The Product Safety Newsletter

IEEE

Vol 2, No. 5 November/December 1989

In this issue

Chairman's Message

The Symposium

We now have a Symposium Chairman. John Knecht has volunteered to serve you _n this very important position. John's, primary functions in this capacity are to coordinate the symposium activities within the PST and to serve as our liaison to the EMC Society Symposium Committee.

Participation in the annual EMC Society Symposi4ffi is a win-win activity. Both the PSTC, and the EMC Society benefit.

We have wanted to make a presentation at the Symposium since our formal acceptance into the EMC Society. This activity is a major vehicle that we can use to promote consistent understanding and interpretation of product safety principles.

Rich Pescatore

At the same time, one of our obligations to the EMC Society is to help make the Symposium a success through our active participation.

Since some of our members have expressed interest in making a presentation at the Symposium, all that was missing was someone to coordinate this activity.

We were not able to participate in the Denver Symposium (held in May of this year) because there was not sufficient time to prepare a proper presentation. However, we had planned to be active in the Washington DC Symposium which will be held August 21-23, 1990. Without a volunteer to serve as the PSTC Symposium Chair, I was becoming concerned that we again might miss an important opportunity. Fortunately, just in the nick of time, John Knecht called and volunteered his services.

Thank you, John Knecht.

If you have any questions regarding our participation in the Washington DC Symposium, or would like to help out in any way, please contact John at:

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333 Pfingsten Road
Northbrook, Illinois 60062
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The support of the officers, chairpersons, and other active members makes a volunteer organization such as ours successful. We are fortunate to have so many capable members. And, we have a lot to do. If you would like to become one of the active members of the Product Safety Technical Committee, give one of your officers or chairpersons a call.

The Product Safety Newsletter

Vol 2, No 5 Nov./Dec. 1989

 Comments and questions about the newsletter may be addressed to the *Product Safety Newsletter,* Attention: Roger Volgstadt, c/o Tandem, Loc. 55-53, 10300 N. Tantau Ave., Cupertino CA 95014-0708, Fax No. (408) 285-0505.

This newsletter is prepared by the Corporate Creative Services Group of Tandem Computers Incorporated. The editor wishes to extend a special thanks to Michael Barnett of Tandem, his work in preparing this newsletter.

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Chairman's Message
Continued

Reader Survey

The last issue of the newsletter contained a reader survey, along with a request for your response. The reasons why the survey is important were explained in the Chairman's Message. By now, I assume that you have completed the survey and returned it to us. But, just in case you haven't, and for your convenience, another one is included in this edition of the newsletter. Please take a moment to answer the few short questions and return the survey now.

For the ten percent or so of you that are color-blind, this edition's survey form has changed from yellow (caution) to red (danger!). This color was chosen to get your attention and warn you that your subscription will be canceled if you do not respond. So please print your name, make any needed address corrections, and complete and return the form. Feel free to pass along copies of the form (in any color) to others who are interested in product safety. To repeat: your response is imperative to your continued receipt of the newsletter.

Also, we encourage you to show your support for your profession by joining the IEEE (and the EMC Society). Membership will make available to you the many benefits provided by the IEEE. Please send in your completed survey form as soon as you know your IEEE membership number.

One Final Thought

If you always do what you've always done, you'll always get what you've always got.

Thanks to Jay Dickinson for bringing this bit of profound wisdom to our attention.

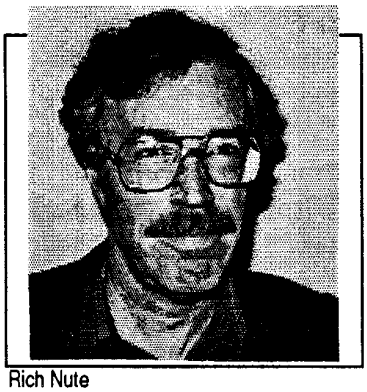
As always, I look forward to hearing from you.

Best regards,
Rich Pescatore
Chairman

Technically Speaking

Rich Nute

Electrically-Caused Fire in Multilayer Circuit Boards



Rich Nute

Hello from Vancouver, Washington, USA:

A few months ago, a colleague asked whether he needed a fuse in series with the 5-volt supply on an OEM-supplied printed wiring board. The 5-volt supply to the board was rated about 40 amps. My colleague wanted assurance that the board would not compromise the safety of the product.

(I recognize that, in the case of a user-accessible board, some standards require an 8-amp inherent limit, or a 5-amp fuse, or a 240- V A limit, or a 150-watt limit. However, readers of this column will recognize that I address the hazards involved rather than the standards requirements. Standards *presume* certain hazards already exist in the equipment regardless of whether such hazards *actually* exist. The design of a product can obviate the hazards from high current or high power by means other than by making such circuits inaccessible. To do so requires that the hazard be identified, e.g., fire, and that the way the hazard arises, i.e., the fire starts, be identified. Safeguards can then be designed into the product so as to prevent the hazard from arising. Such a process yields a safe product, but not necessarily a certifiable product. Such is the sorry state of affairs of the product safety discipline.)

My colleague was dealing with a 5-volt, 40-amp, 200-watt (minimum) source. Two hundred watts is more than enough power to start a fire if the power dissipation is not properly managed and controlled. In terms of whether the safety of the product might be compromised, we would first look at whether this power could be dissipated in such a fashion as to cause a fire.

Let's review the necessary conditions for an electrically-caused fire.

Electrically-caused fire only occurs under fault or mis-use conditions. (I believe it is obvious that fires in electronic equipment do not occur under normal or normal-use conditions.)

Electrically-caused fire occurs when electrical heating raises the temperature of a fuel material to ignition temperature.

Three elements are crucial to this statement. First, virtually all materials will burn if the tempera ture is high enough and if heat is continuously applied to the material. (For many materials, the combustion process produces sufficient thermal energy to sustain flaming and burning.) Second, the temperature of the heating element must be *greater* than the ignition temperature of the fuel material. Third, there must be sufficient electrical energy converted to thermal energy and transmitted to the fuel material to raise its temperature to ignition temperature.

The reason electric heaters don't ignite and burn is that the ignition temperature of the materials is greater than the temperature produced by the heating element. In addition, some electric heaters are built in such a fashion as to limit transmission of thermal energy to nearby external materials.

Electrical heating only occurs when electrical energy is converted to thermal energy (i.e., power dissipated in some device which produces significant heat).

Since electrically-caused fires occur only under fault conditions, the first job is to identify those parts of the circuit which, under fault conditions, would operate as heating elements and could convert a significant amount of power to thermal energy such that:

(I) the heating element temperature will be greater than the ignition temperature

Continued

of nearby fuel materials, and
(2) there will be sufficient electrical energy converted to thermal energy so as to raise the temperature of candidate fuel material to ignition temperature, and
(3) there will be sufficient time to transfer the necessary thermal energy to the candidate fuel material.

To get some clues as to what parts could dissipate significant power under fault conditions, we can examine the variables which would cause power in a circuit to increase by a significant amount. Power dissipation is expressed in three ways:

(1) $P = E \times I$
(2) $P = E \times E / R$
(3) $P = I \times I \times R$

where P is power in watts,
E is potential in volts,
I is current in amperes,
R is resistance in ohms.

Now, which parts on the circuit board can change to affect E, I, and R in such a way as to increase power dissipation?

In equations (1) and (2), if we increase E, we will increase P. Since the voltage source is external to the circuit board, no circuit board faults can increase the value of E supplied to the board. So, we need to look further.

