV<br>4 kV | 6 kV<br>8 kV |

*Table 1 Example of EM-phenomena and test levels*

The construction of the fault tree has been carried out according to IEC 61000-1-2 [10]. Please note:

- The fault tree considers only EM influences. All other effects that may have an influence on the controller safety such as component failure, wrong handling by the operator ete., shall not be included in this fault tree, in order to be specific with regard to electromagnetic effects.
- Events and EM influences, which are not directly related to the top event, shall not be included in the fault tree.
- The "supply voltage" has to be considered in this case as a "common cause" and is treated only once at the lowest level with a transfer-out symbol. The supply circuit may be quite complicated and should be analysed as a separate sub-system in a separate sub-fault tree.

## XI. Evaluation of the fault tree with regard to safety

The fault tree represents in a general manner which EM phenomena, the basic events, have an influence on the various parts of the device. These EM phenomena can have, according to their level, a more or less strong effect in this device which may lead to the different classes of degradation specified in clause 7 [10]: no significant effect, self-recoverable effect, operator recovered effect but no hazard, hazard. However, not all off these effects may have a critical safety effect. Based on the design of the equipment, e.g. protection measures and on experienced results with other similar equipment, the EMC engineer can evaluate which EM phenomena - at the highest environmental level of the disturbances - can/will have a critical safety impact. Such an evaluation is made for the case of "unable to stop" in Table 2. It shows that:

- Voltage dips and interruptions in the mains, all high fre-quency conducted and radiated phenomena, as well as ESD, may have a critical influence with regard to safety.
- Power frequency magnetic fields and harmonics of the mains voltage are unlikely to have a critical influence, but should perhaps not be fully neglected.
- High frequency radiated phenomena may affect all the ele-ments of the controller.

The table allows one to identifY which parts must be:

- Carefully designed with regard to safety.
- Carefully examined in case of failure when testing for safety.

  Please note that Table 2 shows that some phenomena may be critical for safety, which have not yet been considered in the relevant product standard. These still should be tested.

| EM phenomena / Part of the EUT | | LF-cond | | LF-rad | HF-cond | | | | HF-rad | | ESD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Har | Dip and Int | Magn. .field | Surge | OscTransient | EFT/B | CW | CW | Dig Phone | |
| 1 | Power sup | - | - | - | - | - | X | X | X | X | X |
| 2 | Contr Mem | - | - | - | - | - | - | - | X | X | X |
| 3 | Sensors Joystick | - | - | - | - | - | - | - | X | X | X |
| 4 | Int wiring | - | - | ? | - | - | - | - | X | X | X |
| 5 | Ext wiring | - | - | ? | X | ? | X | X | X | X | X |

*Table 2. Evaluation of the influence of EM-phenomena*
*NOTE: Every X means a probable critical influence*
*Every ? means an unlikely critical influence*
*Every - means a critical influence can be neglected*

## XII. Recommendations for the design

The product standard for electrically powered wheelchairs does not prescribe anything about a "one or two failure criterion." In practice, however, the one-failure criterion is applied: no hazardous situation should be created by a single failure. If a failure occurs in the power supply check circuit only, it is a socalled sleeping failure, which does not cause a hazardous situation. When next the power supply circuit fails and provides a too low voltage, the main controller would not operate properly and might generate random signals to the outputs, which can cause an uncontrolled motor behaviour. This implies that the design requires two layers:

- The control layer
- The primary safeguard layer, being able to detect failures in

the control layer and to stop the wheelchair independently This explanation makes it clear that common cause errors due to electromagnetic phenomena have to be avoided. The control circuit and the primary safeguard circuit should not suffer from simultaneous failures. Therefore, the design requires circuits built with

different technologies and different immunity levels. Furthermore, it is important to realise that if testing has demonstrated critical susceptibility, mitigation measures should be considered carefully. One additional capacitor to suppress a transient voltage that caused an unwanted operation of a motor driver can become defective and thus create a sleeping failure. Finally, it should be realised that the electromagnetic immunity of a separate control unit can change when this module is built into a wheelchair (many wheelchair manufacturers do not design and produce the electronic control units). The layout of the wiring as well as the properties of the enclosure can have a large influence. An immunity test of the entire wheelchair is necessary.

## XIII. Conclusions with regard to the test plan for safety

Following the above analysis, the test plan for safety can be set up. It has to include the following information:

- The electromagnetic disturbances to consider, possibly also
  such disturbances which are not specified in the relevant product standard just with regard to functional immunity in this case for the wheelchair controller: transients and conducted HF on the external wiring, i.e. from the joystick as well as radiated immunity above 1 GHz.
- The test levels for safety, either from the relevant product standard if the latter prescribes specific test levels for safety or the functional test levels enhanced by an appropriate security margin, or possibly specific national requirements.
- The unwanted safety events, the non-occurrence of which has to be checked.

