The Product Safety Newsletter

IEEE

In this issue

Vol. 3, No. 4 July/August 1990

Chairman's Message

[The Chairman's Message this month is a reprint of the one published in the August, 1988, issue of the Product Safety Newsletter. We are now marking the second anniversary of the affiliation of the Product Safety Society with the IEEE EMC Society as a Technical Committee for Product Safety (PSTC). Hopefully, the next year will see the transition of the PSTC to a Technical Council within the IEEE, another step towards the goal of becoming an IEEE Society for Product Safety. - Ed.]

Formal affiliation with the IEEE has been established.

In the last Newsletter, I mentioned two intermediate steps that would help us reach our goal of becoming an IEEE Product Safety Society. These were first, a Technical Committee of an existing IEEE Society, and second, a Technical Council of two or more IEEE Societies. Progressing through these steps in an orderly manner will provide the most efficient migration from our present unaffiliated status to an IEEE Product Safety Society.

We have taken the first of these steps. On August 1, I met with the IEEE EMC Society Board of Directors to present our history and goals, and to formally request their sponsorship of our group as a Technical Committee. Upon conclusion of my presentation, a motion was made to form a Technical Committee on Product Safety. The motion was approved and I am pleased to announce that we have successfully completed the first step toward becoming an IEEE Society.

Following the formation of the Technical Committee on Product Safety, a motion was made to appoint me as its Chairman. This motion was unanimously accepted.

Rich Pescatore

I will now be working with the EMC Society Technical Services Director, Don Heirman, to develop the details of our organizational structure. I am confident that we will maintain our focus on Product Safety and move forward toward taking the next step, affiliation with the IEEE as a Technical Council. During this process, I expect to keep in close contact with the Chairmen of our local chapters so that we can coordinate our efforts to continue our rapid and successful growth.

The only immediate change that we will experience is a change in nomenclature. We are now the Technical Committee on Product Safety, rather than the Product Safety Society or the CSA Users Group.

I would like to take this opportunity to thank Don Clark, IEEE EMC Society President, and the other members of the Board for their support. The Technical Committee on Product Safety looks forward to a mutually fruitful relationship.

Richard Pescatore
Chairman

The Product Safety Newsletter

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Comments and questions about the newsletter may be addressed to the *Product Safety Newsletter,* Attention: Roger Volgstadt, LOC. 55-53, c/o Tandem Computers, 10300 N. Tantau Avenue, Cupertino, CA 95014. Fax No. (408) 285-2553.

Technically Speaking

Selecting a Fuse Value (continued) by Rich Nute

[These figures belong with the article by Rich Nute that appeared in the last issue (May/June - Vol. 3, No. 3). We apologize to our readers for their inadvertent omission. - Ed.]

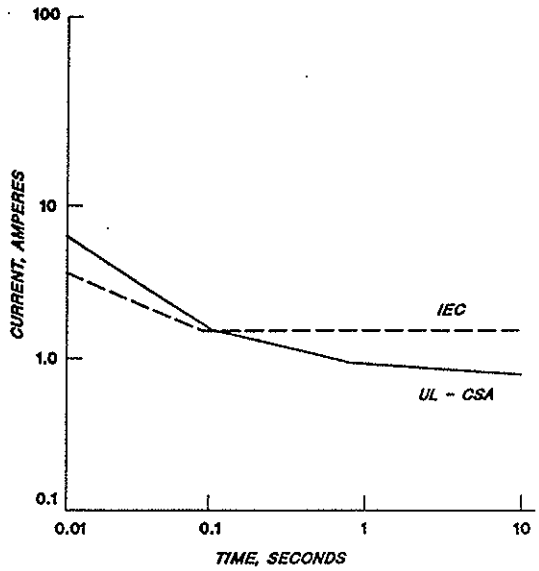

FIGURE 1
1 amp fuse curves
5x20mm fast-acting
IEC and UL-CSA

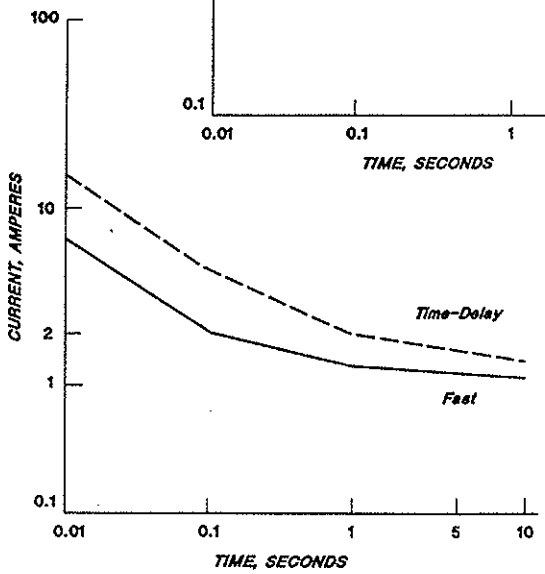

FIGURE 2
1 amp fuse curves
5x20mm UL-CSA
fast and time-delay

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damage claims the friendliest hearings. It is an area of government regulation in which a single federal law will impose a far lighter burden on efficiency and productivity than 50 state laws do." (14) S.44 is not intended to reduce the urgency or responsibility of a manufacturer to provide products in which all unreasonable risks have been controlled. It will, however, be a good start toward correcting the questionable practices of current product injury litigation.

[The conclusion of this paper will be printed in the next issue, when the author discusses, "What is the Role of Engineers in Dealing With the Safety and Liability Challenge?". Letters of comment should be sent to the PSN. - Ed.]

Managing Tomorrow's Product Safety and Liability: The Engineers' Challenge

by K. L. Pfundstein
Member ASAE
Consultant, KPS Technology Co.

For Presentation at the Winter Meeting of the American Society of Agricultural Engineers, New Orleans, LA, December 11, 1984

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["The Lecture Series has been developed by the Power and Machinery Division Tractor Committee (PM-47) of ASAE to provide in-depth design resource information for engineers in the agricultural industry. ... Topics shall be related to the power plant, power train, hydraulic system, and chassis components such as operator environment, tires, and electrical equipment for agricultural or industrial tractors or self-propelled agricultural equipment."

That description may not seem very promising if you are expecting to read an article of interest to engineers interested in electrical product safety. I think you will find that first impressions can be deceptive. This paper contains many concepts that apply to main-frame computers just as well as to tractors.

Because of the length of this paper, the conclusion will appear in the next issue. If you have any comments, we would be glad to hear from you. - Ed.]

ABSTRACT

By most measures, the engineering profession in this country is faced with unprecedented challenge in the immediate future. The challenge wrought by the combination of exploding technology and a dramatic shift toward an information processing society is at least as big as any faced in the past. Foreign competition is awesome. Superimposed on this is the increased priority on accident prevention as well as nearly unmanageable legal demands due mainly to the inconsistencies and abuses of product liability actions.

In spite of a progressively stronger commitment by manufacturers to product safety, and after years of intense regulatory and legal pressures, accident levels are disappointingly high and slow to decline. Instead of sharing a mutually constructive course of action toward overall accident reduction, the engineering and legal professions are operating in an adversarial vacuum. Product litigation often becomes so self-serving as to be counterproductive for product safety/accident prevention.

The purpose of this paper is to help engineers understand today's and tomorrow's product safety and liability climates, the implications of their interactions, and then to describe how to deal with the challenge in terms of policies and procedures in the design of tractors and other machinery. Engineers must continue to innovate - seeking and applying the highest practical level of safety technology, especially as it relates to human behavior. It's called PERCEPTIONEERING. By doing our homework well and performing professionally in the spirit of our engineering code of ethics, we can successfully manage the double-edged challenge to apply design judgments that are most effective in universal accident prevention and when necessary, to demonstrate their legal defensibility.

INTRODUCTION

Successful machinery design in the US today is not possible without an understanding of our social and legal obligations - obligations that may seem peripheral in some respects, yet are as basic as strength of materials or cost overrun. They are:
** Society and management expect a high level of priority, competence, and accomplishment in designing for safety/accident prevention.
** The courts often levy calamitous penalties for inadequate performance, either by the designer or of the product.

By most measures, the engineering profession in this country is faced with unprecedented challenge. The challenge wrought by the combination of exploding technology and a dramatic shift toward an information processing society is at least as big as any faced in the past. The threat of unprecedented foreign competition is just beginning to be understood. Superimposed on all of this is the increased priority on accident prevention as well as nearly unmanageable legal demands due mainly to the inconsistencies and abuses of product liability actions.

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The Engineers' Challenge

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The purpose of this paper is to help engineers, especially the younger ones, understand today's and tomorrow's product safety and product liability climates, the implications and challenge of their interactions, and then to describe how one might deal with them in terms of policy and procedures in the design of farm tractors and other machinery.

The subject is quite complex. There is no handbook on product safety or product liability, and no simple list of "do's" and "don'ts".

Why is Product Safety, Including Product Liability, So Important to Engineers, Particularly Young Engineers?

A moral/ethical opportunity and obligation exists where personal injury is involved. Man's instinctive motivation toward acting as his brother's keeper, finds much satisfaction in product safety work. Who among us has not aspired to be in the right place at the right time so we could save a life? Product safety practitioners who are diligent and effective save many lives and limbs, even though the names of the "unvictims" are usually not known. Consider too, that our Engineers' Code of Ethics (1), like the medical doctors' Hippocratic Oath, provides not only a basis for unique personal satisfaction from a job well done, but also demands a high level of loyalty to standards of our profession.

Admonishment toward accident prevention and concern for the safety of others is at least as old as the Bible's Deuteronomy 22:8 (1220 or so B.C.), "When you build a new house, you shall make a parapet for your roof, that you may not bring the guilt of blood upon your house, if anyone fall from it." The Fundamental Cannons of our Engineers' Code of Ethics contain admonishments like:

"... Hold paramount the safety, health and welfare of the public ..."
"... Truthful manner ..."
"... Faithful agents ..."
"... Not compete unfairly ..."
"... Enhance the honor and integrity ..."

We can conclude then that product safety work is important for reasons of rewarding self-fulfillment, as a central ingredient of character, and in response to societal expectations.

Professionalism demands priority on such important issues. Societal trends in recent years serve to remind us that as engineers, we are truly professionals. As professionals, our actions are rightfully subject to greater public scrutiny than those of some others. More is expected of us.

Examples of failure to perform professionally are all too frequent these days. What about the engineering vice president who says, "I'm not involved with product safety. I have good engineers and I expect our lawyers and insurance carriers to take care of any problems"? Such an attitude reflects some irresponsibility and sooner or later will cause serious economic embarrassment for that company in court.

And what about the design engineer who says, "Because I'm not properly trained, I am not about to deal with human behavior parameters that might contribute to accidents with my tractor design."? This attitude likewise reflects immaturity, perhaps some irresponsibility, and signals probable career limitations ahead.

Professionalism within product safety ethics and today's technology translates into some very specific implications for the design engineer. For example, who has more opportunity to choose the best design tradeoffs, or to determine that a safety warning sign is needed? Society and the courts speak clearly today, "If not you - who, the boss?" and "If not now - when, after the body count?". It is clearly the product engineer's responsibility to recognize and apply not only traditional engineering principles, but also the need for state-of-the-art human factors and behavioral input in safety-related design decisions.

We might conclude then that product safety professionalism requires not only sound engineering, but consistency in personal commitment, comprehensive analysis, and objective input to make certain that known and reasonably foreseeable hazards are eliminated or controlled.