With a constant-voltage power supply, if we decrease R, we will increase P. Let's get some idea of the values of P related to the values of R.

P	=	E	xE	/	R	
12.5	=	5	x5	/	2	(Constant-voltage mode)
25	=	5	x5	/	1	
50	=	5	x5	/	0.5	
125	=	5	x5	/	0.2	
160	=	4	x4	/	0.1	(Constant-current mode)
80	=	2	x2	/	0.05	
32	=	0.8	x 0.8	/	0.02	
16	=	0.4	x0.4	/	0.01	

(Note that if we were dealing with a constant-current source, increasing R would decrease P. However, in practice, the vast majority of circuits are constant-voltage.)

In equation (3), if we increase R, we will increase P. But, since R is in series with the source, if we increase R we will reduce I. Again, let's look at some values of R and I.

p	=	I	xl	x	R	
12.5	=	2.5	x 2.5	x	2	(Constant-voltage mode)
25	=	5	x5	x	1	
50	=	10	xl0	x	0.5	
125	=	25	x 25	x	0.2	
160	=	40	x40	x	0.1	(Constant-current mode)
80	=	40	x40	x	0.05	
32	=	40	x40	x	0.02	
16	=	40	x40	x	0.01	

In a constant-voltage circuit, as R increases, I decreases, and, because I is squared in the equation, I dominates the total effect on P. Thus, increasing R does not increase P. Instead, the total effect is just the opposite: as R decreases, P increases!

Continued

(Note that if we were dealing with a constant-current source, increasing R would indeed increase P just as predicted by the equation. However, in practice, the vast majority of circuits are constant-voltage.)

These data suggest that if we can identify a part failure in which the part resistance goes down to less than one ohm, then we have a candidate part or circuit for converting electric power to thermal energy. The "ideal" part failure is where the fault resistance is sufficiently low to draw maximum current from the supply.

These data dictate a second parameter for candidate parts: The part must be capable of carrying the fault current for an extended time interval without fusing.

Under normal conditions, we usually ignore the resistances inherent to wires, circuit board conductors, and connector contacts. However, when we are dealing with fault conditions where total circuit resistances are fractions of an ohm, and where currents are ten, a hundred, or even a thousand or more times normal current values, we can no longer ignore conductor resistances and connector contact resistances. So, when we are looking for candidate parts for converting electrical energy to thermal energy, we must now include printed-wiring conductor resistances and connector contact resistances.

Now we've got some bounds on what we're looking for. We're looking for that single component which is connected between a high-current voltage source and the return for that source (usually ground). The component doesn't have to dissipate the power, but it does need to carry the high current for an extended time without fusing open. As an example, this could be a bypass capacitor located near the power pin of an IC. Such capacitors can short, resulting in a very low resistance and very high current-carrying capacity-ideal conditions for dissipating power in the fractional-ohm resistance of the conductors to and from the capacitor.

Or, we're looking for two components in series, one of which is a low resistance under normal conditions. As an example, this could be a decoupling circuit comprised of a low-value series resistor and a capacitor to ground. If the capacitor should short, then excessive power would be dissipated in the resistor. Many metal-film and carbon-film resistors initially decrease in value when subjected to heating as from over-power conditions. Again, we have ideal conditions for dissipating power in the form of thermal energy.

Finally, we're looking for candidate fuel materials and their proximity to the power dissipating components. The coatings on capacitors and resistors can be fuel, but there's not a lot of it. Such coatings, when heated to ignition temperature, will burn only for a very short time--less than 30 seconds-before the fuel is consumed. Because of this short burning time, not much thermal energy will be transmitted to other nearby candidate fuels.

For a printed wiring board, the most obvious candidate fuel material is the epoxy of the printed wiring board. And, the quantity of fuel is relatively high. It is in intimate contact with board conductors, and is very near to heat dissipating components mounted on the board.

(At this point, some of you may be saying that your boards are flame-rated by UL and therefore won't burn. Recall that virtually all materials will burn if the temperature is high enough and if heat is continuously applied to the material. The flame tests in UL 94 and its clones are measures of the time of burning *after* removal of the source of heat. The UL 94 flame tests do not address what happens to the material in the presence of a high-temperature source of heat! V -rated boards burn very nicely in the presence of a source of heat.)

And, for a printed wiring board, the most obvious candidate power dissipating component is the conductor itself.

Continued

Now that we've reviewed the necessary conditions for an electrically-caused fire, let's look at the case for electrically-caused fire in multilayer circuit boards.

Remember, we are looking for means for dissipating power. To dissipate power from a voltage source, we are looking for low-value resistances that occur or become significant under fault conditions. The resistance value must not be so low as to cause the voltage source to go into current-source mode.

There are two broad categories of devices which have low-value resistances which maximize power dissipation from the voltage source. First are board-mounted components such as resistors, semiconductors, and connectors. (Capacitors are not included as a shorted capacitor is very-low resistance and does not itself dissipate power.)

Resistors would be limited to low-value or high-power types which, with a fault elsewhere in the circuit, could be caused to dissipate excessive power. Semiconductors would be diodes, transistors, and power ICs which, with a fault elsewhere in the circuit, could be caused to turn on in a fashion to continuously dissipate power in the semiconductor forward resistance.

The second broad category are board conductors. In a multilayer board, the inner layers often are used for power distribution and return (ground). These are usually full copper sheets with holes for vias and interconnects. Because there is so much copper, the cross-sectional area is high and the resistance is very, very low. So, there is low likelihood that the inner layer sheet conductors will overheat. The interconnects from the holes to these planes often have thermal isolation to make soldering easier. While these interconnects have a small cross-sectional area, their total resistance is not high because they are physically short in length and they are well heat-sunk to the inner planes.

With such a construction, we want to look for the longest power supply and ground-return conductors on the top and bottom of the board. These conductors will have small cross-sectional area for the available current, and sufficient length to have enough resistance to dissipate significant power.

In the case of my colleague's board, we found such construction with a bypass capacitor at the end of a 5-volt supply conductor on the top side of the board. We shorted the capacitor, and connected the board to a 5-volt, 40-ampere power supply, and monitored both the voltage and the current.

In a few minutes, the board turned brown, and then black in the region of the capacitor. A few minutes later we had smoke. A few more minutes and we had glowing, and then burning. For the next hour we had alternating glowing and burning as the glowing and burning followed the board conductor to its origin at the board edge connector. The current ranged between 7 and 20 amperes, dissipating from 35 to 100 watts. Then, as it reached the connector area, the current dropped to less than 4 amps, and the glowing and flaming stopped.

We examined the board in the burned area, and we found the epoxy had been burned away, the glass fiber remained, and the circuit was open at the shorted capacitor! What, then, was sustaining the current?

There are a number of possible explanations, especially when such a fire destroys insulation and could cause additional shorts. But such shorts would need to be robust low-resistance shorts to carry the 7 to 20 amperes without fusing. In addition, the low-impedance short would need to be through the fiberglass of the board. None of these explanations is highly plausible.

The one explanation that agrees with the evidence is that the epoxy becomes conductive as it liquifies. Not only does it become conductive, it is a low-value resistance which dissipates power. This power dissipation melts more

Continued

epoxy, and the process continues until the epoxy is consumed.