In this case, with the example for just one safety risk, the required safety test levels are specified in Table 1.

Normally, the test set-up and procedures specified in the basic standards IEC 61000-4-xx should be applied, but more severe procedures may be considered. It is recommended not to test the controller alone but the wheelchair as a whole including the wiring, which may be influenced by high frequency radiation.

## XIV. Conclusion

It has been established that different products, both intended for transportation of people, operating in the same environment, still have largely different product standards to meet. The plethora of EMC standards is illustrated again.

The coordination between ISO and IEC can be improved; unfortunately, also the new ISO/FDIS for wheelchairs does not refer to the safety analysis methodology applied in this paper. It is very likely that the accident with the wheelchair would not have happened if this methodology would have been applied.

## XV. References


[l] European Commission Directive 95/54/EC, October 1995

[2] SAE Standard J113, 1994

[3] ISO Standard 11452, Part 2,1995 to Part 7, 2003

[4] European Vehicle Directive 70/156/EEC, 1970

[5] EN12184 Electrically powered wheelchairs, scooters and their chargers - Requirements and test methods, 1999-11

[6] ISO/FDIS 7176-21.2 Wheelchairs - Requirements and test methods for electromagnetic compatibility of electrically powered wheelchairs and motorized scooters 2002(E)

[7] IEC 60601 Medical electrical equipment, Part 1-2: General requirements for safety, EMC requirements and tests, second edition 2001-09

[8] D.J. Groot Boetle EMC and Functional Safety - IEC 61000-1-2 and its Impact, IEEE Symposium 2002 Minneapolis, pp 353

[9] EN 61000-6-2 Generic Standard, Section 2: Immunity for Industrial Environments, page 11, Note 1

[lO] IEC TS 61000-1-2 - First edition - 2001-06 Basic EMC Publication Part 1-2, General-Methodology for the achievement of the functional safety of electrical and electronic equipment with regard to electromagnetic phenomena

[11] D.J. Groot Boetle, G. Goldberg, S.J. Brown, K. Armstrong Functional Safety and EMC Workshop 4th European Symposium on EMC - Brugge 2000, pp 361

# 2006 IEEE Symposium on Product Safety Engineering

## October – Orange County www.ieee-pses.org/symposium

**October, 2006 Sponsored by the IEEE Product Safety Engineering Society**

**Chairman**
Richard Georgerian
richardg@ieee.org
303-218-5748

**Co-Chairman**
Bansi Patel

**Treasurer**
TBD

**Secretary**
TBD

**Technical Program**
Rich Nute
richn@ieee.org
858-655-3329

**Standards Workshop**
Rich Pescatore
Richard.Pescatore@hp.com
805-786-4018

**Exhibits/Promotions**
TBD

**Registration**
TBD

**Arrangements/Logistics**
TBD

**Communications**
TBD

**Webmaster and Program Records**
Dan Roman
Dan.Roman@ieee.org

**At-Large Members**
Jim Bacher
Jack Burns
Daniece Carpenter
Elya Joffe
Mark Montrose

## Call for Papers and Workshops

**The IEEE Product Safety Engineering Society seeks original, unpublished papers and tutorials on all aspects of product safety engineering including, but are not limited to:**

**Products:**

Test and Measurement Products
Telecommunication Products
Industrial Control Equipment
Equipment
Power supplies
Medical Products
ITE Products
Electric Tools
Consumer Products
Home Appliances
Cellular and Wireless

**Hazardous energy sources and body responses:**

Electrical Mechanical (kinetic energy)
Fire
Thermal energy

**Safeguards against hazardous energy sources, including testing of the safeguards:**

Insulation Grounding
Enclosures

**Safety certifications:**

Processes with third-parties
Processes for the submitter
Laws and regulations

**Safety standards:**

Plans for changes and development
Interpretations

## Technical Paper Formats

- **Formal paper:** Presentation to a technical audience. Presentation time is 20-minute increments, i.e., 20, 40, and 60 minute or longer papers. Time includes set-up, introduction of the speaker, Q&A, closing, and tear-down.
- **Poster paper:** Presented in an informal, open forum to individuals or small groups on a continuing basis for up to 4 hours; need not be technical in nature but may include applied engineering techniques and applications.
- **Technical demonstration paper:** Involves demonstrations of test techniques and applications.