Accidents cost money and affect a manufacturer's profits. Accidents not only produce much human misery, they often result in large economic losses for accident victims. In addition, numerous kinds of costs to the manufacturer can add up to a major impact on profitability. These costs result from:

* Accident investigation
* Accident analysis
* Outside consulting services

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The Engineers' Challenge

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(analytical)
* Evaluation of possible future product changes
* Changes in future products
* Evaluation of possible changes to past products
* Locating owners of past products to be changed
* Changes to past products
* Processing legal claims/ litigation
* Preparation of litigation defense
* Litigation settlement
* Insurance premium increase

The link can be very direct between any one engineer's error of commission or omission and some or all of these costs. In assessing the attributes of their product engineers, companies know that inadequate safety judgments can easily cancel out the merits of an engineer's other proficiencies.

Product safety technology can be expected to continue to progress in scientific/engineering fields, in analytical areas, and especially in administrative procedures. These translate to a need for high priority and commitment by design engineers and by management.

Sound engineering judgements that can prevent accidents and minimize product liability risk require an understanding of certain legal/litigation parameters. Unfortunately, the US is still wallowing in a posture of product liability litigation that is quite unproductive in accident reduction and is insidious in its legal-intensive implications. Instead of sharing a mutually constructive course of action toward overall accident reduction, the engineering and legal professions often operate in an adversarial vacuum. Inconsistencies and questionable tactics by the plaintiffs' bar (lawyers that handle claims for the injured), and by some defense lawyers, give off confusing signals.

Certain actions, or a lack of action, by design engineers, and/or the performance of a product, can be found inadequate by a court many years after design or sale of the product, with that finding subject to later reversal by a different court, and often with little if any allowance for negligent action by the product user. Product engineers are thus faced with a need to understand and act in accordance with certain legal principles and procedures. No engineer can escape the occasional serious questioning of his/her safety design judgement, either by one's in-house management system, or by the courts. It is essential to be able to defend not only the basis for one's technical judgment, but also to know how to cope with and avoid the pitfalls of litigation.

It seems reasonable then to expect design engineers to learn at least as much about defining the term "unreasonably dangerous" as plaintiffs' lawyers are learning about engineering and design. Defense lawyers rely heavily on help from designers to prepare factual and effective arguments. Expert witness work and accident investigation also require the engineers' special perspective.

Good job opportunities are available to the engineer who understands and can manage product safety technology. In addition to various legal premises of" product liability and case law, product safety technology includes the traditional areas of engineering, societal demands, human factors/ human behavior criteria, industry standards work, government regulatory matters, and relevant administrative strategy and organization.

The interdisciplinary nature of product safety together with the potential for major economic loss, defines a management function that is quite unique in its requirement for securing understanding and commitment of nearly all departmental functions in an organization. Special management policies and procedures are essential. A logical question is how/where to learn such a broad combination of disciplines.

Numerous degree programs are available to train for work in occupational safety (employee or plant safety). In contrast, very few schools offer degree work in product safety. This is due, in part, to the complexity of structuring such an interdisciplinary curriculum. Plant safety training and experience are not adequate for product safety work. In addition to the special implications imposed by voluntary industry standards, two very basic differences exist:

** Plant environment and behavior are supervised and therefore controllable to a large degree. Product safety environment and behavior are virtually unlimited, with the user responding voluntarily and only to those safety practice admonishments perceived to be beneficial.

** Product liability exposure imposes

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a variety of nuances on nearly all aspects of design, manufacturing, marketing, and service without providing dependable criteria for the decision process.

A number of excellent training seminars are conducted regularly by academic, trade, and technical organizations. These present not only product safety technology, but also the unique opportunity to get acquainted with the corporate product safety programs of other companies and the people who administer them. There is no substitute for such interchange.

For a management position, prior experience with various engineering related functions is essential. This experience should include extensive dealing with the policies, people, and procedures of product design, testing, manufacturing, reliability, and service. Essential also is the need for considerable first-hand interchange with in-house lawyers and others involved in product liability action.

For the foreseeable future, we can say that product safety administration offers rewarding opportunity for the engineer who enjoys work that preserves lives and limbs, is uniquely involved with top management and many other departmental functions, and has a direct and significant impact on profitability.

Product liability in the United States is "out-of-control", is a serious problem, and most of its accusation is against engineers. Plaintiffs' lawyers often try to show that the engineer was incompetent and/or erred knowingly - even out of willfulness. Such an adversarial posture can be quite repugnant to the accused, especially when they are required to respond within restrictive rules largely controlled by the very group of accusers who stand to benefit financially when they win a point.

Second, and perhaps the most damaging to the cause of overall accident prevention, is the legal procedure that requires defense arguments to focus only on circumstances relevant to the accident in question. (The plaintiffs side is usually permitted to argue with information from other situations.) For example, it often becomes necessary to agree that a particular alternate design might have been beneficial in preventing or reducing injury under the exact set of circumstances of the accident being litigated. Such admission is frequently the key to reaching a verdict against the engineer and his employer. At the same time, it may be well known in professional safety circles that such a design could actually contribute to more accidents under other use environments or circumstances. This practice of isolating the case circumstances from the prerequisites of broader use environments is suspiciously self-serving of the plaintiffs' bar and is contrary to the cause of universal safety.

Another disturbing fallout from current case law is the pall spread over engineering decision-making by judgmental legal premises that are unable (perhaps unwilling) to define in advance what constitutes satisfactory of acceptable design. Unpredictable, after- the-fact litigation, subject to reversals over long and costly periods, is the mold into which product engineering is being forced.

The legal fraternity cannot be expected to correct the ills of runaway product liability considering the dominance of the plaintiffs' bar. Neither the will nor the understanding is there to shape a platform of engineering law that will serve justice for the injured while preserving the foundation of engineering endeavor.

It is the author's studied opinion that the engineering profession is the only qualified group capable of quarterbacking construction of an equitable system so badly needed. My reasons are:

** A traditionally high level of credibility in the engineering profession.

** Numerous experiences with administrative offices of the US Congress and with government regulatory groups, wherein the private sector is requested to provide engineers rather than lawyers, to work out difficult multidisciplinary problems.

** The absence of any overriding self-preservation stimulus in engineering such as the contingency fee syndrome in injury litigation.

John Bunyan, the writer of Pilgrims' Progress, gave us all some good advice on the subject. Even though his focus was on a somewhat broader sphere of lifesaving, he wrote, "You have not lived today until you have done something for someone who can never repay you."

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The Engineers' Challenge

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What is the Nature of the Product Safety / Product Liability Problem and Challenge?

Accident rates in this country are declining very slowly and most levels remain unacceptably high. Beginning in 1970, the Occupational Safety and Health Administration (OSHA) (2) dictated that hundreds of changes be made in plant environments, machinery, and other hardware with little consideration of the importance of related behavior changes. It took nearly ten years to convince the bureaucrats that in occupational accident prevention, such physical changes were often of comparatively minor importance compared to behavior modification. In the product safety area, a similar demonstration resulted from the contrast of automobile design changes vs. a mandated 55-mph speed limit.

In 1965, the American Law Institute adopted Section 402(a) - "Restatement of Torts", called the Doctrine of Strict Liability. The new Doctrine helps plaintiffs' lawyers continue to claim that lawsuits against manufacturers are the only effective way to achieve safety because it forces them to use only those design features that are safe. Court room fixes to the product are often ineffective in overall accident reduction and may actually contribute to more accidents. In a related context, the legal pronouncement that all safety features must be made standard equipment has been rather unceremoniously corrected on several occasions by explaining why in certain instances, the users' option' must prevail due to special use situations.

Safety professionals have long known that without reasonable user behavior, most products continue to be involved in accidents - including those incorporating the features mandated by regulation or born of litigation.

Experience in Europe provides another long-term example of why satisfactory accident experience will never be achieved by simply seeking a different or so- called safest design. For more than 50 years, some European governments have utilized a comprehensive system of analyzing product-related accidents and specifying innumerable and detailed safety design requirements for manufacturers. Until recently, the general feeling was that the system was very effective in preventing accidents. However, in the course of international exchange of accident experiences, it was recently discovered that for farm machinery at least, accident rates (number of accidents per machine Population) have long been much higher than expected and quite comparable to those in the US. This somewhat startling revelation has once again demonstrated that until and unless reasonable behavior is achieved through applied safe work practices and incentives, accident levels will remain unacceptably high.

It is important to keep in mind that some product liability actions are beneficial. Justice is frequently served with reasonable awards to deserving claimants. Accident prevention is promoted when a lawsuit teaches a manufacturer to be more aggressive and safety-minded in a given design or in corporate policy and procedure. Likewise, the cause of safety is damaged, and lawyers can make strong accusation with those occasional examples of shoddy engineering design judgments or corporate practice that reflects apathy.

Basic accident prevention principles are often eroded by the philosophy and arguments of the plaintiffs' bar. The courts shifted the law from one of "responsibility/liability when the manufacturer had knowledge of a hazard" to "when the manufacturer had the ability to foresee the hazard". And, personal injury lawsuits are often won by plaintiffs' arguments that are contrary to universal safety principles. What a dilemma.

For example, on what basis does one decide that the alternate design implication from a lost lawsuit is inappropriate for general application because the hardware would usually be disconnected by the operator, or become inoperative from damage or neglect? Such judgments require a great deal of personal and corporate soul searching in view of the potential economic impact on the manufacturer on the one hand, and in terms of the ethics involved in possible loss of life and limb on the other. They also require a great deal of confidence stemming from intimate knowledge of the products' use environment, and by having certain dependable corporate safety policies and procedures in place. A number of these are presented in some detail in the last section of the

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paper.

The thrust of most plaintiffs' bar arguments is that a different design (or safety sign) might have been better/safer and that the product in question is defective or unreasonably dangerous because it didn't utilize that design. The strict liability legal thesis usually ignores consideration of unreasonable or negligent behavior as a causal factor. This is such a distortion of justice that some states have now modified their strict liability doctrine to permit limited comparative or contributory negligence arguments.

Publicity from endless injury litigation and the impact of many unbelievably large settlements are so pervasive that it encourages many to think and act as if "someone else is responsible for my safety". Safety professionals know that this insidious legacy is counterproductive. It means that accidents will continue in some direct proportion to the resultant loss of personal diligence that erodes awareness and kills incentive to read and heed safety instructions. It is contrary to the useful philosophy that says "learn to drive defensively".

Product liability thesis argues that acceptability of a product can be determined only by the courts. Court decisions, as well as the reasoning behind the decisions, vary with time, vary or conflict from state to state, and may be reversed years later by a higher court. Such unpredictability provides no dependable rationale on which to base professional judgments concerning accident prevention.

With more than 600,000 US lawyers, 25,000,000 new lawsuits each year (3), hopelessly clogged court agendas, and accident rates still unacceptably high, clearly, the 19 litigious years since the Restatement of Torts demonstrate beyond reasonable doubt that injury litigation as now being practiced does little to aid overall accident reduction.

Courtroom-designed product safety features that users frequently disconnect, discard, or refuse to repair/replace, are not cost effective in accident Prevention. However, such features are often foisted on the manufacturer as a result of losing a single lawsuit and out of fear of being cited for punitive damages in future accident litigation if the feature is not provided.

Although ostensibly focusing on unreasonable risk, plaintiffs' lawyer arguments often suggest a requirement for near zero risk. In the human factors area for example, such arguments imply that the omission of any feature that might have assisted in discouraging behavior that led to a particular accident, constitutes a defect in the design. In other words, any design capable of being improved upon is, by definition, defective. This kind of legal posturing is obviously self-serving and does not benefit the cause of overall accident prevention.