We tested this hypothesis by threading nichrome wire through the holes of a bare multilayer board. We connected the board power supply and ground planes to a 5-volt, 10-ampere power supply, and monitored the voltage and current. We gradually increased the power to the nichrome wire until the epoxy started to turn color and then to liquefy. Initially, the current to the board was zero. At the moment the epoxy liquefied, the current rapidly increased. In about 10 seconds, the current was the full 10 amperes our supply could provide! A few moments later, the epoxy was glowing.

This board had numerous holes for ICs. The glowing slowly progressed among the holes for six hours before we terminated the test! We had no flame. We attribute the lack of flame to the limited power available from the power supply. The glowing appeared to be between the 5-volt plane and the ground plane in the center two layers of the 4-layer board. Sometimes the glowing was on the top of the board, sometimes on the bottom of the board. Throughout, the power input to the board remained constant.

The point is, printed wiring board epoxy is conductive when it is heated to the temperature at which it liquefies. At that temperature, and if sufficient current is available, its resistance dissipates sufficient power to heat additional epoxy which sustains the production of liquefied epoxy. Depending on the available current, the liquefied epoxy will smoke, glow, or flame.

Next, we must address the question: How can we provide protection against such fires?

To answer this question, we must review the three conditions necessary for the fire to start:

(1) the heating element temperature will be greater than the ignition temperature of nearby fuel materials, and
(2) there will be sufficient electrical energy converted to thermal energy so as to raise the temperature of candidate fuel material to ignition temperature, and
(3) there will be sufficient time to transfer the necessary thermal energy to the candidate fuel material.

We can provide protection by obviating or preventing any one of these three conditions. We'll look at these in reverse order.

The conventional means for providing protection against electrically caused fire is to control the parameter of time (3) through the use of a fuse or other automatic disconnect in the event of an overcurrent situation.

Since the current involved with this particular fire is proportional to the geometry of the supply and return conductors, a fuse will likely provide protection if the fire evolves between large-area inner layers where the volume of molten epoxy will be large and the current through the epoxy correspondingly large. But the fuse will not provide protection between small-area top or bottom conductors and the inner conductors where the volume of molten epoxy will be small and the current through the epoxy correspondingly small. This is because the differential current between normal mode and fault mode is large for a large-area conductor, and small for a small-area conductor.

Another means for providing protection against electrically caused fire is to control the parameter of conductor resistance (2) through the use of large cross sectional-area conductors such that the conductors will not overheat with the available fault current.

If we increase the cross-sectional area of supply and return conductors, then we have limited the dissipation of electrical energy in the form of thermal energy.

Lastly, we can heat-sink all power dissipating devices so as to

Continued

limit their temperature rise (1). On printed wiring boards this is often done by using large area conductors for each of the terminals of resistors and power semiconductors.

What about two-sided and single-sided boards?

I haven't seen evidence of extensive fires for two-sided and single-sided boards as I have for multilayer boards. There is some rationale for the phenomenon not being prevalent on two-sided and single-sided boards. If we review the process by which the fire arises, it starts with melting the epoxy with some electrical source of heat. If we consider conductors on opposite sides of a two-sided board, then we have at least 1/16-inch of material to heat to melting temperature. This takes a lot more heat than the 1/32-inch or less in a multilayer board. Even if this occurs, the supply and return conductors need to be opposite each other, which is not usually the case.

If we consider the case of adjacent conductors on the same side of the board, we have a similar situation. We must heat the epoxy between the two conductors to melting temperature, which, again, takes more heat because of the greater distance *and* the loss of heat to the air.

Should this occur, the geometry of the conductors likely contributes to a variable distance between conductors and variable resistance of the epoxy-which may reduce the power dissipated in the epoxy which in turn reduces the power and the heating. The fire may not be sustained.

Well... there is opportunity for more study of power dissipated in heated and liquefied printed wiring board epoxy.

Acknowledgments

I want to acknowledge colleague Joe Thomas, Hewlett Packard, Greely, Colorado, who first demonstrated this burning phenomenon to me, and then repeated the test with identical results.

Thanks to Kevin Cyrus here in HP Vancouver who set up the test that conclusively demonstrated the conductivity of the liquefied epoxy.

Another party presented me with additional evidence of this burning process. Though the party must remain anonymous, I want to acknowledge the contribution and thank the party for providing the evidence.

Your comments on this article are welcome. Please address your comments to the Editor, Product Safety Newsletter.

News and Notes

Dave Edmunds

Dave Edmunds

Electromagnetic Radiation

The August issue of *Professional Safety*, a monthly magazine published by the American Society of Safety Engineers, has an article titled "Biological Effects of Exposure to Electromagnetic Fields" by Barrett Miller. The author discusses the possible effects of exposure to electromagnetic fields. [Reprinted in this issue of PSN. -Editor]

"Working with Displays--VDTs and Radiation" is a brochure published by Center of Office of Technology. This pamphlet provides information about VDT electromagnetic radiation. Copies are available from the Center at 575 8th Ave., 14th Floor, New York, NY 10018-3011, phone (202) 560-1298.

British Standards

British Standards Institute has issued the European document EN60950 1988 as a British Standard with the number BS7002:1989. The document also carries the number EN60905: 1988.

CSA Update

CSA on May 15, 1989 issued an update to the Category Certification Program. This updated guideline is for setting up CSA customers' factories which are remote from the Design and Prototype verification facilities.

CSA has recently reached an agreement with BSI (British Standard Institute) for CSA to test and evaluate products and issue the BSI mark. This evaluation includes the quality review and audit of the factory. More information on this new CSA service is available from the CSA offices.

UL 1950

UL is in the process of trying to obtain an ANSI document status for UL 1950 under the canvas method. The voting document has been circulated.

UL and CBEMA have been working to develop a course on UL 1950. The details and tentative dates are not available.

NEC

A one-day course on the changes to 1990 NEC is being offered by NFP A. Contact NFP A, Seminar Registrar, Batterymarch Park, P.O.Box 9101, Quincy, MA 02269-9959, phone (800) 344-3555, 8:30 a.m. to 8:00 p.m. EST.

Telecom Product Safety

The 1990 National Electric Code (NEC) adds a new requirement on telecommunications. Article 800-51 (i) of the revised code states that "Equipment intended to be electrically connected to a telecommunications network shall be listed for the purpose." Thismeans that as of January 1, 1990, products connected to the telephone network must be listed as complying with the appropriate Underwriters Laboratories (UL) standard, or be listed to another appropriate standard, by a recognized testing laboratory. For most telephone equipment the standard is UL 1459, second edition. The NEC, which is revised and reissued every three years, is a model code adopted in whole or in part by local governmental jurisdictions and enforced by local inspectors. In addition to UL, other recognized testing laboratories include Factory Mutual, Dash Straus & Goodhue, and MET Electrical Testing. Information about UL 1459 can be obtained from Randy Ivans, UL, at (516) 271-6200, extension 269. For more information on the NEC contact Richard Murray, National Fire Protection Association (NFPA), at (617) 770-3000, extension 428.-from the Telecommunications Industry Association*

Continued

Ask Doctor Z

Doctor Z

In the world of Product Safety and Certification, there are many pitfalls for the unwary. If you have a problem that seems insoluble, then it's time to ask Doctor Z! *He has the answers, derived from his many years of training and experience in the Science of Product Safetiology. Pitfalls hold no terrors for Dr.* Z, *since he is on a first name basis with most of them. Any resemblance to persons. places, products, agencies, or good advice is purely coincidental. but don't let that stop you. Write to Dr.* Z *today!*

Dear Doctor Z,

I've been reading your column for a while, and I think I have a question that you can answer. What does the "Z" stand for, anyway? Or would that be telling?