Formal and informal papers will be published in the conference proceedings.

## Author's Schedule

| | |
|---|---|
| Intent to present and topic (e-mail) | April 29, 2006 |
| Draft e-paper | June 2, 2006 |
| Notification of Acceptance | July 7, 2006 |
| Complete e-paper | August 17, 2006 |

## 2006 Call For Papers continued

**Intent to present.** The "intent to present" will be used for preliminary organization of the technical program, consideration for possible inclusion in a workshop or tutorial session, and to provide some initial feedback to the author on the paper and its position in the technical program. The "intent to present" does not commit the author or organizer to the paper or session. However, the "intent to present" will be taken as a strong indication that the paper or session will take place; the symposium will hold a place for the paper pending the draft e-paper and acceptance.

Prospective authors, workshop organizers, and tutorial organizers should submit an "intent to present" e-mail (or e-mail attachment) describing the title, topic, objective, and synopsis of the paper, and the type of presentation, i.e., formal, informal, demonstration, tutorial or workshop session, or tutorial session.

**Format.** The completed and finished e-paper must be submitted in IEEE Xplore® PDF format. Please refer to http://www.ieee.org/confpubcenter for details on the submission format. The IEEE has a web-based tool to check the format of PDF files at http://216.228.1.34/pdfexpress/log.asp. Draft e-papers may be submitted in Word or PDF format. Presentations that are to be optionally included in the conference proceedings should be PDF or PowerPoint.

**Draft e-paper.** Acceptance of the formal paper, informal paper, technical demonstration, workshop, or tutorial will be based on the draft e-paper. Draft e-papers are peer-reviewed by select members of the IEEE Product Safety Engineering Society. Acceptance is based on:

> **Importance of Topic:** Does the subject matter have direct significance to the safety community and/or any aspects of products safety engineering?
>
> **Technical Sophistication and Depth:** Does the paper, workshop or tutorial present information that is of a significant contribution, advancement, application or refinement in the state of the art? Does the presentation expose the reader to a higher knowledge level than currently available from other sources?
>
> **Readability, Clarity and Presentation:** Is the objective of the submission clearly defined? Is the material written in a clear and concise fashion, in proper English, and with topics presented in a logical and organized manner?
>
> **Novelty and Originality:** Does the paper propose a new and unique aspect of product safety engineering, or clarify or expand on an existing premise from a unique point of view?

Visual aids, e.g., annotated diagrams, pictures, etc., are highly encouraged.
Prospective Technical Paper authors, including Technical Demonstrations, must submit a draft of the Formal Paper, Informal Paper, or Technical Demonstration.

Prospective Tutorial (single speaker) or Workshop (multiple speakers on a common topic) organizers must submit a proposed title of the session, session objectives, and tentative topics detailing the subject material and relevance to the field of product safety engineering. Workshops and Tutorial sessions are allocated 4 hours, including breaks.

If the draft e-paper is accepted, the author or presenter and organizers must pre-register for the symposium by July 1, 2066. Failure to pre-register by the due date will be cause for the paper to be withdrawn from being presented and published in the conference proceedings.

**Complete e-paper.** The completed and finished e-paper must be submitted in PDF in IEEE Xplore® format. All papers must be orally presented at the Symposium by the authors or their designated presenters.

**Submission.** All communications, including "intent to present," draft e-paper, and complete e-paper should be sent to: richn@ieee.org

# Taiwan Chapter

# 2005 Promotion Party

- **Taiwan Chapter Formation**
- **2005 Feb.**
  Introduction to Burn Hazards
- **2005 Mar.**
  Product Safety Overview of PoE switch
- **2005 Apr.**
  External Power Supply—Energy Efficiency & Stand-by Power
- **Standard Comparison**
  Comparison between ECMA 287, IEC 60065 and IEC 60950-1

TW Chapter Officer:
Zenon_Wang@ieee.org
Maurice_Wu@ieee.org

## Technical Briefing

### Burn Hazards

2005 Feb. 16

……the researchers worked with 29 healthy volunteers aged 21 to 35, measuring two one-hour sessions of scrotal temperatures on different days with and without laptops. The men were dressed in the same casual clothing for each session and sessions. Body temperature was taken by mouth beforehand and each volunteer spent 15 minutes standing in the room to adjust to room temperature before being seated……

### Power over Ethernet

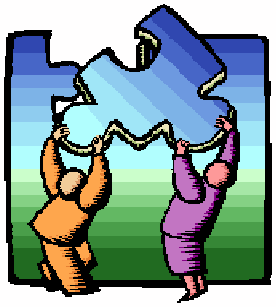
2005 Mar. 31

……external CD/DVD Rom or Hard Driver, Keyboard, Mouse is intended to be connected with PCs or Laptops via IEEE 1394, USB, PS/2 ports. Now, they are possible to connect via LAN ports, like typical RJ-45 connectors. Most of these products employ only HB flammability plastic enclosure……

### Energy Efficiency

2005 Apr. 26

……requirements mentioned in this brief are based on external power supplies only, with a maximum power rating of 250 W for Energy Star and international efficiency level and 150 W for…..



