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**Triodyne Inc.**

(Est. 1969)

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S. Carl Uzgrins

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## Model Laboratory

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Wilmette, IL 60091-2101  
Bill Brown

## Vehicle Laboratory

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## Photographic Laboratory

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Morton Grove, IL 60053  
Larry Good

## Business Systems

Chris Ann Gonatas  
Jennifer Bitton  
Sandie Christiansen  
Sandra M. Duffy

## FIRE AND EXPLOSION:

**Triodyne Fire & Explosion Engineers, Inc.**

(Est. 1987)

2907 Butterfield Road  
Suite 120  
Oak Brook, IL 60523-1176  
(630) 573-7707  
FAX: (630) 573-7731

## Officers/Directors

John A. Campbell  
Ralph L. Barnett  
S. Carl Uzgrins

## Engineering

John A. Campbell  
Scott M. Howell  
Kim R. Mniszewski  
Norbert R. Orszula

June 1998

**Triodyne Inc.**

Consulting Engineers &amp; Scientists - Safety Philosophy &amp; Technology

5950 West Touhy Avenue Niles, IL 60714-4610 (847) 677-4730

FAX: (847) 647-2047

e-mail: infoserv@triodyne.com

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## RECREATION ENGINEERING:

**Triodyne Recreation****Engineering, Inc.**

(Est. 1994)

5950 West Touhy Avenue  
Niles, IL 60714-4610  
(847) 647-9882  
FAX: (847) 647-0785

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Brian D. King  
Jeffery W. Abendshien  
Ralph L. Barnett  
S. Carl Uzgrins

## Engineering/Science

Brian D. King  
Jeffery W. Abendshien  
Patrick M. Brinkerhoff  
Peter J. Poczynok

## SAFETY RESEARCH:

**Institute for Advanced****Safety Studies**

(Est. 1984)

5950 West Touhy Avenue  
Niles, IL 60714-4610  
(847) 647-1101

## Chairman of the Board

Ralph L. Barnett

## Director of Operations

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Theodore Liber

## MANUFACTURING:

**Alliance Tool & Mfg. Inc.**

(Est. 1945)

91 East Wilcox Street  
Maywood, IL 60153-2397  
(312) 261-1712  
(708) 345-5444  
FAX: (708) 345-4004

## Officers

S. Carl Uzgrins  
Ralph L. Barnett

## General Manager

Ramesh Gandhi

## Plant Manager

Ray Gach

## Founders/Consultants

Joseph Gansacz  
Albert Kanikula

## CONSTRUCTION:

**Triodyne-Wangler****Construction Company Inc.**

(Est. 1993)

5950 West Touhy Avenue  
Niles, IL 60714-4610  
(847) 647-8866  
FAX: (847) 647-0785

## Officers/Directors/Managers

Joel I. Barnett  
William A. Wangler  
Joseph Wangler  
Ralph L. Barnett  
S. Carl Uzgrins

## CONSULTANTS:

Richard M. Bilof, Ph.D.  
Electromagnetic Compatibility

Claudine P. Glabs Myers

Biomechanics

Richard Gullickson

Industrial Hygiene/Safety/Chemistry

Beth A. Hamilton

Information Science

David W. Levinson, Ph.D.

Senior Metallurgical Advisor

Steven R. Schmid, Ph.D.

Food Processing Equipment

## Design Defect: Doctrine of Alternative Design

by Ralph L. Barnett\*

### Abstract:

The American Law Institute has finalized its formulation of the Doctrine of Alternative Design which it adopted and promulgated on May 20, 1997 as Restatement of the Law Third; Torts: Products Liability<sup>1</sup>. This paper is an attempt to characterize this doctrine from a technologist's viewpoint. Specifically, the application is explored as an analysis protocol for determining whether a product is defective and we outline the consequences that flow from its use as a safety design tool for product development. What is not done in this paper is to attack the Restatement on the basis of its internal and external inconsistencies, its lack of global scholarship; its avoidance of philosophical arguments such as *reductio ad absurdum*; its prophylactic exclusion of safety engineering and science principles; its invasion into social value systems that should properly be left to the legislature, its failure to define really important terms, its clueless application of critical concepts such as foreseeability<sup>2</sup> or its anti-capitalist impact on small and fledgling manufacturers.

The alternative design doctrine for defective product design is defined by both subparagraph 2(b) of the Restatement and about 150 pages of commentary. This may be distilled into the following approximate statement of analysis theory:

*A product is defective in design if a safer reasonable alternative design could have been adopted at the time of sale where reasonableness is judged by a broad based safety-utility balancing analysis.*

In essence, the alternative design doctrine states that my dog is prettier than your dog; therefore, your dog is ugly. The doctrine does not accommodate the notion that both can be pretty. All comparisons are made using advanced salesmanship techniques that bear no relationship to the protocols of science or technology; it's called "junk science."