A.*Nonymous*

Dear *Mr./Ms.* Nonymous,

Like yourself, Doctor Z is certainly not one to cower behind the shield of a pseudonym and is glad to have this chance to fully reveal himself (or herself) and completely describe the origin and meaning of his name. As politicians say, just before giving a full and frank answer, "I'm glad you asked that question." But, just as in Product Safety there are many hazards which must be evaluated, none of which can be considered unimportant, there are several reasons why my name is Doctor Z.

One of the most obvious is the mystery of the single letter designation, "Z." Actually, the common phrase is "X, the unknown"; but beyond the unknown lies "Y" and even further, reaching the totally obscure, stands "Z." One might compare this concept with coordinate geometry, where the X-Y plane defines everyday two dimensional figures. With "Z" we enter the third dimension, which expands our perceptions into solidity and reality and makes a common flat square into a true cube. Nonetheless, Doctor Z promises to be square with you and always give you the right angle on Product Safety.

Speaking of answers, others have commented that they can be found here, from "A to Z." Because of space and time limitations, the Editor has asked me to eliminate those from" A to Y" and include only the final summation of "Z." In this way we can bypass the limited accuracy of "A" solution, avoid falling into the vacuity of "MY' solutions, and get straight to the ultimate ... "Z" solution. Even if you do not agree it is the last word, it is certainly the last letter.

I disagree completely with a proposal from one who fancied himself a wit (he was half right) that Doctor Z is short for Doctor ZZZZZZZZ, which was the representation of the sound of the somnolent activity induced in this individual while reading my column. Absolutely false, no matter how much he thanked me for curing his insomnia.

My favorite explanation comes from my favorite television show as a child, "The Adventures of Zorro." Like Zorro's mark, the "Z" of Doctor Z strikes terror into the hearts of evil-doers, tyrants, newsletter editors, and those who do not use Hazard Based Safety Engineering. However, conscious of the duty of a Product Safety professional, Doctor Z does not wave around any metallic sharp edges, per paragraph 4.1.3 of IEC950.

Perhaps the one most important source of the name, Doctor Z, and the basic significant meaning of the "Z" is contained within an explanation not yet presented here. That explanation alone would probably be a fully acceptable and satisfactory response to your original question. Unfortunately, it appears that the space allotted to me by the Editor of this fine newsletter has been filled for this issue, so any additional explanation will have to wait until later.

Doctor Z

Biological Effects of Exposure to Electromagnetic Fields

Barrett C. Miller

Reprinted from the August 1989 *edition of* ***Professional Safety****, official publication of the American Society of Safety Engineers.*

Doctors at the medical care center of Kaiser Corporation thought they were investigating pesticide exposure. They accidentally discovered a numerical association between computer use by pregnant women, spontaneous abortions, and birth defects. The study, published in June, shows a statistical correspondence between the extended use of computer monitors during the first trimester of pregnancy and miscarriages.

The study rekindled and deepened a debate over the effect of extended exposure to the low level electromagnetic emissions. Manufacturers and other interested groups assume conflicting positions. Critics were quick to blame the study for its failure to look at other factors.

Electromagnetic Fields (EMFs)

Modern electric appliances surround us with magnetic energy. Every wire carrying a current adds to the natural and man-made background level. Magnetic field-strength is measured in gauss and milligauss. We measure gauss with a special meter. All appliances, power tools, television sets, and other electronic devices produce these electromagnetic fields (EMFs). If you increase the current in a device, the electromagnetic field usually increases in size. For comparison, we measured a number of devices. A black and white computer monitor measured 2,500 milligauss; a color monitor 3,500 milligauss. When we move to the rear of the monitor, levels jump to 12,500 milligauss. A walk through the author's neighborhood one afternoon produced readings of 100 milligauss.

It is difficult to know what exposure levels are safe. One safety engineer reports that exposures up to 100 gauss are reasonable on a continuous basis. A Denver study shows that continuous exposure to levels as low as three to five milligauss may be dangerous.

Safety

For years, scientists believed that the dangerous effects of electromagnetic exposure came only from very high intensity exposures. Low intensity magnetic fields were considered harmless. However, beginning in 1958, researchers began to warn of the effects of less concentrated exposures.

Published studies have examined both high voltage transmission lines and residential exposure. We now know that low frequency electromagnetic fields can injure humans. Swedish studies report brain tumors in men working with electricity. Nancy Wertheimer's respected Oregon study shows a correlation between intense residential exposure and cancer in adults. Dr. Jerry Phillips, Director of the Cancer Therapy and Research Center of the University of Texas says, " .. we have a situation in which, because of electromagnetic field exposure, not only do cancer cells grow and become tougher, normal cells have a decreased ability to fight as well."

The textbook of the American Industrial Hygiene Association summarized the problem. If energy is absorbed, and its intensity and frequency is equal to the transformation rate of an absorbing molecule, a number of effects may take place. The biological effects can vary from temporary photochemical excitation to lasting changes in the organism. The change may even take place at points remote to the site of exposure.

Some researchers now believe that exposure to electromagnetic fields is cumulative. Standard texts provide safety professionals and lay persons with little help. Future studies will attempt to describe the exact mechanism of the risk and set meaningful limits for exposure.

The Denver Study

In 1981, an assistant professor of

Continued on Page 26

Biological Effects of Exposure to Electromagnetic Fields

Continued

epidemiology at the University of North Carolina reported one suspected effect. David Savitz investigated the coincidence of cancer in children and the presence of low level magnetic fields found in neighborhoods. Savitz's Denver study showed that children exposed to medium intensity electric transmission lines had an increased chance of developing cancer. They had a 1.7 times greater chance of getting all cancers and a 2.1 times greater chance of getting leukemia. Savitz's research marked the beginning of a six-year study supervised by the State University of New York at Albany.

The New York Department of Health published the study in July 1987. Other conclusions are equally disturbing. They discovered 17 adverse biological effects in animal and human subjects. The study showed reduced intelligence in some species exposed to moderate electromagnetic fields after birth. Cancers grew faster in the presence of magnetic fields. The study showed that the length and intensity of the exposure are not directly related to the incidence of biological injury. It was not long distance, ultrahigh voltage lines that presented the maximum risk. It was the moderate voltage lines found in most neighborhoods that appeared to influence the growth of cancer. The study concludes that 10 to 15 percent of childhood cancers may be the result of exposure to 60 cycle electromagnetic fields.

Critics

Critics say that both the New York and California studies challenge all established standards for evaluating biomedical risks. They complain that the studies are not repeatable and do not contain traditional exposure period information. Critics point to a violation of the dose response phenomenon that exists with known carcinogens. The dose response curve for most substances falls on a straight line graph. If the dose of any chemical increases, the effect of the substance on the organism usually increases. In this case, biological damage is independent of the intensity or length of exposure. If the risk attributed to magnetic fields is real, it rebuts this phenomenon. Two other substances known to violate the dose response curve are radioactivity and asbestos.

What Is Proof?