**Date:** 2005/6/18, Taipei
**Time:** AM 9:30 ~ PM 12:00

### Standard Comparison

…… in the scope of the Standard are ICT equipment, audio and video equipment, and … The final draft of the second edition has been contributed to IEC TC108 to be used by the "Hazard Based Development Team"……

## about Taiwan Chapter……

2004 December 26, the first initial meeting held in Taipei Westin resort and determine to form the Taiwan Chapter, Product Safety Engineering Society of IEEE.

The petition with 13 IEEE members' signature sent on 2005 February 7 and approved by IEEE Regional office on April 29.

The Chapter is funding by each member's willing and plan the activity by passion.

The Chapter vision is for networking, connection of worldwide safety field, a neutral safety engineering platform and sharing the experience from industry-wide.

The 1st newsletter issued on February 16 and distributed on February 18. Till May, 3 newsletters and one comparison sheet of ECMA 287, ITE and A/V safety standard has been distribute and hope to share the good news to industry-wide by 1st promotion party on June 18, 2005.

**We are looking for your attendance!!**

Regular face-to-face meeting and conference discussion planned launch to all members and stakeholders.

# Ground Bond Testing

**Ground Bond Testing vs. Ground Continuity Testing:**
**What is the Difference and Why Choose One Over the Other?**
by Shari Richardson

Test equipment purchasing trends indicate that production line electrical safety testing is moving away from the traditional ground continuity test in favor of a ground bond test. We will examine here the differences between the two tests and what advantages are afforded by performing the ground bond test. An article written in the past came to the conclusion that "For production-line testing, the 25 A or 30 A grounding continuity test is not likely to identify construction anomalies that would not also be identified by a simple low-current test."[1] This article explains why that may not always be the case.

For safety purposes products must incorporate features to protect anyone that comes in contact with the product from electrical shock. One form of protection is grounding. If there is an electrical fault within the product, the ground is intended to carry the fault current until the fuse or circuit breaker enables. This means the ground wires must be capable of carrying up to 20–40 A for a significant amount of time.

A ground continuity test simply verifies that there is an electrical connection between the mains power ground and any conductive surface of the product, usually the chassis. Typically this test is performed with a multimeter or 100 mA dc source. If the resistance is less than 1 W, then the ground is considered good. This method of testing ground meets the requirements for production testing for most safety standards.

A ground bond test applies a higher ac current to the ground connection. This test simulates the fault which may occur within a product by applying 25 A or higher at 60 Hz to the mains ground connection and any exposed metal on the product. A ground bond test checks the integrity of the connection and its ability to sustain high current. Most standards require that the resistance from mains ground (protective earth) to the conductive surface on the product does not exceed 0.1 W.

Due to the low resistance requirement it is necessary to use a Kelvin connection for the measurement to reduce errors induced by lead resistance. A Kelvin connection automatically compensates for the additional lead resistance by bringing a second lead to the point of measurement. This allows for a voltage measurement across one lead pair while the current is supplied in the other, thus removing the lead resistance from the measurement. See Figure 1 for a typical ground bond test setup using a Kelvin connection.

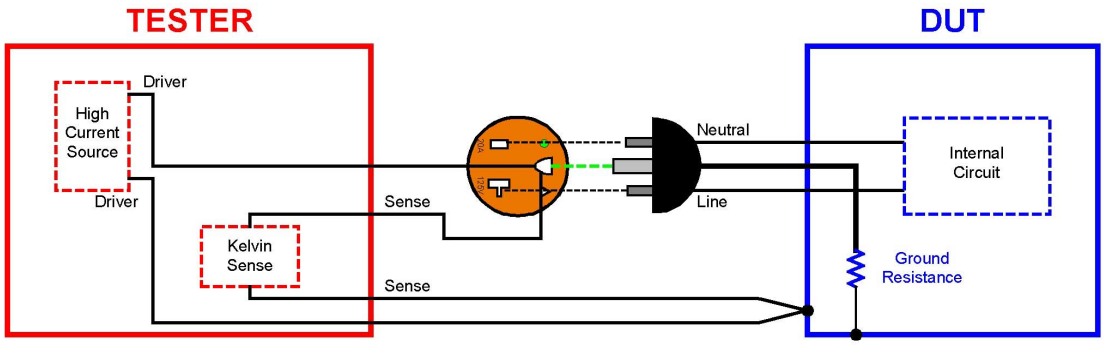



Figure 1. Functional Diagram of a Ground Bond Test.