Questionable practices of plaintiffs' lawyers are responsible for loss of respect and a growing concern within the American Bar Association. A recent Gallup poll records the "honesty and ethical standards" of 24 professional groups according to the American public (4). Lawyers fall below the mid-point, between clergymen, pharmacists, and engineers at the top and car salesmen at the bottom.

In a Houston, Texas meeting last year (5), public skepticism concerning the honesty and ethics of some lawyers was raised. Six legal experts met to instruct 70 other lawyers on how to win acquittals for drunken driving defendants even if there is substantial evidence against their clients. Lawyer Reese I. Joye, Jr. summed up the conference by advising "try the case, try the machine, try the prosecutor, try the judge, and try the case".

Perhaps the most revealing indictment of lawyers in recent times comes from the grand mentor himself, Chief Justice Warren Burger. In a recent presentation before the Notre Dame University Law Center in London, England (3), he made the following points:
" - lawyers should be the healers of conflicts - . Lawsuits ought to be the last resort - like war. Lawsuits and wars often occur when the lawyers and statesmen fail in their role as healers and peacemakers."
"In America, I am bound to say the current generation of lawyers, or at least far too many of them, seem to act more like warriors eager to do battle than healers seeking peace."
" - professional ethics must have far greater attention from the profession."
" - American courts are flooded with thousands of cases that should not or need not be there and cost shifting might help." (author explanation: taxing of costs to the losing party in litigation).

Some responsible members of the Bar, and many others, are so concerned over the dangerous perva-

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siveness of injury litigation that at least some effort toward regulation of litigation lawyers has begun in the form of tort reform state legislation and a federal bill.

Unwarranted costs to society of product injury litigation could be greatly reduced by correcting certain abuses. Long, drawn-out, costly lawsuits have become characteristic of accident/injury situations in recent years. Much of the high cost is a direct result of delay/postpone maneuvering, of the "unlimited game" of searching through files, and the deliberate creation of mountains of paperwork that blur the objective and confuse those who must process all of it and respond. Unfortunately, these tactics are sometimes practiced by the defense as well.

Claims for a single accident today may reach $100,000,000 or more, although typical awards are much lower. Lawsuits frequently include what is known as punitive damages, which usually exceed the basic compensatory claim by several times. For example, in addition to requesting compensation for injury, say $500,000, the plaintiffs lawyer may ask the court to punish the defendant with a $5,000,000 award for action that is alleged to be wanton or irresponsible - for alleged failure to take proper preventive action. The defense costs of such suits are often staggering, win or lose, and punitive damage claims are not insurable in most states.

In the US, it is permissible for lawyers to collect not only their regular fees but also what is known as a contingency fee when handling lawsuits. A plaintiff's lawyer, for example, may claim as much as 50% of the award and the injured plaintiff gets what is left. A recent study of 24,000 claims showed that for every 59 cents a plaintiff actually nets, lawyers (plaintiff plus defense) get 99 cents or 68% more than the injured party (6). In Canada, such abuse is controlled by law by placing a limit on certain fees.

The cost of injury litigation to manufacturers includes a variety of defense costs, settlements, insurance premiums, etc. The total of these for all of industry is a staggering amount, nearly all of which is added to the price of the product.

The use of large numbers of expensive expert witnesses is another reason for excessive costs. The expert witness trend has been called an "unregulated growth industry." The following is a quote from the News Sun, February 19-20, 1983 (7). "A Los Angeles trial lawyer, Herb Hafif, says such growth has caused some trials to become just a parade of expert witnesses in which jurors are confronted with conflicting expert testimony. They often introduce unnecessary complexity into a case, adding only confusion and creating opportunities for flimflam." The newly installed president of the California Trial Lawyers Association, Roberta Ritter, is also quoted in the article, saying, "Sometimes they are very good Liars."

Another hidden cost of the present product liability climate is the all too frequent decision by management to forego development or introduction of a new product (or to drop an existing product) because of the uncertainties and expected high cost of possible litigation defense. This situation continues to contribute to the rather alarming trend of the US falling behind in the international race for research leadership, new product introduction, and patents.

An equally serious "cost" problem stems from the understandable reluctance of a company to endure the negative publicity that often accompanies a large economic loss in litigation. As a result, individuals and their companies may resort to procedures which are inefficient, frustrating, and counterproductive for overall accident reduction. Examples include:

** Following legal advice to either avoid keeping records or to destroy all records that might be damaging in court.

** Adding a safety device that obviously will be discarded or circumvented by the owner.

** Failure to identify/record mistakes or weaknesses in corporate product safety effort for fear of self- indictment in discovery.

Present injury litigation practice includes large and shameful misuse of national resources. The problem and challenge for engineers then, is to first understand when and how justice and right are being prostituted, and to respond with candor and truth. Whether we choose to support the plaintiff or the defense, we dare not become insensitive to the need to define justice on the side of action that serves the highest cause - fewest accidents for the greatest number.

What Should Be Done to Correct the Problem?

Continued

The Engineers' Challenge

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Engineers and their employers must continue a priority of diligence that controls all unreasonable risks. Special commitment and emphasis is necessary for individuals and organizations to be sure product safety is always an integral part of the fabric of product design and not some peripheral or after-the-fact endeavor. Safety considerations are as much a part of successful product design as strength of materials. Correction of design deficiencies is nearly always more costly in late stages of development than in concept or early stages.

Through control of all unreasonable risks, a manufacturer protects countless lives and limbs and provides the necessary confidence for seeking justice in any lawsuit. By maintaining a high priority on product safety, manufacturers are continually advancing the state-of-the-art of accident prevention.

Because untoward human behavior is so often the cause of accident and injury, design engineers need to continually develop their skills of perception and foreseeability involving product use environment and related human behavior patterns. More research and task analysis work is needed to find additional/better ways to elicit prudent user behavior, especially in instances where essential tradeoffs dictate inherently dangerous machine environments. As with the unbuckled seat belt question for example, we must elevate the farmer's incentive to shut off the power before leaving the operator's station. Proficiency in the interface area of design and foreseeable human behavior is so productive in framing practical design judgments that it deserves a name like PERCEPTIONEERING.

PERCEPTIONEERING includes professional responsibility for early identification and response to certain elusive societal benchmarks of safety and health. For example, until recently, emotional and legal threats were sufficient to prevent public admission that risk of injury or death could and should be quantified, or a dollar value placed on a prevented injury or fatality. While difficult to do, it is a must if we are to deal realistically in product safety judgments with those issues that a free society, by its degree of public clamor, actually quantifies every day in a subjective manner. Public tolerance of 40,000 annual highway automobile fatalities is one example.

In another example, the Nuclear Regulatory Commission has finally succeeded in quantifying a reasonable degree of risk of fatality for living next door to a nuclear power plant. In their draft-for-comment of "Safety Goals for Nuclear Power Plant Operation" the risk is defined as, "The risk to an average individual in the vicinity of a nuclear power plant of prompt fatalities that might result from reactor accidents should not exceed one-tenth of one percent (0.1%) of the sum of prompt fatality risks resulting from other accidents to which members of the US population are generally exposed." (8)

Chauncey Starr published some unique study results in 1969 entitled "Social Benefit vs. Technological Risk". (9) By calculating risk as "fatalities per person exposed per hour of exposure", he was able to present a comparison of risks that was much more informative than the traditional statistical count of the number of occurrences (see table). Farm tractor operation risk was calculated and inserted by the Product Safety Dept. at Deere & Co., according to Mr. Starr's criteria. Who would have believed that the risk of fatality from driving a farm tractor and smoking were about equal, and only one-fifth that of riding in commercial aircraft.

COMPARATIVE RISK OF FATAL ACCIDENTS:		Fatalities per exposed person per hour of exposure	An equivalent ranking for ease of comparison
Electric power	fewer	3 x10*-9	0.008
Railroads	accidents	5 x10*-8	0.1
Farm tractors	|	4 x10*-7	1.0
Smoking	|	4 x10*-7	1.0
Hunting	|	1 x10*-6	2.5
Skiing	|	1 xl0*-6	2.5
Motor vehicles	|	1 xl0*-6	2.5
Commercial aviation	more	2 x10*-6	5.0
General aviation	accidents	3.5x10*-5	87.5

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The Engineers' Challenge

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How often we fall victim to so much preoccupation with immediate short-term demands that the search for better long-term solutions is ignored. Product safety needs fresh insights in both the analytical and presentation fields - insights that focus more on accident prevention than on legal defense.

Make sure our employers have certain key corporate policies and procedures in place. In every successful organization important decisions involve a management hierarchy that functions according to certain principles, policies, and procedures. Product safety decisions frequently involve complex trade-offs and judgments, yes, even conflicts between practical accident preventing design and the liability implications of a lawsuit.

For example, what should you do when your company has just lost a large product injury lawsuit and the plaintiff s lawyer then threatens to bring a huge punitive damage claim against your company in any next accident unless you promptly modify all such products now in the field, plus all such future products, according to the court's design criteria? Let's assume you believe the court's design criteria are based on tunnel vision from a single accident situation and would cause more accidents rather than fewer, if applied to all of that model of your products. Many are tempted to cave in to such threats because of the large economic risk.

To decide under such circumstances, that your current design is better, requires courageous management backed up by sound corporate policies and procedures. These policies and procedures need to serve both product engineers and management in providing practical decision-making guidelines that balance the requirement of societal ethics, technical/engineering professionalism, and legal/liability demands. The more important areas of such guidelines are addressed in the last section of this paper.

Strive for good voluntary industry safety standards that cover all identified major safety hazard categories. Because of the need for interchangeability among makes and models of farm machinery, and because of the importance of safety, practical voluntary industry standards have been a vital part of design considerations since the late 1935. The federal government's investigation of farm machinery safety in 1970 resulted in a report by the Department of Transportation that saw no need for regulation - citing a high level of voluntary accomplishment within the industry.(10) Manufacturers, along with organizations like ASAE and FIEI, had reason to be proud of this finding that cited good voluntary industry standards in concluding that commitment and progress in industry safety efforts were adequate, and that accomplishment should be checked again in two to five years.

Perhaps the greatest single reason for this complimentary conclusion was that the industry was continuing to identify the most serious safety hazards associated with the use of farm machinery and then developing practical voluntary safety standards for each. Much good safety standard work has been done since then, but it has not kept pace with expanding needs.

Ironically enough, the standards effort continues to be hampered by the threat of embarrassment in litigation over some procedural or problem admission that occurs, for example, in committee work. Those who are known to manipulate, for their own economic benefit, information learned during candid exchanges in safety standards committee sessions, often cause company lawyers to recommend limited or no participation by manufacturer's representatives. Personal ethics seem to be the only solution to this problem and most manufacturers are finding ways to live with the threat.

A rather recent development that many feel is beneficial to our country's safety standards efforts and to overall product safety, is the joining of the federal government and the private sector in a mutual objective and standards purpose. The Office of Management and Budget circular A-119 entitled "Federal Participation in the Development and Use of Voluntary Standards" 1982 (11), makes it clear that government is to encourage and participate in the development and use of voluntary industry safety standards as usually sufficient, and where a regulatory standard is needed, to adopt any reasonably sufficient industry standard in place of developing a separate government standard.

In contrast to the early OSHA approach, or the more recent misdirected attempt by the Federal Trade Commission to regulate all standards

continued

The Engineers' Challenge

Continued

issuing organizations (initial proposal, December 1978), this climate offers great incentive for the private sector and government to work together, and on fundamental needs in place of contrived bureaucratic objectives. It also challenges us to be sure our standards exhibit the highest level of professionalism as to content and structure including grammatical accuracy, that they are effective, and, of" course, avoid any intentional exclusion of an adequate product.