Buckminster Fuller reportedly told an audience that nothing exists in science until a model of it exists. Our model of EMF damage is incomplete; its parameters aren't clear. Scientists began to petition the American government to provide basic research on the cellular effects of electromagnetic radiation as early as 1957. Without this fundamental research, no standard model will ever confirm epidemiological observations. Public sector research supports the reality of biological damage and cannot be ignored. To proceed, government-funded scientists need two things they don't have to investigate this risk-money and time. Legal standards of proof may be found in the case law of several states. State and local agencies may infringe on the property rights of utility owners when the public interest is at risk. New York State demonstrated that it can require utility companies to fund impartial government research. States may set minimum limits on the proximity of high voltage lines to homes. They may set maximum levels for magnetic fields at the edge of a power company right of-way. Public commissions may legitimately pass the burden of proof of EMF safety back to the utility company. Even a local school board- demonstrated its ability to force a utility to remove high voltage lines near schools. Children spend almost 1,000 hours a year in school. If we suspect that dosages are cumulative, we can protect schools from exposure. We can require power companies to lay neighborhood supply lines underground and physically monitor them. Federal

Continued

Biological Effects of Exposure to Electromagnetic Fields

Continued

law requires power companies to provide energy audits for their customers. We can require electromagnetic monitoring in the same way. The public can restrict the level of emissions that public utilities project beyond their right-of-way to no more than 100 milligauss-50 milligauss near schools.

Government Studies

The Reagan administration closed the EP A's Health Effect Laboratory. Even with inadequate funding, however, surprising results were reported. Studies show new relationships between body tissue and weak magnetic fields. These a thermal relationships may account for the ability of weak electromagnetic fields to cause cell damage. Studies demonstrate field effects on molecular growth markers within cells and a suppression of immune reactions to disease.

From animal studies, government scientists linked EM fields to the growth of breast tumors and to unregulated cell growth. One scientist conducted a study of 486,000 adult male death records. It showed increased ratios of leukemia and lymphoma in those who worked around electric fields.

Most, but not all, reported effects come from subjects already experiencing rapid cell growth. Pregnant women and children need immediate protection from exposure. The highest levels of electromagnetic exposure come from appliances. If it is possible to manufacture low cost microwave ovens without emissions, the same is true of monitors, toasters, and television sets.

Most surprising is the strong conclusion drawn by one investigator. Dr. Ross Adey is Assistant Chief of Staff of Pettis Memorial Veterans Administration Hospital at Loma Linda, California. He says: Even without supporting evidence from epidemiological findings, results of animal, tissue, and cellular research strongly suggests tissue interactions with environmental EM fields that would initiate pathological responses, including cancer promotion.

We know that electromagnetic energy can interfere with cell growth. One example is x-rays. Most engineers believe that low intensity electromagnetic energy is non-ionizing and therefore safe. Scientists assume that low intensity electromagnetic energy can't collect in the body. All of these assumptions are now questioned.

Industry Opinions

In Florida, some type of transmission line standard seems certain but power company representatives are not talking. Officials apparently fear what they see as public overreaction. The bio-environmental group of Florida's Jacksonville Electric Authority conducted extensive surveys of the cost of various compliance levels for electrical exposure. They also studied industry preferences. Dr. John Shatmeyer, who supervised the study, says that his company decided not to comment on their work. The industry will present a united front through a public relations spokesman. Florida power companies presented their position at a meeting in the state capital.

A few utility employees are talking. One engineer who did, spoke about the things that bother him. "We're not dealing with an electrical hazard here," he said, "this thing is a health risk. If the risk is real, we need to take immediate action." He objects to the utility position that would grandfather in existing power lines. According to public data, most Americans cities exceed the new proposed standard of 100 milligauss. Many exceed the standard by amounts of three to seven hundred percent during heavy load periods. Industry proposals, if accepted, will produce no immediate change. Power lines will remain unchanged for at least 25 years.

Another controversy involves the method of regulating emissions. Electromagnetic radiation

Continued

Biological Effects of Exposure to Electromagnetic Fields

Continued

surrounds every current-carrying device. The radiation has two components: an electric field and a magnetic field. *

The magnetic field is difficult to control because it is dependent on load. The power industry wants measurements made only from engineering data and station measurements of current flow. They say that too many factors influence actual field readings. For example, a house or tree will intensify readings as EMFs gravitate toward the house. Environmentalists want regulation based upon measurements made in the field.

Political Decisions

Every industry study cautions us to go slowly. No one wants to panic the public, especially if we don't understand the extent of the risk. We are not sure how to cope with it. Spokesmen say we could spend billions of dollars to redesign our neighborhood circuits and find we had not eliminated the hazard. They say that only long-term studies can determine what risk, if any, we face from low level electromagnetic radiation.

Scientists demand strict statistical data to establish proof. The test of us don't. At some point, most humans act upon reasonable probability. It is not possible to predict the effects of EMFs with present knowledge. If we depend on future field studies to provide guidelines, we will not have meaningful information for more than a quarter century. It is possible to take some prudent steps now.

* Transmission lines produce both electric and magnetic fields. This article discusses only magnetic fields.

A Funny Thing Happened to Me on the Way to the Airport

Rich Pescatore

Was it a product safety issue?
Was it operator trouble?
Was it foreseeable misuse?

I had an interesting experience on the way to SFO recently. I was headed north on Highway 280, enjoying the spacious back seat of a limo. It was raining outside and the TV didn't work, but the ride was otherwise uneventful. Until we exited the highway, that is.

Instead of taking the commonly used route to the airport, 280 to 380 to 101, the driver chose, in his words, "the scenic route," Millbrae Avenue.

Then it happened. We rounded the curve that connects Millbrae Avenue to Highway 101, a typical 25 mph connector. I doubt that we were going much faster than 25 mph, but the big heavy limo decided to plunge straight ahead, over a steel reflector post, into the iceplant. We probably wouldn't have ended up in this predicament had the driver "powered out" of the turn instead of climbing on the brakes, but **…** "Not to worry," says the driver, "the rear wheels are still on the pavement. We should be able to back out"

As we started to back up, terrible sounds emanated from under the car. Then we stopped. A couple of tries later (forward-reverse, forward-reverse) the steel post of the reflector joined me in the rear seat. It came through the floorboard, missing my legs by inches. Boy, was I glad that the angle of the post wasn't a little higher, lest I could have ended up with a higher voice.

Since this car was hooked, not unlike a fish on a barb, another car was called and off I went to the airport.

Now, I ask you, was this a product safety issue? Would a warning label have helped? Was the operator properly trained?

Area Activity Reports

Orange County Chapter

Charlie Bayhi opened the September meeting with 19 members in attendance. Ed Spooner of TUV Rheinland spoke about several safety standards, together with what involvement he has had in the CBEMA ESC-3 power supply committee meetings. Ed also noted that TUV Rheinland of North America, Inc. opened another office as of August 1, 1989. The address is 11995 EI Camino Real, Suite 101, San Diego, CA 92130, phone (619) 792-2770, fax (619) 792-2774.

The chapter also elected the following officers for a year of service:

Charlie Bayhi,
MAl Basic Four,
Chairman

Ray Jimenez,
B.S.C.,
Vice Chairman

Excell Bryant,
File Net,
Programs

Paul Herrick,
Gradco Systems,
Secretary(treasurer

The October 3 program featured Roy Clay of Rod-L Associates, a manufacturer of High Pot Testers. Mr. Clay spoke about the philosophies of Dielectric Strength Testing.

The November 7 program featured Konrad Kobel of TUV America on product liability in Germany and the European Common Market after 1992.

Meetings are held the first Tuesday of each month at *MAIl* Basic Four Corp. For additional information, please contact Paul Herrick in Irvine, CA. Phone (714) 770-1223, fax (714) 768-6939.