The Ground Bond test is required by certifying agencies for compliance testing of products. The compliance test is performed on a sample during the design phase of a product. It is generally extensive and covers all aspects of electrically safety tests. Ground Bond is typically not a requirement for production line testing; a simple continuity test for production meets requirements.

So why are companies performing ground bond tests on the production line instead of ground continuity? Some claim that performing a bond test they can determine if their ground connection is tight, has the correct gauge wire, and even that the wire crimp is correct. Is all this possible to detect by performing a ground bond test? Let us look at the ground connection.

We took a "UL-approved" chassis ground connection, loosened the ground nut, and performed a 25 A, 30 sec ground bond test. Successive tests were run one hour apart to ensure the heating of the ground wire did not play a role in the results. Figure 2 shows the measured resistance vs. the torque of the ground nut, position A being the tightest, position H being loosest, in ¼ turn increments. One can see from Figure 2 that as the ground nut was loosened, the ground resistance increased. Note the low resistance in measurement H. The nut was very loose on the ground screw, so by applying 25 A an arc occurred between the nut and ground screw, welding the nut to screw. Since the nut was now welded to the screw, the resistance dropped back down well-within specification. It is worth noting that a simple continuity test was performed at all positions, and a pass was the consistent result.

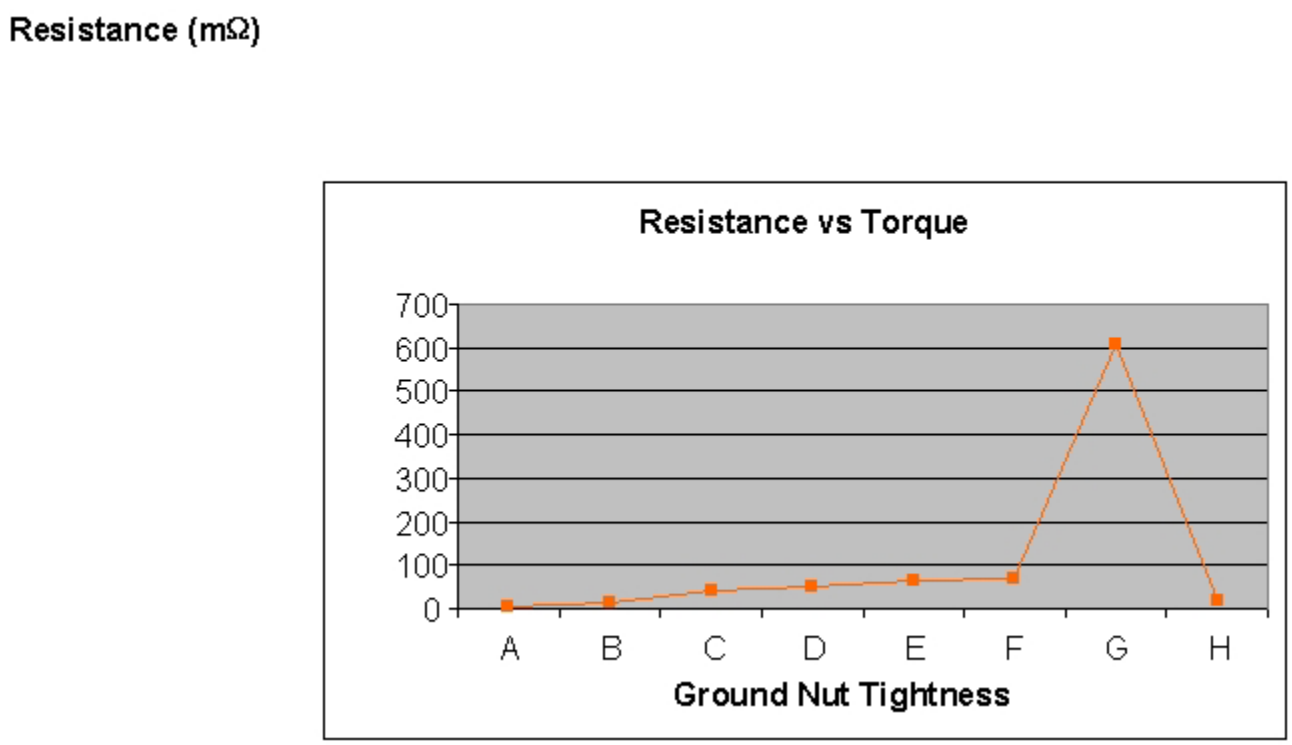



Figure 2. Measured resistance at 30 A as the ground nut was loosened.