After some 15 years of unsuccessful effort to control hazards/accidents through government regulations and litigation, safety practitioners are even more aware of the foundation of dependable accident prevention - awareness and avoidance. Manufacturers have both a moral and legal duty to warn of reasonably foreseeable hazards such that a product user is able to avoid or control the risk. When safe use of a reasonably designed product depends on reasonable prudence by the user, it would seem that the users' responsibility to read and heed the warning should be commensurate with the manufacturers' responsibility to issue those warnings. Unfortunately, plaintiffs' lawyers often distort the duty-to-warn part of tort law by applying it only to the manufacturer.

To say human behavior cannot be changed, so the only thing left is to change the machine, is an unfounded and dangerous generalization. Human nature may be unchangeable but human behavior is not. Much of life is spent learning to modify one's behavior, for example, to prepare for an athletic event, to learn to buckle our seat belt, or to accept the 55-mph speed limit to save lives and fuel. Incentive is the mother of change and our survival often depends on that change.

Acceptable accident experience with farm tractors and other machinery will be achieved only when we gain acceptance of and rigorously apply the discipline that says
** Provide only machines in which all unreasonable risks are eliminated or controlled.
** Make certain that reasonably foreseeable remaining hazards are identified and warned about through practical safe work practices (operator's manual, safety signs, dealer predelivery instructions, etc.)
** Provide users with incentives-to read and heed those safety practices (strong incentive is provided by extension safety programs, a "nagging" spouse, insurance ratemaking, court decisions that punish imprudent behavior, etc.).

To make industry safety standards more effective then, it seems clear that for each category of hazard the standard should focus as much on safety practices as on the performance of hardware. For example, a damaged or removed ROPS may provide little or no protection in a tractor upset; full effectiveness of ROPS is achieved only when the seat belt is buckled; or, how does one achieve reasonable transport safety with a tractor front-end loader combination unless the load is carried low? There is urgent need in ASAE, and in other technical societies, to formalize this focus on safety practices as a basic part of safety standards work. It holds much potential in future accident prevention and is an essential ingredient in correcting that often misdirected lawyer argument, "It should have been designed differently".

Help lawyers prepare and present arguments that are technically and ethically sound. Lawyers are heavily dependent on engineers to explain the technical/engineering aspects of product design and manufacturing, and to do so in terms that are easily understood by all concerned. Whether for the plaintiff's side or for the defense, justice requires objective and forthright engineering analysis of a design or accident phenomenon. Unfortunately, the use of hired expert witnesses may entail a manipulation of the issues to confound, overpower, and/or mislead the court. As pointed out earlier, this growing trend strikes at the very heart of our profession. It is the ethical duty of every engineer to expose any technical misrepresentation and those engaged in such veiled perjury.

Defining or proving unethical conduct is difficult, but not impossible. Both professional and personal ethics (morality) are very much a part of legal proceedings. Yet it is a well known "backroom admission" that injury litigation is considered by many lawyers to be a "game".

Whether we assist in litigation voluntarily or through subpoena, both our personal character and professional credibility are at stake. Neither should be for sale to the highest bidder.

Encourage insurance industry to

continued

The Engineers' Challenge

Continued

provide safety incentive through attractive premium reductions for good preventive practices and/or good loss performance. The incentive to qualify for a lower insurance premium often influences what fire control materials or features are selected for a building, for example, sprinklers. Carriers often reduce premiums on automobile accident insurance for non-drinkers or for a long accident-free driving record. Incentive, both personal and corporate, is the leading driving force behind most modified behavior. It has proven to be both the mainspring and balance-wheel of individual lives and of free enterprise in the western world. It should be a larger part of all future safety work.

Given today's understanding of the value of safe work practices, the insurance industry could strengthen its effectiveness and profits by a more structured promotion of safety practice information and through performance related rate setting. Premium-reduction incentives for farms with hired help could be especially effective, either under Workmen's Compensation or for private liability coverage.

Encourage the courts to provide safety incentive by awarding damages in relation to good preventive practices. What's wrong with settling a lawsuit in favor of a plaintiff when it is shown that the manufacturer failed to identify/warn about a basic safety hazard? Or, what's wrong with settling a case in favor of the manufacturer when the plaintiff admits to a willful breach of a well-known safety practice identified in the operator's manual. I once read of a perceptive judge that reduced the size of an auto injury award by 50% because the plaintiff admitted to an unbuckled seat belt.

Engineers need to speak up for what they believe to be justice that serves society as a whole, whether it be as an expert witness, as a member of the jury, or as a professional citizen. So long as plaintiffs' lawsuits continue to command huge awards in the face of admitted violation of fundamental safety practices, accidents will continue in direct relation to the apathy and contempt which such a discipline breeds.

Since the shooting of President Reagan in March, 1982, we have witnessed the power of public outcry in demanding that lawyers and judges correct the scandalous injustice of the "innocent by reason of insanity" legal procedure. The same sort of public pressure on lawyers and judges may be required to move injury litigation procedures back to reasonableness.

We must not allow the unprincipled lawyer or suspect legal procedure to frustrate legitimate safety goals. In a recent address to the Bar Association, Chief Justice Burger chided his profession over abuses of frivolous lawsuits and the discovery process. In urging judges to use sanctions, he said: "A few, carefully considered, well-placed $5,000 - or $10,000 - penalties will help focus attention on the consequences of abuses by lawyers." (12)

Federal legislation needed to bring uniformity and predictability to criteria for liability in litigation. With 50 different, and sometimes conflicting, sets of rules governing product liability law and Litigation in the US today, it is not surprising that manufacturers are unable to determine their obligation to society. Likewise, consumers have no way of knowing what their rights are or to receive consistent or expeditious remedies for product related injury.

In 1976, a Federal Interagency Task Force on Product Liability began examining the situation in depth. This study defined two root causes of the problem:
1. Unpredictable/unmanageable procedures in the tort litigation system greatly increase the cost of litigation claims.
2. Large uncertainties in product liability insurance rate setting. The latter problem was partially resolved in 1981 with passage of the Risk Retention Act that permits more realistic insurance coverage.

The remaining and primary problem of tort reform is addressed in Senate Bill S.44 by Senator Robert W. Kasten (13). While the bill has widespread support, a well organized lobby by the Association of Trial Lawyers of" America has until now (September 1984) prevented the bill from becoming law. The heart of the bill is the uniformity and predictability it would bring to product liability action by clarifying/defining the ways a product may be proven defective.

Stanley Lehrer of the New York law firm Squadron, Ellenoff, Plesent & Lehrer, says, "Imagine attorneys shopping among those 50 laws for the one that will give their clients'

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News and Notes
Dave Edmunds

Dave Edmunds

What Do Engineers Do?: An informal survey of 32 Rochester, NY, high school students was asked the question, "What do engineers do?". The responses, while interesting, show how far the engineering profession must go to obtain identity and recognition. If students don't know what an engineer does, why would they become one? Some of the answers - "Fix things like broken motors to things like computers", "He works on machines", "Make and fix machines", "An engineer is a dude who works on engines", "He draws sketches", "Is in charge of a certain department". Eoght students realized they did not know and said so.

German Post Authorities: In a letter from H. Landeck of R&L Engineering Consulting of Raunheim, West Germany, he stated that "the German Post Authorities (ZZF) have decided it is necessary to put the self-declaration per Postal Decree 1046/84 on built-in devices such as hard disks, etc., if they are sold directly to the public (meaning from stores directly to owners of PCs to install themselves)."

NEC 1990: The 1990 edition of the National Electric Code (NEC) is available from the National Fire Protection Association (NFPA), 1 Batterymarch Park, P.O. Box 9101, Quincy, MA, 02269-9101. The code is in looseleaf or softbound edition, and a handbook is also available.

1993 NEC Deadline: Proposals to revise the 1993 National Electric Code (NEC) must be submitted to the National Fire Protection Association (NFPA) prior to the November 9, 1990, deadline. Sample forms for this purpose as well as other information related to the NEC

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PS Abstracts
Dave Lorusso

Dave Lorusso

"Setting Standards; In 1992 Europe, US firms may find themselves at a marked disadvantage", was published in the January 22, 1990, issue of Information Week. The authors, Elliot M. Kass and Ellen Messmer, express concern over European companies possibly using tariffs or quotas to block US telecommunication companies. Western Europe also might use telecommunications standards to stifle American and Japanese marketing efforts. The push for global rather than regional standards is also discussed.

"The Need for Scientific Consensus in the Courtroom", was published in the June 1990 issue of Appliance Engineer. The author, Ralph H. Johnson, discusses the controversy concerning possible health hazards created by exposure to the non-ionizing electric and magnetic radiation produced by appliances. He briefly reviews conflicting books, articles, and court cases on the subject. Article includes a bibliography for further information.

"Europe 1992: Blueprint for Action", was published in the July 9, 1990, issue of Design News. The author, Lawrence D. Maloney, discusses how engineers who want to design products for Europe can play a role in shaping harmonized standards. Steps are given on how design engineers can keep pace with EC 1992.

"Electromagnetic Fields: the Jury's Still Out", was published in the August 1990 issue of IEEE Spectrum. The associate editor, Karen Fitzgerald, presents a three part article examining the electromagnetic fields issue, with a concentration on extremely low frequencies (ELF).

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News and Notes

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development process may be obtained by contacting the Secretary of the Standards Council at NFPA headquarters at 617-770-3000.

VDT Impact Test: UL, CSA and industry representatives held a joint meeting on June 13, 1990, to organize and give direction to an ad hoc task group to provide technical assistance toward the harmonization of standards for implosion protection of CRTs. Standards affected are UL 1418 and CSA 22.2 No. 228. Contact Mr. W. Schallhammer of the UL Northbrook office for further information.

NIST Directory: The National Institute of Standards and Technology (NIST - formerly the National Bureau of Standards) publishes a directory of U.S. private sector product certification programs. Alphabetical listings describe the type and purpose of each U.S.-based group, the nature of its activity, products certified, standards used, certification requirements, and any accreditation for recognition by a U.S. or foreign private sector or government agency. Also described are the availability of services and the method used to determine service costs.

Copies of the directory cost $12 each. Contact the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 and order stock number 003-003-02984-0.

EC 1992 Analysis: The U.S. Department of Commerce has prepared three analyses and reviews of the EC's 300 or so directives.
Volume 1 analyzes 66 EC directives on individual products and services (180 pages, $10.00, GPO stock no. 003-009-00557-3).
Volume 2 analyzes 54 EC directives on company law, trademarks, and processed foods (180 pages, $19.50, GPO stock no. 003-009-00543-7).
Volume 3 analyzes 690 directives and regulations, principally in the area of product safety and environmental protection, telecommunications, computers, medical devices, procuremnt and financial services. Also included is an assessment of the impact on U.S. industry of proposed and adopted directives on public procurement, and potential problems with EC's new approach to standards and testing for products and environmental safety (237 pages, $13.00, GPO stock no. 003-009-00572-8).

IEEE Membership: IEEE has a free information kit on membership. Write to IEEE Membership Development, IEEE, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ, 08855-1331.

IEC 990: The IEC has issued a new basic safety standard concerned with leakage current. The standard IEC 990, "Methods of Measurement of Touch Current and Protective Conductor Current", is available from IEC or from ANSI.

GOST Office Opens: The USSR State Committee for Product Quality Control and Standards (GOST) has opened an office in New Jersey to help obtain the Soviet Union's safety approval mark. "Gosstandart of the Americas" may be contacted at 201-861-2293 for more information.