Portland/Seattle Chapters

The Portland and Seattle chapters took the summer off and are now in gridlock trying to catch up. No meeting was scheduled for September or October, but they do plan on a meeting in November, the subjects of which were originally planned for September's meeting. As noted in the last newsletter, meetings at both Portland and Seattle will cover three topics: Dept. of Commerce/ Harmonization, Various Seminar Reports and 1992 in the European Community.

The Portland and Seattle chapters are both in a state of transition which may result in either a split into two separate Chapters or to only have meetings every other month. A questionnaire should have been mailed out recently to local chapter members which will determine chapter directions and interest.

Until further notice, all meetings will be announced by local mailings. The meetings will be held every month on the third Tuesday of the month at 7:30 p.m. in Portland and on the following Wednesday at 7:00 p.m. in Seattle. The locations are as follows:

Seattle Chapter:
Portland General Electric Co.
14655 SW Old Scholls Ferry Rd., N.E.
Beaverton, OR 97005
(503) 643-5454
Corner of Murray & Schools Ferry Rds.
Redmond, W A 98073

Portland Chapter:
Data I/O Corp.
10525 Willows Rd.
P.O. Box 97046
124th St. Exit off 1-405 Portland, OR

For further information, please contact the appropriate individuals below:

Seattle:
Rich Nute - HP
(206) 896-2691

Portland:
Raj Shah - Data I/O
(206) 881-6444
Art Henderson - Western Transformer
(503) 777-5636
Al Van Houdt
Product Safety Engineer
SpaceLabs

Santa Clara Valley Chapter

The August meeting of the Santa Clara Valley Chapter consisted of a formation of committees to discuss issues and provide guidance to the chapter. The chapter wishes to thank those in atten-

Continued

Area Activity Reports

Continued

dance who provided their valuable time and insight into the direction of the chapter.

The September meeting focused on a presentation by Gary Fuji of the UL Santa Clara office. Gary spoke to 40 attendees on the "DI" deviations listed in the new UL Standard, UL 1950. Following the presentation, elections were held for chapter officers. Congratulations are to be given to Hugh Hagel, Chairman; John Reynolds, Vice Chairman and Programs; and Dave McChesney, Publicity Director. Rick Buck continues as Secretary- Treasurer and Kevin Ravo as Membership Chairman.

The October meeting featured a presentation by Bob Wersen, President of Panel Components Corp. Bob discussed the recent developments in International Power Connector Standards, specifically IEC 320 and EN 60 320. Excellent notes were distributed. Readers interested in getting copies may call Panel Components toll free at (800) 662-2290.

In November, Joseph Wujek of Apple Computer will speak on Professional Ethics. Mr. Wujek gave us the following material to whet appetites for his presentation:

"Professional ethics is viewed by some as a marginal subject for inclusion in the already-crowded engineering curricula. But the practicing engineer is often confronted with matters of ethical behavior having profound implications to safety, legality, and other societal values. Thus, one may view engineering ethics as part of engineering effort which includes scope, schedule, budget, design, test, manufacture, and numerous other activities. "

In this slide-illustrated lecture, fundamental principles of ethics relevant to engineering practice will be examined. Some topics to be discussed are: concepts of ethical behavior, justification for "whistle-blowing," the IEEE Code of Ethics, and answers to the fundamental question: "Why be ethical?" The emphasis will be on practical applications to "Real World" cases. A scenario of an ethics predicament with safety implications will be presented interactively (role-playing) between attendees and the speaker."

Copies of the slides and supplementary notes, with an annotated bibliography, will be distributed.

For more information about the SCGV Chapter activities please call David McChesney at (408) 987-1365 or John Reynolds at (408) 942-4020.

Northeastern Chapter

The meeting on September 27, 1989, included committee chapter reports and Liaison reports. Highlighted is the report by Art Michaels in which he notes that the Memo of Understanding between UL and CSA is leading to some confusion about the recognition of component power supplies. According to Art, CSA says the agreement accepts UL Recognized power supplies while UL says the agreement does not accept CSA Recognized power supplies. Bruce Langmuir reported on the inclusion in the recently revised National Electrical Code of the requirement for the Listing of telecom equipment. TIA and EIA are apparently sponsored a meeting last month (October) to discuss the possibility of overturning or postponing the implementation of this requirement. Lou Feudi of Dash, Strauss & Goodhue then gave the presentation for the evening on "Basics of Electronic Product Safety". Lou discussed the various hazards and overviewed the domestic, Canadian and European Standards, along with a detailed review of the specific safety standards underlying IEC 950.

The October 25 meeting featured Mr. Joe Green, CSA' s manager of new program implementation, and his presentation on the recent Memo of U nderstanding between UL and CSA, as well as other international approval issues.

Details for the next meeting, and the European Common

Continued on Page 17

Area Activity Reports

Continued

scheduled for November 29, have not been finalized. Readers interested in the chapters activities are encouraged to contact Bill Von Achen at (617) 263-2662 Fax: (617) 263-7086.

Chicago Chapter

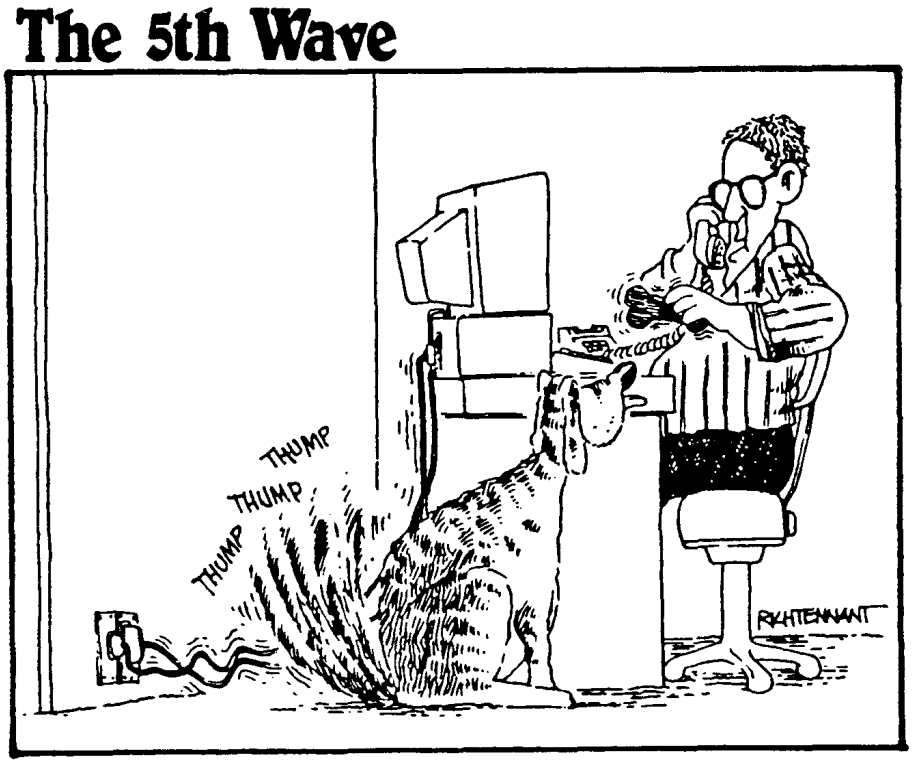
John Allen reports that there have been no meetings recently and that no meetings are planned until after the first of the year. Readers interested in participating in a Chicago area chapter are encouraged to contact John at (312) 827-7520.