What does this tell us? In agreement with previous articles[1,2] it is unlikely that a production test will detect a loose screw by following a certifying agency requirement for ground bond. Most agencies state that the resistance must be below 100 mW. Figure 2 shows that a nut with a full turn loose will pass. However, if you look closely at the measured resistance (Figure 3) you can see that the resistance doubled at just ¼ turn loose and increased by 700 percent at just ½ turn loose. Using a

Ground Bond Tester, which allows for programmable limits to be set, one can be alerted that a change has occurred from one product to another.

For instance, most testers on today's market will allow for a high limit and low limit to be set. In the case of the product in this example you could set your high limit to 10 mW. This limit is much stricter than the certifying standard but it will serve its purpose for notifying you if the ground screw is not secured properly. This of course is only valuable if your process is in control and the measured variation from one product to another is less than the variation due to process noise. Using a tester capable of data collection you can quickly look at the data from one product to another and determine whether or not this method is feasible. We can conclude that by setting tighter limits on the ground bond test, a loose screw may be detected whereas a simple continuity test passes the loose screw.

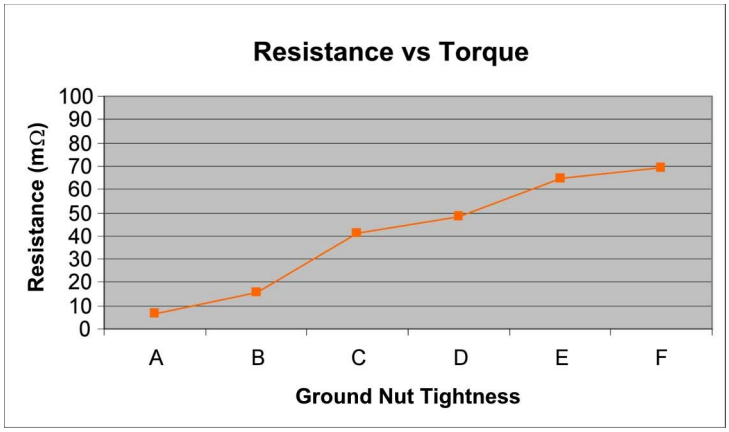



Figure 3. Data points from Figure 2, with different scale.

What about broken strands of wire? In this regard the findings in a previous article state:
"This test shows that the 25-ampere test is not likely to find a wire with cut or broken strands as may occur due to defective crimping or due to excessive bending." [2]

We took an 18 AWG, 16 strand "UL-approved" ground wire and applied 30 A for 60 sec. The resistance of the wire measured 4.0 mW. The test was then repeated removing one strand at a time from the wire. Each time the test was performed the resistance increased, as shown in Figure 4. With six strands of wire missing, the resistance doubled. Some may say that applying 30 A to the wire each time increased its resistance. To verify that this was not the case, a control wire was also tested each time at 30 A for 60 sec. The resistance of the control wire did not change more than 0.1 mW. The missing strands can definitely be detected using a high current tester which records the actual resistance value.

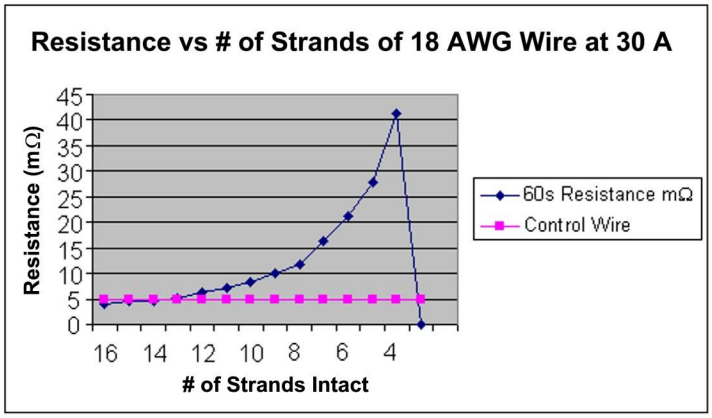



Figure 4. Resistance increases as strands are removed.