1st World Congress on Safety Science: An estimated 1500 participants from the world's industrialized nations in the fields of science, environmental protection, law, medicine and the humanities are expected to attend the 1st World Congress on Safety Science in Cologne, Germany, September 24 to 26, 1990. Sixty scientists and practitioners from 15 countries will give lectures and lead discussions on the nature of the new international discipline of safety science.

"The objectives of the Congress will not only consider risk assessment and risk control with respect to the technical and anthropological aspects, but will give equal priority to ecological, industrial, medical and legal questions," said Professor Dr. Ing. Albert Kuhlmann, Chairman of the Board of Management for TUV Rheinland, host of the Congress. The Congress will focus on the application of safety science in Western industrial countries with emphasis on the fields of energy, traffic, material and product technologies.

Anyone interested in attending or further information about this Congress should contact TUV Rheinland in Cologne at tel. (0221) 806-1715. In the U.S. contact the Danbury, CT, office at 203-798-0811.

Send your news items to:
Dave Edmunds (MS 843), c/o Xerox Corp., 800 Phillips Rd., Webster, NY, 14580 (or fax 716-422-7841)

ECMA Meeting
Selected items from the February 1990 minutes

[Many readers are concerned with product safety for computers, or information technology, and work for companies who are members of the Computer and Business Machines Manufacturers Association (CBEMA). Others, with European connections, are familiar with the European Computer Manufacturers Association (ECMA).

ECMA is very interested in safety standards, having written its own, and carefully tracks standards activity, particularly in Europe. Membership in ECMA is one way in which companies are able to keep up to date and to have input into IEC Standards, and even EC Standards.

The group within ECMA with particular responsiblity for product safety is TC12. The following article is excerpted with permission from the Chairman from the minutes of the 73rd meeting of TC12 held in Geneva, 7-9 February 1990. The items reprinted here are chosen for their interest and topicality. - Ed.]

4.0 LIAISON WITH TEST LABORATORIES

The Chairman (Mr. Ferguson - Unisys) welcomed the representatives from the test laboratories and they, and the members of TC12, introduced themselves.

Mr. Wegelius (Electrical Inspectorate Finland) presented IEC CTL and described the functions of the group. Representatives from 31 countries are members of the group. The USA are not yet members, but the legal implication of becoming a member are being discussed and a decision is expected in the near future. Association by Canada is also expected.

4.1 Preselection Testing of Insulating Materials

This item was considered one of the most important to be discussed and the main reason for the joint meeting. Mr. Wentholt (Rank Xerox) presented the situation with respect to plastic materials. In IEC 950, and EN 60950, some materials are permitted without testing, provided that they are from defined categories with respect to flammability. This means that a form of preselection is admitted.

The situation in UL was presented by Mr. Giannoni (UL). UL has available a data file (the Yellow Book), where a large number of plastic materials, with their characteristics according to different tests (resistance to arcing, hot wire test, different flammability tests) are listed. For all these materials UL provides a follow-up service, to ensure that the quality of the materials does not change.

A similar list exists for approved moulders, again with a follow up service. Nothing similar exists in Europe.

In fact, in UL, there are three levels:

** type testing of raw material; follow-up service
** testing of moulders; follow-up service
** inspection of the finished IT product containing the plastic part for moulder markings, possibly checking of the material used ("fingerprinting", flammability test).

UL will accept, without testing, parts moulded with a recognized materials by a recognized moulder. For parts prepared with a recognized material by a non-recognized moulder the amplitude of the testing might vary.

In Europe, test houses act in a different way: some will accept parts moulded with UL-recognized material without testing only for a certificate to be used in the country (but will test for an international certificate, also depending on the instructions of the manufacturer), others will not accept UL recognized materials without testing.

Mr. Voigt (Siemens) reported that only a few UL-recognized moulders (about 45) are located in Europe, and that there is some reluctance for European moulders to get UL certification for reasons of costs. Mr. Giannoni stated that obtaining recognition from UL was not difficult, consisting mainly in having proper working and record keeping procedures.

The discussion continued for a while, and the importance of in house verification of products, of proper Quality Assurance Programs by IT manufacturers, and of proper selection of material was stressed. The importance of obtaining a "portable" certificate, valid in different countries, was in general agreed. The difference between testing to a Standard (European test houses) which requires that all rules are conformed to, and testing by UL (where a product tested for conformity might respond to all the tests and not be

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accepted, or inversely not respond to some rules and be accepted) was highlighted.

Summing up the discussion, the Chairman stated that TC12 is pushing for an harmonization of technical requirement, and that this had largely been addressed. The remaining problems are that test houses are implementing the same document in different ways, the test and approval procedures are different and tests from third parties (even other test houses) are not always accepted.

TC12 would like to see an international regime established for preselection of plastic materials. However they also recommended that CTL not start a totally new programme on certification of materials but use the UL database as a starting point. On the other hand, UL should admit additions to the database from outside UL.

Mr. Wegelius invited TC12 to nominate a representative to the meetings of CTL. Mr. Ferguson stated that, as already indicated other times, representatives of test houses have a permanent invitation to attend TC12 meetings. Later in the meeting Mr. Wentholt announced that he had received permission to attend CTL meetings, and TC12 agreed that he should represent ECMA in this capacity.

4.2 Laboratory Conditions for Short-circuit Testing

In order to obtain repeatable results from short circuit testing it is necessary to have an agreed definition of the impedance of the supply network. This led to a discussion on the possibility of relying on the building protection, a point that is under discussion in a number of countries and in any case not accepted in the Nordic countries and in the UK.

One problem is that some building circuit breakers will open too slowly to prevent wiring from overheating.

Mr. Cox (UL) announced that in USA a research programme had been started on protection of circuits in general, and this could lead to a revision of the standard UL circuit breaker definition.

The problem of using glass cased fuses that can shatter during testing was discussed: in addition to presenting a danger during testing, this could scatter conductive parts over circuit boards and it is in any case to be considered a component failure.

It was generally agreed that a standardized circuit impedance should be defined for testing, and that this impedance should be defined at the point where the equipment, including any power supply cord delivered as part of the equipment, is connected to the mains. The problem of components (in general filter components) that can be connected to the power cable upstream from the equipment fuses remains open.

4.4 Failure of Electronic Circuitry

This item had been discussed at the previous meeting of TC12, and reported in the minutes (see 89/33, item 9.3). Members reported that some test houses required to know the internal circuitry design of integrated circuits, in order to be able to test under simulated fault conditions. This information, in addition to being frequently proprietary information, is in general useless for testing, being very difficult to know which fault can develop in an integrated circuit, without very specialized knowledge. It was agreed that this item should be discussed with the test houses representatives in respect of each application.

Mr. Hughes (EOLAS) stated that in the case of a protection circuit (for instance, the part of an integrated circuit protecting a lithium battery from overcharging) this information can be very useful. In one case they requested and obtained (with some difficulty) this information, and found it very useful.

Similar cases were quoted, typical ones being circuits containing lithium batteries, or circuit used in critical applications (interlocks).

It was agreed that, in general, information on the circuit layout of an integrated circuit and simulation of possible faults is not needed, an exception being the circuits used in interlocks.

4.7 Low Smoke Cables

The subject of fire resistant cables with low smoke development and higher safeguard to burn was discussed following a request of Mr. Voigt.

In the USA, signal cables used under the floor of computer areas and in air

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distribution ducts must met the low smoke and high fire resistance criteria. It is possible that, in future, power cables in the same conditions will have to met the same criteria.

The problem is that most of the cables meeting these criteria are made or covered with fluorinated polymers. In Europe there is concern about using these materials, and some countries are trying to outlaw them. In fact, these cables can emit highly corrosive fumes when overheated. This, in addition to being a health hazard, can cause important damages even after a minor fire.

A number of other problems exist in the area of cables; for instance, are there UL-listed power cables with European color coding, what is the situation in Europe of UL or MIL approved cables, are there rules for testing or inspecting the repairs after a fire. These subjects are still under development and will be discussed again at one of the next meetings.

4.8 Quality of Capacitors

The quality of filter capacitors and the testing done by test houses on this subject were discussed briefly. At present, the filter capacitors between line and neutral shall be X1. However, some test houses permit X2 capacitors, with additional requirements or, but not in the Nordic countries, in a metal case. There is some work in IEC to define a new X2 capacitor (that will be larger and more expensive than the present ones). Old X2 will be re-classified X3.

4.10 Use of Metal Foil

The use of test foil as a probe to test non-conductive parts of equipment was considered again. The representatives of the test houses were in agreement that this test, used in different cases in IEC 950 and proposed for the addition considering equipment to be connected to telecommunication networks, was not fully specified. In particular the usage of a "sandbag" to press the metal foil against parts like a telephone handset was considered impractical. Many test houses use now an adhesive-backed test foil. The dimension of the foil was considered important, and since this test is intended to simulate hand contact a foil of 10 cm by 20 cm was considered to be of the correct size. It was agreed that TC12 would prepare a proposal to IEC TC74 WG8, WG7 and possibly to CENELEC.

7.0 IEC MATTERS

7.2 Future Publications IEC 950 (90/3A), IEC 990

Mr Ferguson reported that the amendments to IEC 950 will be available, in the form of self-adhesive correction pages, in the spring of 1990. The second edition of IEC950 should be available in March 1991.

[Dates for both have slipped somewhat, according to recent reports. - Ed.]

Publication IEC 990 (a technical report on touch voltages) will be available in a few months time. *[See "News & Notes". - Ed.]* The possibility of referring to it in IEC 950 was discussed, however this will be a technical change.

The problems related to the spacing between SEL and non-SELV voltages, creepage distances and insulation were discussed. Most of the tests are requested "where safety is involved", but this definition is not clear and leaves space for discussions with the test houses. Some work should be done in this area, and could be given to TC74/WG6, originally established to handle safety matters for switched-mode power supplies and that will now discuss spacing matters. TC12 should reinforce liaison with TC74 WG6, and might prepare, for the next meeting, a contribution on this subject. A draft was prepared at the meeting, but could not be completed due to the lack of documentation.

Mrs Araway (Data General) stated that some problems were encountered with epoxy multilayer boards with respect to flammability: subject to heating, for example by a faulty component, these melt locally and become conductive. This increases the dissipation, leads to more melting and possibly to a fire. This particular problem makes the tests required in 90/2 J useless, and will be discussed again at the next meeting.

7.3 Report from TC74/WG7

Document IEC/TC74(CO)153 (90/2 K) contains the modifications and additions to IEC 950 in order to cover the equipment connected to telecommunication networks. The discussion of this document led to the considerations of the problems arising from the existence of different IEC/CENELEC/ETSI documents, and to the need to

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IEC 950 - ITE Safety

Dr. Steven Kraemer

Introduction

IEC 950, first published in 1986, is titled "Safety of information technology equipment including electrical business equipment". This international standard, which in both English and French is almost 250 pages in length, replaced the previous standards IEC 380 "Safety of Electrically Energized Office Machines" and IEC 435 "Safety of Data Processing Equipment".

Figure 1 shows a comparison of these IEC standards with equivalent European and German national standards together with their publication and withdrawal dates. To date, the first amendment to IEC 950 has been published.

It should be borne in mind that, for official safety certification in European countries, the relevant national standards are used instead of the IEC standards. Even in the case of "harmonized" standards there are national differences which must be taken into account. EN 60950 is the new European standard based on IEC 950. The national differences are contained in the standard which refers to IEC 950 as the source document.

In this paper, some aspects of IEC 950/EN 60 950 are discussed from the agency point of view. It is by no means a comprehensive coverage of these standards, which would be a formidable task, considering the length and technical complexity of the documents. In cases of doubt, the text of the original standards should be referred to.