AUSTIN CHAPTER

Bob Hunter has indicated that he is still looking for those interested in holding product safety meetings in the Austin area. Currently, regulatory engineers are meeting as part of the EMC chapter of the IEEE. No separate product safety meeting has been held. Product Safety professionals interested in a product safety meeting should contact either Bob Hunter at (512) 250-6878 or George Jurasich at (512) 343-6231.

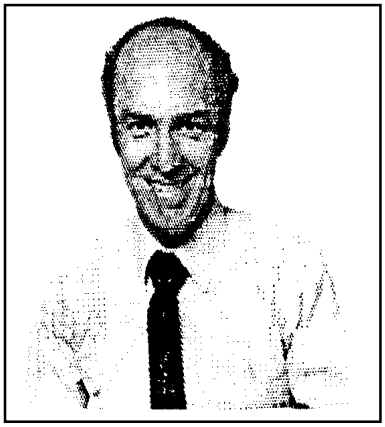
LOS ANGELES CHAPTER

Roy Clay of Rod-L Electronics was the featured speaker of the last product safety meeting on September 11, 1989. Mr. Clay spoke about the philosophies of Dielectric Strength Testing. The November 6 program featured Konrad Kobel of TUV America on product liability in Germany and the European Common Market after 1992. The next meeting of the Los Angeles Chapter is scheduled for after the first of the year. Those interested in the activities of this chapter are encouraged to contact Rolf Burckhardt at (818) 368-2768.



Editorial

Roger Volgstadt



Roger Volgstadt

Can you remember how you felt when you got your grade on a big paper you wrote for a crucial class? You know, the paper that counted for at least half the class grade? Sweaty palms, heart palpitations, a quick look around to see who else is watching? Well, the *Product Safety Newsletter* staff just got our grade from many of you and. . . we think we're passing. But the rest of you need to let us know for sure.

Comments have been, for the most part, encouraging and we certainly appreciate that. Some have been more critical. Praise came from many for the fine work Rich Nute is doing on Technically Speaking, for Rich Pescatore's clarity of thought and leadership, and for Dr. Z raising issues no one else dares touch. Many appreciated the general appearance and quality of material for which Jodi Elgin, our superb review editor, is to be praised. Some of the specific comments include:

"Usable information for practicing professionals"

"Good research and facts"

"Exceptionally well written and detailed"

"Clears up misconceptions"

OK, true confession time. We didn't get straight A's from everyone. The following are a few of the items we need to work on:

"Encourage more participation from more people, in particular agency management people 'in the know'"

"Give more current news"

"[articles] should be much shorter and much more readable"

"Color (more interesting way of giving same information) would bring more interest"

"More information about standards other than Information Processing Equipment"

We will do everything we can to implement the constructive criticism and suggestions. Which brings us to those of you with your yellow page still in hand: please return your forms at your earliest convenience. Don't forget to write your name on the form (a few have forgotten)! We strive for straight A's, but can do so only if you will give us your grade.

Roger Volgstadt
Editor

1990 IEEE International Symposium

on Electromagnetic Compatibility

• Product Safety Session •

CALL FOR PAPERS

See Page 23

Continued

Letters to the Editor

RFI Filter Caps Revisited

I have received the newest issue of the *Product Safety Newsletter* where you mentioned on page 9 my name. [Vol. 2, No.4-Editor]

I think, however, the article is a little bit misleading since VDE does not mandate to use X1-capacitors when testing in accordance to mc 380.

Concerning the requirement not to accept X2-capacitors in IEC 950 I wish to emphasize to you that this is not a rule that VDE made on its own but it is just a logical result of the different requirements of mc 950 as follows: clause 2.9.1 mentions that on the AC-termination points of data processing equipment a transient overvoltage per installation category II (in accordance to mc 664) has to be expected; this means 2500 V transience may occur.

That means X2-capacitors (that are only tested with peak-voltages up to 1200 V) are not acceptable per this mc 950.

I wish to inform you that also the Northern European testing agencies, e.g., DEMKO, SEMKO; etc., follow that rule.

By the way, may I also inform you that the date of retesting of products per EN 60 950, mentioned in the article of Dr. Steve Kraemer (TUV), is given as January 1, 1993. [Vol. 2,No. 4, page 17 -Editor]

This is not true. Please refer to the attached flow chart (next page).

Helmut Landeck
R&L Ingenieur Consulting GMBH

Cheers for PSN!

Hooray! I just finished reading Rich Nute's article on "Burning PC Boards" [on the HP E-mail, printed this issue -Editor] and on Grounding Impedances in the *Product Safety Newsletter*. I really appreciate your clarity of thought and explanation. It is like a breath of fresh air in a smokey conference room! (Keep up the good work, Rich Pescatore, you are doing the world a service by publishing this newsletter with such good stuff in it!)

Joe Nesheim
HP

Flammability Class Change to GE Lexan 1 XX

If you are using GE's Lexan 1XX materials in your products and the UL 94 flammability class is important to you, beware! GE has made "quality improvements" in their Lexan 1XX by removing trace amounts of salts. Unfortunately, the same salts that were removed contribute to the 94V-2 or higher flammability class that the 1XX series materials have had for some time.

It is suggested that you contact your GE representative if you use one of these materials and are concerned that the flammability rating may now be 94-HB.

For applications that demand the old flammability class, GE is introducing a new series of resins, Lexan 2XX, to meet your requirements.

Now for the big question: Why didn't GE assign a new designation to the revised material? I can't really answer this question. However, I can point out the ramifications to the material user of changing the properties of a UL Recognized material, especially when the change degrades one of the critical parameters.

- A user of the old 1XX materials who wishes to retain the original flammability class must now change all of his purchase specifications and documentation.
- If the old 1XX materials are used in UL Listed or Recognized prod-ucts, and the flammability class is important to the application, the manufacturer must notify UL of the change and to revise their records. While I understand that UL will not have to retest the 2XX materials, it will still require work to revise their records.
- A user of the material who is concerned about the flammability class will have to put a

Continued

Letters to the Editor

Continued

process in place to ensure that any lXX material that he has in inventory is the classic (old) formulation.

- I understand that the new lXX compounds will mold the same as the classic compounds, so this should not be an issue, once verified.

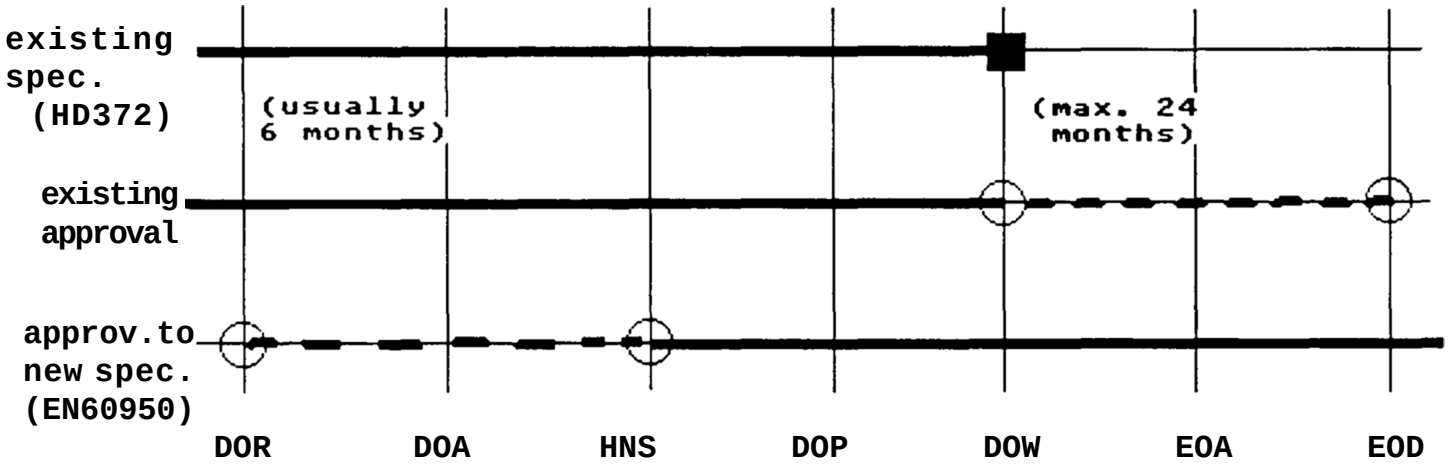
The net result of implementing the above tasks is costly, both in terms of time and money. From a manufacturer's point of view, I consider these costs as wasted effort. There is no real benefit to be derived.