What if the wires were broken? Starting with an 18 AWG, 16 strand "UL-approved" ground wire, a 30 A current was applied for 60 sec. Once cooled down, one strand at a time was cut, and the wire was retested at 30 A for 60 sec. Figure 5 shows the results as each strand was cut to simulate a broken wire. The resistance reading fluctuated, even during a 60 sec test, increasing to as high as 12 mW but dropping down as low as 6 mW during the test. In agreement with previously reported observations, unless the ground wire is very consistent from one product to another, it is very unlikely a ground bond test will provide any additional information beyond a simple continuity test to determine whether there are broken strands due to crimping or flexing.

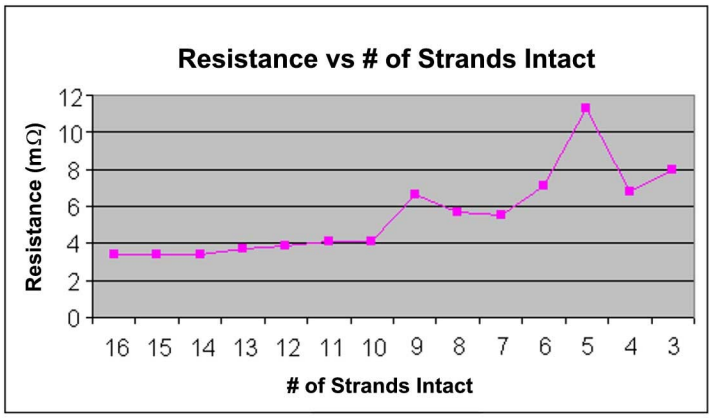



Figure 5. Resistance increases slightly as the strands are cut.

In conclusion, a Ground Bond test in production can provide information from which you can deduce whether or not your ground was assembled tightly. It may also determine if the correct gauge wire was used. This can be a valuable tool in examining process variation and assist in the elimination of failures. Simply following certification requirements alone may or may not provide enough information. Looking deeper into the data may be enough to ensure your grounds are assembled correctly and properly connected.

Shari Richardson is an Application Engineer for test equipment manufacturer QuadTech (www.quadtech.com).

1. Richard Nute. "More on Ground Impedance Test," *The Product Safety Newsletter*, Volume 10, No. 2, April-July, 1997 http://www.ieee-pses.org/Downloads/newsletters/97v10n2.pdf

2. Richard Nute. "The 25-Amp Grounding Impedance Test," *The Product Safety Newsletter*, Volume 10, No. 1, January-March, 1997 http://www.ieee-pses.org/Downloads/newsletters/97v10n1.pdf

# EDITORIAL

**Product Safety in Academia**

It appears that many colleges of engineering have an abysmal record of imparting the fundamentals of product safety to aspiring engineers. At the U.S. Standards Strategy Forum held in April in Washington, DC, a repeated lament was heard that U.S. colleges provide little in the way of such education. It seems plausible that the IEEE, through the PSES, could accomplish something of extraordinary value to society by working to change that situation.

We all know that a truly potent way to effect change is to get the message to the "next generation." Wouldn't there be a major benefit to society and our profession if most engineering schools included in their curriculum a course, or at the least a course module, addressing product safety?

We're not talking here about dispensing platitudes reminding students that when they go out into the world, they must design safe products. We're talking about a cross-sectional view of the nuts and bolts of product safety. We're talking about an introduction to the concepts of hazard-based safety engineering; an understanding of how product safety needs to be part of the entire product cycle, from conception to production; an overview of the role of standards and how they are developed and maintained; and how all this relates to product liability.

How's this for thinking big? If there really is a need, the PSES is in a unique position to both distinguish itself and deliver the aforementioned extraordinary value to society by developing a basic course or course module in product safety that could be offered to all engineering schools.

Anecdotal evidence indicates that some U.S. schools pay more than lip service to product safety, but no one seems to know how many really do. And, it's not clear if or how the matter is addressed in other countries. If you are aware of the treatment (or lack of treatment) of product safety at any particular academic institution, please contact one of us and tell us about it.

Gary Weidner
Editor
gweidner@ieee.org

Michael Morse, Ph.D.
Co-Editor
mmorse@sandiego.edu

Rich Nute
Co-Editor
rich.nute@hp.com

# IEEE Journal on Product Safety Engineering Call For Papers

**Information for prospective authors for the IEEE Journal on Product Safety Engineering**

Contact: Mike Sherman, JPSE Editor-in-Chief
952-361-8140, msherman@fsi-intl.com

**What is Product Safety Engineering?**

The design and evaluation of equipment, devices and systems such that they can be used at an acceptable level of risk.