When applied to product design rather than analysis, the doctrine provides a methodology that theoretically leads to a single product design that is a safe reasonable candidate; the optimum. Unfortunately, there is no existing search engine for exploiting this methodology to uncover this optimum safe reasonable alternative design. The best practical result will represent only the limit of the design team's imagination and/or resources. It will *always* be possible to render this candidate design defective by producing yet one more safer reasonable alternative design. This is a doctrine of absolute liability.

### I. Introduction

The American Law Institute (ALI) has proposed a Restatement of the Law Third, Torts: Products Liability. Paragraph 1 is stated as follows:

#### § 1. Liability of Commercial Seller or Distributor for Harm Caused by Defective Products

One engaged in the business of selling or otherwise distributing products who sells or distributes a defective product is subject to liability for harm to persons or property caused by the defect.

\* Professor, Mechanical and Aerospace Engineering, Illinois Institute of Technology, Chicago, and Chairman, Triodyne Inc., Niles, IL.

No Charge

This is a sensible if unremarkable doctrine that would be embraced without hesitation by all technologists if they knew the definition of defective product. For comparison one notes the first canon of ethics of every founder engineering society:

#### Canon of Ethics

*"Engineers shall hold paramount the safety, health and welfare<sup>†</sup> of the public in the performance of their professional duties."*<sup>3</sup>

Clearly, the code of engineering ethics will not support the introduction of a defective product into the stream of commerce and in this sense both doctrines are compatible. On the other hand, there is a major philosophical difference. Engineering is required to prevent or minimize injuries; tort law tries to redistribute wealth to make injured parties whole again after harm has been inflicted. Engineering produces works *a priori*; tort law judges these works *a posteriori*.

Recovery for harm caused by defective products has proceeded historically using various legal theories, e.g., negligence, implied warranty of merchantability, strict liability and risk-utility. The legal shortcomings, limitations and inadequacies of these doctrines are extensively explored in the Restatement of the Law Third. This restatement proposes yet another theory of recovery in paragraph 2 which is reproduced herewith:

#### **§ 2. Categories of Product Defect**

A product is defective when, at the time of sale or distribution, it contains a manufacturing defect, is defective in design, or is defective because of inadequate instructions or warnings.

A product:

- (a) contains a manufacturing defect when the product departs from its intended design even though all possible care was exercised in the preparation and marketing of the product;
- (b) is defective in design when
  - (i) the foreseeable risks of harm posed by the product could have been reduced or avoided by the adoption of a reasonable alternative design by the seller or other distributor, or a predecessor in the commercial chain of distribution,
  - (ii) and the omission of the alternative design renders the product not reasonably safe;
- (c) is defective because of inadequate instructions or warnings when the foreseeable risks of harm posed by the product could have been reduced or avoided by the provision of reasonable instructions or warnings by the seller or other distributor, or a predecessor in the commercial chain of distribution, and the omission of the instructions or warnings renders the product not reasonably safe.

This paper addresses only paragraph 2(b) covering design defects. This paragraph will be discussed together with the ALI commentary.

<sup>†</sup> Welfare includes economic well-being.

## **II. Alternative Design Doctrine**

### **§ 2(b) – An Analysis Methodology**

From the point of view of a technologist, subparagraph 2(b) together with its commentary is manifestly user unfriendly; on the other hand, the diverse positions of the law, its practitioners, its critics and its scholars are well represented. Our critique of the alternative design theory is contained in the following observations:

#### Observation 1:

Paragraphs 1 and 2 do not define the proposed reasonable alternative design theory. The ALI commentary is an intrinsic part of its definition.

#### Observation 2:

The use of the word *foreseeable* in 2(b)(i) is incorrect; it should be replaced by the phrase *reasonably foreseeable*. ALI Comment 2(a) states, "*Subsections 2(b) and 2(c) speak of products being defective only when risks were reasonably foreseeable.*" The difference between foreseeable risk and reasonably foreseeable risk is simply staggering<sup>2</sup>. As presently stated in 2(b), one must address every foreseeable risk no matter how remote, infrequent or bizarre. Referring to ALI Comment 2m, "*Subsections (b) and (c) impose liability only when the product is put to uses that it is reasonable to expect a seller or distributor to foresee. Product sellers and distributors are not required to foresee and take precautions against every conceivable mode of use and abuse to which their products might be put. Increasing the costs of designing and marketing products in order to avoid the consequences of unreasonable modes of use is not required.*"

#### Observation 3:

The phrase *foreseeable risks of harm* used in 2(b)(i) has no precise meaning in either the technical or non-technical language. It may be taken as "predictable mischief." The way the word risk is used throughout the Restatement does not require discrimination which may account for the fact that its various meanings are not defined. In safety engineering, exacting definitions for risk arise from the two classic formulations of the Exact Theory of Safety<sup>4</sup>.