As an aside, I must say that I am very concerned about the value and integrity of UL's Recognition Program if they will allow a manufacturer to alter a Recognized component or material in such a way that the component or material's performance is degraded without also changing the Recognition identifier. I urge UL to reconsider this practice in the future.

I am also disappointed that GE did not fully evaluate the impact of this change on their customers.

Rich Pescatore
HP

CHANGEOVER TIMES FROM HD372 (IEC380) TO EN60950 (IEC950) IN EUROPE



DOR = Date of Ratification by European Committee (CENELEC)
DOA = Date of Announcement by all CENELEC Members
HNS = Harmonized National Spec. published by CENELEC Members
DOP = Date of Publication of new national spec. harmonized to EN60950 completed by all CENELEC Members
DOW = Date of Withdrawal of old national spec. by all CENELEC Members
EOA = Expiration of Approval using old national spec.
EOP = End of Production with old approval

Institutional Listings

The Product Safety Technical Committee of the IEEE EMC Society is grateful for the assistance given by the firms listed below and invites applications for Institutional Listings from other firms interested in the product safety field.

9420 RESEDA BLVD.
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NORTHRIDGE, CA 91324

TEL (818) 368-2786
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Fax# (301) 586-1460

RES-WEST
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Sunol, CA 94586-0543
Tel# (415) 862-9012
Fax# (415) 862-9013

An Institutional Listing recognizes contributions to support the publication of the *Product Safety Newsletter* of the IEEE EMC Society Product Safety Technical Committee. Minimum rates are $100.00 for listing in one issue or $400.00 for six consecutive issues. Inquiries, or contributions made payable to the Product Safety Technical Commit-tee of the IEEE EMC Society and instructions on how you would like your Institutional Listing to appear, should be sent to: PSTC *Product Safety Newsletter*, c/o John McBain (M/S 42LS), Hewlett-Packard, 19447 Pruneridge Avenue, Cupertino, CA 95014.

Calendar

The Product Safety Technical Committee of the IEEE EMC Society

Austin Chapter Activities

No meetings are planned through February, 1990. For further information about Austin's activities, please call George Jurasich (512) 343-6231.

Chicago Chapter Activities

No meetings are planned until after the first of the year (1990). For further information about Chicago's activities, please call John Allen (312) 827-7520.

Los Angeles Chapter Activities

The next meeting of the is scheduled after the first of the year (1990). For further information about Los Angeles' activities, please call Rolf Burckhardt (818) 368-2786.

Northeast Chapter Activities

***Wednesday, November* 29**
Subject: TBD
Speaker: TBD
Time: 7:00 pm
Location: Sheraton Boxborough
Intersection of Rts 495/111
Boxboroug, MA
Contact: Bill Von Achen
(508) 263-2662

***Wednesday, December* 27**
Subject: TBD
Speaker: TBD
Time: 7:00 pm
Location: Sheraton Boxborough
Intersection of Rts 495/111
Boxboroug, MA
Contact: Bill Von Achen
(508) 263-2662

***Wednesday, January* 24**
Subject: TBD
Speaker: TBD
Time: 7:00 pm
Location: Sheraton Boxborough
Intersection of Rts 495/111
Boxboroug, MA
Contact: Bill Von Achen
(508) 263-2662

Orange County Chapter Activities

No meetings are planned until after the first of the year. Those interested in the activities of the Orange County Chapter are encouraged to call Paul Herrick at (714) 770-1223.

Portland/Seattle Chapters

Portland-
***Tuesday, November* 21**
Seattle-
***Wednesday, November* 22**
Subjects:
1) Dept. of Commerce/Harmonization
2) Seminar Reports
3) 1992 in the EC
Speakers:
1) P. Perkins, Tektronix
2) J. Patterson, Spectraphysics
3) TBD
Time: 7:30 pm - Portland
7:00 pm - Seattle
Locations:
Portland General Electric Co.
14655 SW Old Scholls Ferry Rd.
Beaverton, OR 97005
(503) 643-5454
Corner of Murray & Schools Ferry Rds.
Data I/O Corp.
10525 Willows Rd., N.E.
P.O. Box 97046
Redmond, W A 98073
124th St. Exit off 1-405
Contact: Rich Nute - HP
(206) 896-2691
Raj Shah - Data I/O
(206) 881-6444
Art Henderson
Western Transformer
(503) 777-5636
No December meeting.

Santa Clara Valley Chapter Activities

***Tuesday, November* 28**
Subject: Ethics in Product Safety
Speaker: Joseph Wujek, HP
Time: 7:00 pm
Location: Apple Computer
20705 Valley Green Drive
Cupertino, CA
Contact: Mike Campi
(408) 773-0770
No December meeting.

Tuesday, January 23, 1990.
Speaker: TBD
Time: 7:00 pm
Location: Apple Computer
20705 Valley Green Drive
Cupertino, CA
Contact: John Reynolds
(408) 942-4000.

1990 IEEE International Symposium on Electromagnetic Compatibility

A Spectrum of EMC Issues for the Nineties

August 21-23, 1990, Washington Hilton Hotel, Washington, D.C.

CALL FOR PAPERS
for the
Product Safety Session

The Product Safety Technical Committee (TC8) of the IEEE EMC Society seeks original, unpublished papers on all aspects of providing protection from electric shock in the design of electrical and electronic products, which include, but are not limited to, the following means:

Grounding	Double and Reinforced Insulation
Shielding	Ground Fault Circuit Interrupter (GFCI)
Polarization	Immersion Detection Circuit Interrupter (IDCI)

Papers on the above topics will be incorporated into a program which will provide a brief overview to define each topic and describe the advantages of each method. Note that papers should mention any connection or conflict between the electric shock protection means and EMC control methods (e.g.-leakage current, grounding points, etc.).
The Session title is "Electric Shock - Means of Providing Protection in the Design of Electric Products".

Prospective authors should submit a 50 to 75 word abstract and a 300 to 500 word summary with a maximum of five illustrations covering their selected topic. Upon acceptance, authors will receive their manuscript preparation kits.

We would appreciate the abstract and summary by **December 15,1989.**

The abstract and summary should be sent to the PSTC Symposium Liaison Chairperson:

John Knecht
Underwriters Laboratories Inc.
333 N. Pfingsten Road
Northbrook, IL 60062
tel. 708-272-8800 X3416
fax. 708-272-8129

The Product Safety Newsletter

c/o Tandem Computers Incorporated
10300 North Tantau Avenue, Loc 55-53
Cupertino, CA 95014-0708
Attn: Roger Volgstadt

(See Inside for expanded calendar!)