**The Journal is intended to:**

* Promote, develop, recognize and archive original work that advances the theory and practice of product safety engineering.
* Provide those interested in product safety with an incentive and vehicle to formalize and share their research, theories and practices across disciplines, potentially enriching all.
* Create a centralized knowledge base of theory and proven practice.
* Encourage practicing product safety engineers to strengthen their profession by distilling their successes into articles that stimulate others and promote best practices.

**The following types of products fall within the scope of the Journal:**

* medical devices and instrumentation
* consumer appliances, both personal and commercial
* transportation (e.g., vehicles, systems)
* industrial and scientific equipment
* information technology equipment
* life support
* telecommunication systems

**Topics include the following sample list:**

* risk assessment, design review, and failure analysis
* validation (i.e., testing)
* product liability and litigation
* standards
* system reliability and maintainability
* functional safety associated with electromagnetic compatibility
* manufacturing processes

**Suggested Topics to Stimulate the Thought Process**

* alternative clinical trial designs for medical devices
* allowable electrical fault currents in human brain tissue
* a model for allowable shear or crush forces on fingers
* interactions between product safety and management systems (e.g., GMP, ISO 9000)
* alternative approaches to controlling product liability costs
* EMC (emissions and immunity) effects on product safety
* effect of USA "expert" court decisions on risk assessment record keeping
* hazard-based safety engineering (HSBE)
* accident investigation (e.g., forensic analysis)
* user manuals and documentation (e.g., what is appropriate and realistic)
* safety of software, networks and systems
* life support system design
* cost/benefit analysis applied to product safety
* human factors and accident avoidance
* integrating risk assessment into the design process
* fire protection applied to product design
* integrating arc flash protection into equipment

**The schedule for the premiere issues:**

* submit abstracts (up to 200 words) to msherman@fsi-intl.com
* written articles submitted 30-60 days after abstracts accepted
* 90-day peer review window after articles submitted

**Contact Information**

Editor-in-Chief, Mike Sherman, at msherman@fsi-intl.com, phone 952-361-8140 (USA Central time zone).

**Aids for Authors**

The following from the IEEE web site provide useful guidance for authors.

**General Information: Information for Authors**
http://www.ieee.org/portal/cms_docs/pubs/transactions/auinfo03.pdf

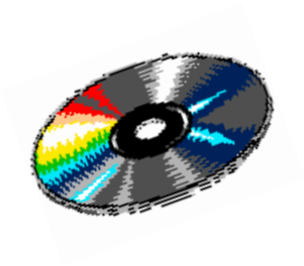
**Formatting: Preparation of Papers of IEEE Transactions and Journals (March 2004)**
http://www.ieee.org.my/micc-icon2005/MICC&ICON2005template.pdf

**Proper Crediting of Work: Updated Plagiarism Policy**
http://www.ieee.org/portal/site/tionline/menuitem.130a3558587d56e8fb2275875bac26c8/index.jsp?&pName=institute_level1_article&article=tionline/legacy/inst2004/dec04/12w.pub.xml&

http://www.ieee-pses.org/Downloads/call_for_J_P.pdf

## 2004 IEEE-PSE Symposium

### CD Purchasing Information



August 13-15, 2004
Santa Clara Convention Center
Santa Clara, California

SYMPOSIUM PAPERS ON CD:

The Product Safety Engineering Society continues to offer the 2004 IEEE PSES records for sale. The cost for the CD is $35 plus shipping and handling for IEEE members; $50 plus shipping and handling for non-IEEE members. At this time, check or money orders are the means for payment. Please provide the following information:

CDs to be shipped to- ( Please print or type.)

Name:_____

Mailing address::_____

_____

_____

_____

IEEE member number:_____

Shipping and handling: $5 per CD

Payment: Check or money order.

Make Check or money order to: "IEEE Product Safety Society"

Quantity:____ x $35 = _____ for IEEE members
Quantity:____ x $50 = _____ for non-IEEE members

S&H: quantity _____ x $5 = _____

Total = _____

Send payment to:

IEEE Product Safety Engineering Society
c/o Richard Georgerian, PSES Board of Directors
7103 Sioux Court
Longmont, CO 80504
U.S.A.

Depending on stock availability allow 2 to 3 weeks for delivery.

# Institutional Listings

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. Rates are $150 per issue and $400 for four consecutive issues. To place ad with us, please contact Jim Bacher

*The*
**Product**
**Safety**
**Engineering**
**Newsletter**

Gary Weidner
GW Technical Services Inc.
2175 Clarke Drive
Dubuque, IA 52001-4125

**CHANGE SERVICE REQUESTED**