Components

Where safety is involved, paragraph 1.5 requires that components comply with IEC 950 or the safety aspects of the relevant IEC component standard. These requirements have generated a vast international business in certified components. The availability of certified components relieves the agency from carrying out unnecessary testing and speeds up the evaluation of the end-use product. The use of certified or "pre-approved" components has spread to subassemblies such as filters, inlet combinations and power supplies.

There are still several problems related to the use of certified components. One is that specific national conditions apply to component certification, resulting in a plethora of country approval markings and the high cost of multiple certifications. Another problem is the lack of specific standards, e.g. for switch-mode power supplies, and the corresponding lack of uniformity in interpretation.

Nevertheless, the increasing availability in North America of components certified to IEC standards has enormously simplified the design and certification process of end-use products in the last 5 years.

The safety aspects usually apply to primary components, some of which are operator (user) - accessible, and primary/secondary components. They include cords and cordsets, plugs, inlets, X and Y capacitors, RFI filters, fuses and fuseholders, switches, opto-couplers, relays, transformers, fans, CRT's and power supplies.

In some cases, e.g. cords and fuses, harmonized standards are used in several European countries and national markings are not required. An exception to this is the Swedish requirement for SEMKO approved fuses. Component manufacturer's catalogues and data sheets usually contain information to which standards and by which agencies the components have been certified.

From the Agency's point of view, proof must be supplied that a component is certified to the relevant standard. This could involve the submission of a copy of the component certification document or "licence". Most licenses are longer than one page and it is essential that copies of all, not just the first, pages are submitted. This is because important information on applications and restrictions for use may be included somewhere in the license document. For example, the thickness through insulation in an opto-coupler must be at least 0.4 mm when used as reinforced insulation in accordance with IEC 950. At least one certified opto-coupler does not meet this requirement as it was certified for a different application.

Components may be inadvertently or deliberately marked with agency approval marks before certification has been completed so that reliance on markings is not necessarily sufficient proof of certification (for example, this has occurred with relays and switches). Even if the component is certified it must meet the requirements for safety in the end-

continued

IEC 950

continued

Figure 1 - OFFICE PRODUCT SAFETY (NOTE: Dates = day.month.year)

IEC INTERNATIONAL STANDARDS	EQUIVALENT GERMAN NATIONAL STANDARDS
IEC 380	DIN IEC 380 / VDE 0806/08.81 (= IEC 380 2nd edition 1977 plus German National Deviations)
(to be withdrawn 1.9.1990)	(to be withdrawn 1.9.1990) (production until 1.9.1992) (distribution until 1.9.1993)
IEC 435	DIN IEC 435 / VDE 0805/11.84 (= Draft German Standard -- not ratified)
(to be withdrawn 1.9.1990)	(draft to be withdrawn 1.9.1990)
IEC 950	EN 60 950/09.87 (= IEC 950 1st edition 1986 plus CENELEC common modifications & German National Deviations)
(published 1986)	(ratified 22.09.87)

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ECMA Meeting

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maintain a coherence between the various versions of these documents.

The problem starts with IEC 950 and EN 60950. The second edition of IEC 950 will be available in March 1991, and it is expected that the corresponding version of EN 60950 will not be available before June 1994. The second edition of IEC950 contains a number of relaxations, changes to follow the new technologies, common sense simplifications that will not be available in EN 60950 before June 1994. The EN being a law in the CENELEC countries, from September 1990 the industry will be obliged to use the first edition of EN 60950, that will not even contain the changes agreed to IEC 950 and that will be available in June 1990.

TC12 was of the opinion that EN 60950, corresponding to the second edition of IEC 950, should:
** be available faster;
** contain the minimum number of changes with respect to IEC 950;
** contain the minimum possible number of national deviations.

7.4 IEC 555 (89/20 E, 89/28 AK)

Publication IEC 555, prepared by IEC TC76, defines the limitation of harmonic currents injected into the public supply system by equipment connected to it. In a first edition, IT equipment was not included, however the revision being now prepared (see IEC/TC77(secr.)36 - 89/28 AK) would include it, for power up to 300 W. The Secretariat of IEC TC74 had already drawn the attention of its members to the fact that, if approved, this document would probably prevent the usage of switched mode power supplies (see 89/20 E). The same type of change could be made to EN 60555.

The contribution from Mr. Smith (ICL), document 90/7, was discussed briefly. Publication IEC 555 was mostly prepared taking into account small appliances (TV sets, typically), and cannot be easily applied to ITE. The problem is mostly for the supplier authorities, since with the decrease of the power factor the energy consumption measured by power meters decreases.

The Devil in the VDT

Paul Andrews

[This article gives an overview of a topic that has created much controversy and few conclusions. - Ed.]

If you believe a growing community of skeptics, George Orwell got it only half-right. Big Brother isn't just watching you, he's irradiating you as well.

Concerns about low-frequency electromagnetic radiation, long a source of simmering controversy in the personal computer industry, have boiled to the surface recently, capped by a special July issue of MacWorld magazine headlined, "Could Your Computer Be Killing You?"

In a report by New York author Paul Brodeur, whose book "Currents of Death" coalesced concerns over possible birth defects and cancer "clusters" from a variety of electronic devices including video display terminals, the 375,000-circulation computer monthly compared the electromagnetic radiation issue to asbestos and cigarette smoking.

The report comes at a time of growing concern, if not confusion, over the impact of electromagnetic radiation, which is produced by computer screens, appliances like electric blankets or toasters, and even electric power lines.

Electromagnetic radiation should not be mistaken for the X-ray or "ionizing" radiation that raised concerns over television screens in the 1950s and today is controlled by shielding. Nor is it the same kind of dangerous emissions produced by the uranium or plutonium used in nuclear reactors. Electromagnetic radiation more resemble radio waves that are constantly being emitted by electronic devices.

Electromagnetic radiation from computer monitors takes two forms: very low frequency, or VLF, in the 15,000 to 20,000 hertz range; and extremely low frequency, ELF, at the 60 hertz level. VLF radiation has been linked in some studies to pregnancy problems in VDT workers and laboratory mice. ELF has been linked circumstantially to "cluster" outbreaks of cancer, including leukemia, lymphoma and other forms.

With more than half of the nation's 40 million office workers using a computer daily and about 20 million computers in homes nationwide, "this is an issue that's not going to go away," said MacWorld editor Jerry Borrell. He feels the $6 billion to $10 billion computer-monitor industry should "be out there aggressively seeking solutions" instead of taking a low-profile or noncommittal attitude toward the issue.

MacWorld's report included the most comprehensive testing of computer monitors to date for radiation emissions and concluded that users should keep at least 28 inches from the front and four feet from the sides or back of monitors to minimize exposure.

Pioneering studies in Sweden during the 1980s involving laboratory mice found a higher incidence of fetal deaths and "resorption" problems - equated with miscarriages for humans among embryos exposed to magnetic fields. Follow-up studies by researchers in Sweden and Canada have indicated that mice and chicken embryos are vulnerable only in the first nine days of pregnancy.

"This is a pretty disturbing development," said Louis Slesin, editor of the New York-based newsletter Microwave News and its sister publication, VDT News. "It means that by the time an exposed woman VDT worker discovers she is pregnant, the damage might already have been done."

The most incriminating epidemiological study to date, performed by the Northern California Kaiser Permanente Medical Care Program in Oakland, found that among nearly 1,600 women surveyed in 1981 and 1982, those who worked at VDTs at least 20 hours a week suffered more than double the miscarriage rate of other women.

Other studies, however, have found no links between VDT emissions and pregnancy problems. A Danish union-funded epidemiological study involving more than 6,000 pregnant women found no statistical correlation between pregnancy problems and VDT work, determining only a "tendency for higher-stress VDT work to entail a risk of adverse pregnancy outcomes in contrast to lower-stress VDT work."

Preliminary findings from a yearlong University of Toronto study funded by International Business Machines Corp. and Ontario Hydro, which employs a large number of computer operators, found no higher incidence of pregnancy problems among laboratory mice exposed to VDT emissions. The complete study has

continued

The Devil in the VDT

continued

not been published.

"The weight of scientific evidence would say that there is no strong evidence to support an effect of VDT-like magnetic fields on pregnancy outcomes," said Professor Michael Wiley, who ran the Toronto study. He cast doubt on the Swedish studies, saying his statistical analysis focused on litters of mice rather than individual pregnancies, as the Swedish scientists had done.

However, Slesin said Swedish researchers feel the outcome of the Swedish studies would have been the same whether litters or individuals were analyzed.

Another possibility, scientists say, is that different strains of mice used in each study may have yielded differing results. Laboratory studies have focused on VLF emissions only. Far less scientific investigation has been done on ELF radiation. Wiley feels that although "people should look elsewhere than VLF" for pregnancy problems, "I don't think we know enough about magnetic fields to say that what applies at one frequency applies to another."

In the United States, little has been done by manufacturers to address the problem. A new line of IBM monitors, for example, shields against VLF radiation but not ELF. But IBM's Sheila Shanahan said the shielding is not offered because of health concerns. Rather, it is to meet Swedish emission standards and customer demand.

"My reading of it is that if IBM were to say anything else, it would open the floodgates of liability," VDT News' Slesin said. "There are tens of millions of VDTs out there, and if IBM were to acknowledge health problems, it would mean a monumental recall to retrofit ex isting monitors."

Other monitor makers, including Sigma Designs Inc. of Fremont and Megagraphics of Camarillo, are working on models that meet the Swedish VLF rules. Safe Computing Co. of Needham, Mass., manufactures liquid crystal displays that are radiation-free but lack the screen quality of tube monitors.

"Standards need to be developed to give the industry some direction," said Diane Scott, CEO of Megagraphics, noting that a VDT's pulsed, sawtooth-shaped emission pattern may have a different impact from the undulating "sinusoidal" waves of electric appliances and wiring.

But other monitor-emission studies have reached conflicting conclusions from MacWorld's. A February MacUser magazine report found shockingly high radiation levels three feet from the front of a Macintosh Plus screen - 25 times the level some scientists believe to be cancer-causing and more than 180 times higher than MacWorld's findings.

Studies by PC Magazine Labs found "much lower levels than talked about in the MacWorld article," said director Fred Davis. He said he is "not sure how to explain" the discrepancies.

Amid the conflicting evidence, two comprehensive studies are continuing in an attempt to shed more light on radiation. The National Institute for Occupational Safety and Health recently announced it will measure VLF and ELF electromagnetic fields in the VDTs of workers at Bellsouth offices who are being studied for pregnancy risks. The results are expected to be available by September 1.

A two-year National Institute of Health epidemiological study is under way involving 8,000 female office workers in four states, including California. The study, coordinated by Mount Sinai School of Medicine in New York, was prompted by a congressional Office of Technology Assessment report stating that electromagnetic fields "can interact with individual cells and organs to produce biological changes. The implications of these interactions for public health remain unclear, but there are legitimate reasons for concern."

MacWorld and Supermac Technology Inc. of Sunnyvale, a manufacturer of Macintosh display screens, have invited major manufacturers, including IBM, Apple Computer Inc. of Cupertino, Compaq Computer Corp. of Houston, Sun Microsystems Inc. of Mountain View, Hewlett Packard Co. of Palo Alto and monitor makers such as Radius Inc. of San Jose, Megagraphics Inc. and Rasterops Corp. of Santa Clara, to a July 24 meeting in San Jose to establish a working group within the computer industry to focus on VDT emissions.

Borrell also is working with the Atlanta-based National Center for Disease Control to set up a one-day symposium bringing together academicians, government agencies and concerned interests.

"This is not just a one-shot subject for us," Borrell said.

[Reprinted with permission from the author from the San Jose Mercury-News, Sunday, July 15, 1990. - Ed.]

Area Activity Reports

Santa Clara Valley report:

The July 24 meeting was surprisingly well-attended (almost 40 people) considering the postponement from June and the usual "summer doldrums". Those who came were rewarded with an enlightening presentation by a panel from Underwriters Laboratories Santa Clara office.

The panel members (Mike DeMartini, Electrical Dept. Mgr.; Kevin Ravo, Section F Mgr.; Steve Undorte, Section B Mgr.; Bob Miller, Section K Mgr.) revealed a new "top down" emphasis on quality and customer satisfaction that, if followed through, could lead to significant changes in the way UL does business and is perceived by its clients. The key seems to be an attempt to instil in UL employees an attitude of wanting to help the customer's product get Listing instead of wanting to find something wrong with it -- a cooperative instead of an adversarial attitude.

To achieve this goal a number of changes are being made: increased staffing, to reduce workload and turnover; increased training, to improve job skills and satisfaction; decentralized authority, for example having word processing in each Section and giving more job control to individual engineers; formal Quality improvement programs that include everyone from the UL President down. Panel members admitted that results are not obvious yet, but they expected to see a turnaround within the next year.

After a question and answer period, which had to be cut off from lack of time, the chairman, Hugh Hagel, invited UL back early next year to tell us how their quality program is working.

Next month, August, there will be no meeting. See you at the Product Safety Special Session at the EMC Symposium in Washington, D.C.! In September there will be a business meeting and elections (technical program to be determined), and in October the UL Safety Training course is planned to be presented. For more information contact Dave McChesney at 408-985-2400.

Orange County / Southern California report:

The June meeting featured a demonstration of power factor measurement equipment by Mr. Kerry Clark of Valhalla Scientific. Mr. Clark provided an article [See "Abstracts" - Ed.] regarding the serious problems that may be caused in building wiring when switching power supplies induce harmonic distortion. Contact Charles Bayhi about handouts.

The July meeting featured a presentation by Mr. Alan Knight, Marketing Manager from CSA, regarding the CSA study to implement a worldwide Certification / Marketing Research service. The presentation also included a survey of industry needs/ desires in this area.

Announcement: The next CBEMA meeting will be at the Sheridan Universal Hotel in Universal City on September 18 and 19, 1990 (Tues. and Wed.). Reservations can be made by calling 800-325-3535. The rate of $110 is available if you state that you are attending the CBEMA meeting.

For more information contact Charles M. Bayhi, tel. 714-730-2556.

Northeastern report:

The June meeting technical presentation was by Mr. Dennis McCabe of Analogic Corporation. He described Analogic's new product safety test system, which automates the manual test setup procedures for the evaluation of power supplies. The system, which plugs into a standard AT-style personal computer, includes a datalogger with up to forty-eight thermocouple inputs and can monitor and log the temperature response of various samples for changes to AC input and load conditions. It can also take additional measurements.

Committee Reports:
Constitution/Bylaws - Tony Nikolassy gave a detailed review of the current organization of the Product Safety Technical Committee (PSTC) and the local PSTC groups throughout the country. Because the PSTC is affiliated with the EMC Society of the IEEE, local PSTC groups are formally affiliated through their sanctioning by the local EMC Society Chapters.

Tony reviewed the options [for the Northeastern group], which include maintaining the current informal structure, affiliating with the IEEE EMC Society through the local EMC Chapter, or organizing as a private body incorporated under the laws of Massachusetts. In the ensuing discussion, attending members

Continued

continued to disagree about the benefits of affiliation with the IEEE, or the need to change the current structure. While some members agreed that holding elections would be an important first step, there still exist the concerns of legal liability without a formal organizational structure. Balloting all members was suggested as a way to reach the final determination on the wishes of the group in connection with affiliation.

[See the Chairman's Message on page one of this issue for comments relevant to the statements in the above paragraph. - Ed.]

Technical Presentation - Bill von Achen reported that Carl Lindquist of San-O Industrial Corporation would be the speaker at the July meeting. Carl will discuss selection of fuses in good product safety design.

Liaison Reports:
UL - Nancy Araway reported that UL is in the process of developing a series of new product safety standards for power supplies. The apparent intention is to replace the generic power supply standard, UL 1012, with a variety of standards that are application specific.

CSA - Alan Meirs of CSA reported on the development of a new standard for power supplies for EDP equipment, based on CSA's Bulletin 1402C and IEC 950. [The new standard no. 234 reportedly "will be out next month", but no guarantees! - Ed.] Alan also reported that CSA is adopting IEC 601 as the Canadian National Standard for Medical Equipment.

IEC - Fred Grund reported that some amendments to IEC are not being reflected in subsequent revisions of EN 60950, and that companies testing to IEC 950 should record the exact version of the standard to which their product has been tested.

ECMA - Nancy Araway reported that the upcoming ECMA meeting will include a discussion of testing and certification issues for IEC 950. Nancy also reported that ECMA was working with the CEPT on the development of NETS for product safety or telecommunications equipment.

EC 1992 - Bill von Achen and Art Michaels provided additional information on the bills recently introduced in the U.S. House of Representatives by Sam Gejdenson (D. Conn.), which restrect EC manufacturers and test labs from submitting data to U.S. agencies.

OSHA - Art Michaels raised the issue of status of CSA's application with OSHA to become a U.S. NRTL (Nationally Recognized Test Lab). Bill von Achen reported that the application process is apparently at a standstill, pending a resolution of reciprocal trade issues by the Department of Commerce.

Contact William von Achen at 508-263-2662 for more information.

Los Angeles report:

Rolf Burckhardt opened the July 9 meeting by introducing the Standards Engineering Society (SES) to attendees. Rolf had recently become a member of SES and gave a brief summation of the purpose of this society, which has been in existence for some 40 years. The society is interested in standards of all types, both electrical and non-electrical, in the regional and international areas. Membership is $40 per year which includes a 58 page membership directory describing the principles and other aspects of the SES, and a quarterly journal. Interested parties can contact Rolf for further information.

The technical presentation was given by Alan Knight, Marketing Manager of CSA Rexdale. The topic was CSA's proposed program "Technical Services for Exporters" or TSE. The program is being considered to assist exporters in all areas of business by providing various services and information such as testing and inspection services in preparation for foreign certifications, information on foreign standards and certification authorities, and seminars on financial matters, marketing, distribution, etc. in other countries. During the meeting, a questionaire was handed out and asked to be completed as a CSA survey for the validity of the proposed program.

The next meeting was announced for Monday, August 6, at Harman Electronics. The program presentation will be given by Ms. Kerry Cabak of UL on UL's ISO 9000 certification program.

For further information contact Rolf Burckhardt at 818-368-2786.

IEC 950

Continued from page 20

use equipment. In the case of "international" fuseholders which accept either 1/4 x 1-1/4" or 5 x 20 mm fuses by means of interchangeable fuse carriers the prevention of access to live parts must be checked by inspection. With 1/4 x 1-1/4 fuses this is not always so. In addition, the safety aspects of user replaceable fuses must be considered and they should be generally available in the country where the equipment is sold.

The use of an IEC 320 power inlet ("appliance inlet") enables an end use product to be supplied with a variety of detachable power cordsets for different countries. These inlets may by approved in North America and Europe but current ratings vary (e.g. 6.3 or 10 A). For high current, three phase or non-detachable cordset applications the convenience of such internationally certified components is not yet available. In these cases, the selection of power connection components should be carefully considered for different countries.

Special national standards may apply to some certified components. For West Germany, X and Y capacitors are usually certified to VDE 0565 part 1 as can be seen on the component markings. Capacitors which are marked VDE 0560-3 are for general use and may not be accepted.

Power supplies which are certified to other IEC standards are usually, but not always, suitable for use to IEC 950 because of differences in the standards. The outputs of certified power supplies do not always comply with the requirements of SELV circuits and their end-use applications may be restricted. Special attention must be paid to the specification of power supplies and their license documents. In many cases, all the safety related components are in the power supply.

Power Interface

Apart from the obvious differences in plugs and voltages in different countries, there are a number of other differences in mains power systems which must be taken into account in the design and certification of equipment.

Standard wall outlets are not polarized in some European countries. This means that, for Class 1 equipment with single fuses, the design and testing of protective earthing to IEC 950 may be different. In this case the fuse cannot be relied on to protect against earth faults and the current carrying capacity of protective earthing must be designed accordingly. Safety aspects of power supply design can also be affected by unpolarized mains connection since either "line" or "neutral" may be connected externally to earth. A single diode rectifier would not be permitted, for example.

In countries with IT power systems (Denmark) special consideration for protection against ground faults apply. This can affect a number of aspects in design and component selection in practice. In EN 60 950 several special national conditions related to this problem can be found. Current ratings for standard supply outlets in Europe vary from 10A (Denmark) through 13A (U.K.) to 16A. This affects the selection of primary power components, some of which are only rated 6.3A in some countries (Sweden) or 10A (West Germany). Again, careful attention to these details is required, especially in high powered equipment or equipment which provides mains power for additional equipment ("daisy-chaining").

Marking and Instructions

Marking and instructions are discussed in paragraph 1.7. One of the most important markings is the "power" rating, or "rating label", which must be visible on equipment. This must include manufacturer identification, model number and input ratings for voltage, frequency and current according to a specified format. There are some subtle differences to previous IEC standards - power rating (W) may not be used instead of current (A); the symbol for a.c. supply is not required; the relation between multiple rated currents and voltages must be distinct. It is also clear that nominal supply voltages should be used and not design ranges (tolerances are given elsewhere in the standard).

Other marking requirements include:

o IEC symbol for protective earth terminal (Class I equipment)

o IEC symbol for Class II equipment (where applicable)

o Rated operating time / resting time (where applicable)

o Special instruction on equipment rated for multiple voltages if the setting

Continued

cannot be easily changed by the operator

o Maximum power outlet load (where applicable)

o Fuse ratings (where applicable)

o Switch and control markings using IEC symbols, including On/Off markings (where applicable)

Other warning markings may apply and are referred to in the standard, including warnings for excess leakage current, mechanical hazard, service warnings such as shock or stability hazard when open, etc. If symbols are used they must meet ISO/IEC standards (e.g. IEC 417). Indicator lights and controls should meet the color requirements of IEC 73 (e.g. red may only be used for danger warnings). Protective earthing conductor insulation should be green/yellow (exceptions are permitted).

For power supplies, many of the markings requirements may apply, including the power rating markings, although there are no specific requirements in IEC 950. Other components have specific markings requirements in other standards (e.g. temperature ratings). Important information on power supply outputs (e.g. temperature ratings). Important information on power supply outputs (e.g. voltage, current, maximum power, SELV circuit applicability) is not specifically required to be marked. This information should however appear in the license documentation.

In addition to markings on the equipment, IEC 950 requires that, where necessary for safety, instructions shall be available. These could include instructions for operating, installing, maintaining, transporting or storing equipment. The instructions should be available in different languages, where necessary. Some of the warning markings specifically refer to operating/installation instructions which must, therefore, be provided for safety reasons (e.g. voltage selection and fusing, protective earth connection, etc.)

Although not stated specifically in IEC 950, power supplies for build-in applications should be provided with installation instructions which could refer to:

o the relevant standard(s)

o maximum allowed output load and interconnection voltages

o maximum allowed surrounding temperature

o external fuse requirements

o cooling requirements

o voltage selection

o mounting spacers and maximum allowed mounting screw penetration

o protective earthing

o other safety related installation requirements

Design Requirements

The fundamental safety requirement in designing to IEC standards, including IEC 950, is to prevent hazards in the use and servicing of the equipment. The IEC concept requires that two levels of operator protection against electrical shock be provided - the equipment shall remain safe in the event of a single component or insulation fault.

This concept affects many of the design and testing requirements. Access to hazardous live parts must be prevented by double insulation or its equivalent. It should be noted that double insulation consists of "basic" plus "supplementary" insulation and its equivalent is called "reinforced" insulation. A simple example is the use of double sleeved power cords. The connection of metal enclosures to protective earth is considered one level of protection, equivalent to supplementary insulation. Equipment of this type is usually classified as "Class I". If no connection to protective earth is provided, equipment containing or connected to hazardous live parts is classified as "Class II" and must be marked accordingly. Equipment which does not contain or is not connected to hazardous live parts is classified as "Class III".

It should be noted that, even though the Class II marking symbol ("box-in-box") indicates that double or reinforced insulation is required, the same requirements apply to Class I equipment.

In complex equipment, especially power supplies with primary and secondary circuits, it is necessary to classify circuits with regard to operator access and hazard before specifying the grade of insulation

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required. In some cases this becomes an extremely complicated exercise as can be seen in Table CII and figure C1 in the standard.

Figure 2 compares circuit definitions used in the selection of insulation requirements in IEC 380 and IEC 950. In figure 3, distances through insulation, creepages and clearances are compared. It should be noted that spacings for operational insulation need not meet the requirements if no hazard occurs when they are short circuited. Spacing requirements for other grades of insulation must be met.

Equipment shall remain safe in the event of a single fault. Uncertified components may be short or open circuited to demonstrate this. In power supplies with voltage-doubler circuits, particular care must be taken to ensure that toxic or inflammable gases are prevented from venting from electrolytic capacitors under single fault conditions. A detailed circuit analysis may be required in some equipment to ensure that operator accessible circuits do not become hazardous under fault. Certified components are not usually subjected to fault tests in equipment.

In the design of Safety Extra-Low Voltage (SELV) circuits separation from hazardous parts is usually provided by double or reinforced insulation ("Method 1" of paragraph 2.3.3) or by basic insulation and earthed conductive screens or other conductive parts as supplementary insulation ("Method 2"). It should be noted that, in Denmark and France, "Method 3" is not considered acceptable (protection by earthing the SELV circuit) and that, in most European countries. "Method 4" is not considered acceptable (protection by basic insulation only with additional protection e.g. by components). These details are clarified in EN 60 950 under common modifications and special national conditions relating to paragraphs 2.3.3, 2.3.6 and 2.3.7.

Another design aspect which must be considered is the prevention of electrical shock at the power plug or inlet by capacitor discharge. This can usually be provided by a bleed resistor which meets the requirements of paragraph 2.1.10. Nevertheless, this has been often overlooked, especially when certified power supplies are not correctly specified in end use equipment applications.

Factory Production Requirements

The tests specified in the standard are type tests, usually carried out on a sample under laboratory conditions. Nevertheless, in the examination and testing of samples, the safety of production models must be considered. This includes the suitability of insulation or methods of securing wiring. Transformer design should include the provision of methods for maintaining the required spacing between windings in production (e.g. spacers).

Production testing is not specified in the standard but may be required under the certification procedures of different countries. Electric strength (hi-pot) testing is usually required on 100% of end-use products and on specific uncertified components including safety isolating transformers. In IEC 950 (paragraph 5.3.2) the duration of the electric strength tests may be reduced from one minute for type tests to one second for production tests without increasing the test voltage.

Other factory inspection and tests, including earth continuity testing up to 25A and leakage current testing may be required if considered necessary by the certification agency. In order to ensure that the factory is capable of maintaining the production of products which meet all the specified safety requirements a quality systems audit and regular follow-up inspections must be passed. The auditing and inspection of factories is however a larger topic which is neither covered in the standard nor in this paper.

[Dr. Steven Kraemer is General Manager of TUV Rheinland's Canadian operations, stationed in North York, Toronto. - Ed.]

Continued

Figure 2 - ELECTRICAL DESIGN (two levels of protection)

CIRCUIT DEFINITIONS	IEC 380 REQUIREMENTS	IEC 950 REQUIREMENTS
SELV (peak)	42.4V max.	42.4V max.
SELV (dc)	42.4V max. (para 2.2.48)	60V max. (para 1.2.8.5)
Limited Current (peak)	0.7mA max.	0.7mA max.
Limited Current (dc)	2mA max. (para 8.1.3.1)	2mA max. (para 2.4.1)
Energy Hazard	240VA or 20J (para 2.2.50)	240VA or 20J (para 1.2.8.7)
Insulation Requirements:	(para 8.1)	(para 2.2)
Hazardous to Prot. Earth	Basic	Basic
Hazardous to SELV	Reinforced (= Basic plus Supplementary)	Reinforced (= Basic plus Supplementary)

Figure 3 - INSULATION AND SPACINGS

TOPICS BEING CONSIDERED	IEC 380 MIN. REQUIREMENTS	IEC 950 MIN. REQUIREMENTS
Distance through insulation:	(para 29.2)	(para 2.9.4)
Basic	no thickness	no thickness
Supplementary	1.0mm	0.4mm
Reinforced	2.0mm (transformers can be 0.5mm) (optocouplers can be 0.4mm)	0.4mm
Creepage and Clearance:	(para 29.1)	(paras 2.9.2+3)
(working voltage < 300V)	creep clear	creep clear
Basic	3mm 2.5mm	2.5mm 2mm
Supplementary	4mm 4mm	2.5mm 2mm
Reinforced	8mm 8mm	5mm 4mm
(working voltage > 300V)	creep clear	creep clear
Basic		4mm 3.2mm
Supplementary		4mm 3.2mm
Reinforced		8mm 6.4mm

NOTE: Creepage and Clearance depend on working voltage - examples are given above, which may be in some switch-mode power supplies.

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.

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 Committee 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 (MS 42LS), Hewlett Packard, 19447 Pruneridge Avenue, Cupertino, CA 95014.

Calendar
The Product Safety Technical Committee of the IEEE EMC Society

Chicago Activities:

No meetings are planned for the Chicago area until fall.
Contact: John Allen
708-827-7520

Los Angeles Activities:

Monday, September 10, 1990
Subject: MedGV and IEC 601 (Medical)
Speaker: Konrad Kobel, TUV America
Time: 6:30 pm
Location: Harman Electronics
8500 Balboa Blvd.
Northridge, CA
Contact: Rolf Burckhardt
818-368-2786

Monday, October 1, 1990
Subject: Summary of September CBEMA Meeting
Speaker: Charlie Bayhi, MAI Basic Four
Time: 6:30 pm
Location: Harman Electronics
8500 Balboa Blvd.
Northridge, CA
Contact: Rolf Burckhardt
818-368-2786

Portland Activities:

Tuesday, September 18, 1990
Subject: Fuse Safety (tentative)
Speaker: Littelfuse rep.
Time: 7:30 pm
Location: G.E. Co.
14655 SW Old Scholls Ferry Road
Beaverton, OR
Contact: Fran Pelinka
(503) 641-4141

Tuesday, October 16, 1990
Subject: NEC, OSHA & the Manufacturer
Speaker: State Electrical Inspector
Time: 7:30 pm
Location: G.E. Co.
14655 SW Old Scholls Ferry Road
Beaverton, OR
Contact: Fran Pelinka
(503) 641-4141

Seattle Activities:

Wednesday, September 19, 1990
There will be no September meeting in Seattle.

Wednesday, October 17, 1990
Subject: NEC, OSHA & the Manufacturer
Speaker: Electrical Inspector (tentative)
Time: 7:00 pm
Location: Fluke
6920 Seaway Blvd.
Everett, WA 98203
Contact: Heber Farnsworth
(206) 356-6045
Walt Hart
(206) 356-5177

Northeastern Activities:

Wednesday, September 26, 1990
Subject: to be determined
Speaker: to be determined
Time: 7:00 pm
Location: Sheraton Boxborough Mass.
Routes 111 and 495
Contact: Bill Von Achen
508-263-2662

Continued

Institutional Listings

Continued

Calendar

Continued

Wednesday, October 24, 1990
Subject: to be determined
Speaker: to be determined
Time: 7:00 pm
Location: Sheraton Boxborough
Mass.
Routes 111 and 495
Contact: Bill Von Achen
508-263-2662

Santa Clara Valley Activities:

Tuesday, September 25, 1990
Subject: Business meeting
Speaker: to be determined
Time: 7:00 pm
Location: Apple Computer
20705 Valley Green Drive
Cupertino, CA
Contact: John Reynolds
408-629-3281

Tuesday, October 23, 1990
Subject: to be determined
Speaker: to be determined
Time: 7:00 pm
Location: Apple Computer
20705 Valley Green Drive
Cupertino, CA
Contact: John Reynolds
408-629-3281

Orange County/Southern California Activities:

Tuesday, September 11, 1990
Subject: Med GV & IEC 601 - Medical
Speaker: Mr. Konrad Kobel, TUV America
Time: 6:00 pm
Location: MAI Basic Four
14101 Myford Rd.
Tustin, CA
Contact: Paul Herrick
(714) 770-1223

Tuesday, October 2, 1990
Subject: Summary of September CBEMA Meeting
Speaker: Charlie Bayhi
Time: 6:00 pm
Location: MAI Basic Four
14101 Myford Rd.
Tustin, CA
Contact: Paul Herrick
(714) 770-1223

P S Abstracts

Continued from page 14

In part 1, "Biological Effects", Indira Nair and M. Granger Morgan, discuss the scientific research to date and analyze various findings to determine the current knowledge of the biological effects of electromagnetic fields. In part 2, "Societal Reverberations", Fitzgerald reports on how utilities, regulatory agencies, standards groups, and citizens are attempting to cope with the situation. In part 3, "Managing the Risks", Morgan and Nair discuss several possible strategies for managing a problem of unknown risk, outlining the "prudent avoidance" approach that they proposed in a June 1989 Office of Technology assessment report.

"Switching-supply power factor is more than a nuisance", was published in the March 1990 issue of Electronic Products. The author, Jack Graham, discusses the harmonic distortion induced by switching power supplies, gives a case history of such a problem, and proposes a solution.

[Send your abstracts articles to:
Dave Lorusso (MS C1-20),
c/o Codex/Motorola,
20 Cabot Blvd.,
Mansfield, MA 02048.
or fax 617-821-4211]

PSN READERS -

We need your help to make this newsletter complete! The items in "News and Notes", the articles in "PS Abstracts", the events in the "Calendar", and the letters in "Letters to the Editor" must come from you. The better the input, the better the output. So, the next time you find an article, news item, or conference with an aspect relating to product safety, tell us about it. Then we can pass it along to our colleagues through the pages of the Product Safety Newsletter. Thanks for your help!

The Product Safety Newsletter
c/o Tandem Computers Incorporated
10300 N. Tantau Avenue, LOC. 55-53
Cupertino, CA 95014
Attn: Roger Volgstadt

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Our Reader Survey confirmed that hundreds of you are interested in continuing to read the Product Safety Newsletter. We have prepared an address directory, organized by name and by postal code, to help put readers in touch with each other. To order a copy, please send a check for $15.00 payable to the Product Safety Technical Committee to the address given for the PS Newsletter.

[If you want your address deleted from the directory, please contact us.]

BACK ISSUES

The Product Safety Newletter's first issue, Vol. 1, No. 1, was ten pages published in Feb. 1988. We now have available two years (1988 and 1989) of past PS Newsletters, with an article index, for those who missed them. To order a set, please send a check for $20.00 payable to the Product Safety Technical Committee to the address given above for the PS Newsletter.