In the first, Danger is taken as a function of hazard and risk where hazard is something that can injure or cause damage and where risk is the probability of encountering a hazard and receiving an injury. Here, risk intervention focuses exclusively on hazard isolation, safeguard systems, warnings and training. In the second formulation, risk is used as a replacement for Danger. It is a function of severity (magnitude of hazard) and frequency (probability of an injury). With this definition, risk control would embrace additional countermeasures; minimizing or eliminating hazards and the application of personal protective equipment.

More than 50 word combinations appear in the Restatement that include the word risk. Usually the meaning coincides with one of the two cited technical definitions. Occasionally, its use defies analysis, e.g., in the phrase *risk of danger* or *utility of the risk*.

#### Observation 4:

In all likelihood, those technologists that are introduced to the alternative design doctrine will not have an opportunity to

read the associated Restatement commentary. Consequently, one may expect them to attempt a literal interpretation of subparagraph 2(b). We shall demonstrate that this will lead them down a false path.

Assume that a plaintiff has suffered harm and that he invokes subparagraph 2(b) to establish that the challenged product is defective in design. Its literal interpretation provides a two part test. The second part of the test is described by subparagraph 2(b)(ii) which states, *“and the omission of the alternative design renders the product not reasonably safe.”* This may be restated as, *“and the original (challenged) design is not reasonably safe.”* This implies that a challenged design may be reasonably safe or not reasonably safe. If it is reasonably safe, the challenged design is not defective. If it is not reasonably safe, the first part of the test given in subparagraph 2(b)(i) provides that the existence of a safer reasonable alternative design renders the challenged product defective in design. On the other hand, if a safer reasonable alternative design cannot be provided at the time of sale or distribution, the challenged design is not defective in design in spite of the fact that it's not reasonably safe!

In each of the three possible outcomes outlined, the safety of the original (challenged) design must be established. There are, of course, many ways of doing this; but, none but this comparison method are acceptable to the Restatement. Our literal interpretation of subparagraph 2(b) must be rejected; absent the commentary, the alternative design doctrine is not defined by subparagraph 2(b).

#### **Observation 5:**

When subparagraph 2(b) is read in conjunction with the whole Restatement, the doctrine of alternative design may be viewed as a comparison protocol where the challenged product is almost always evaluated against a safer reasonable alternative design.

#### **ALI Comment b:**

Referring to subparagraph 2(b) it is noted that *“it reflects the substantial body of case law suggesting that reasonable alternative design is the predominant, yet not exclusive, method for establishing defective design.”*

#### **ALI Comment d:**

Referring to subparagraph 2(b) it states, *“that a design is defective if the product could have been made safer by the adoption of a reasonable alternative design. If such a design could have been practically adopted at time of sale and if the omission of such a design rendered the product not reasonably safe, the plaintiff establishes defect under Subsection (b).”*

Also,

*“subsection (b) adopts a reasonableness “risk-utility balancing” test as the standard for judging the defectiveness of product designs. More specifically, the test is whether a reasonable alternative design would, at reasonable cost, have reduced the foreseeable risks of harm posed by the product and, if so, whether the omission of the alternative design by the seller or a predecessor in the distributive chain rendered the product not reasonably safe.”*

#### **ALI Comment f:**

*“To establish a prima facie case of defect, plaintiff must prove the availability of a technologically feasible and practical alternative design that would have reduced or prevented the plaintiff's harm.”*

*“In sum, the requirement of Subsection (b) that a product is defective in design if the foreseeable risks of harm could have been reduced by a reasonable alternative design is based on the commonsense notion that liability for harm caused by product designs should attach only when harm is reasonably preventable.”*

*“The necessity of proving a reasonable alternative design as a predicate for establishing design defect is, like any factual element in a case, addressed initially to the courts. Sufficient evidence must be presented so that reasonable persons could conclude that a reasonable alternative could have been practically adopted.”*

#### **ALI Comment p:**

*“Under the rule in Subsection (b), liability for defective design attaches only if the risks of harm related to foreseeable product use could have been reduced by the adoption of a reasonable alternative design.”*

#### **ALI Comment d:**

*“Assessment of a product design in most instances requires a comparison between an alternative design and the product design that caused the injury, undertaken from the viewpoint of a reasonable person.”*

*“How the defendant's design compares with other, competing designs in actual use is relevant to the issue of whether the defendant's design is defective.”*

#### **Reporter's Note; Comment f:**

*“Subsection 2(b) requires a comparison between the actual design and the alternative proffered by the plaintiff. The availability of an alternative design does not mean that the alternative is a reasonable substitute for the actual design utilized by the manufacturer. The monetary cost of the alternative design may exceed the safety benefits to be derived from it. Furthermore, an alternative design may impose significant nonmonetary costs on product users and consumers. It may deprive a product of important features which make it desirable and attractive to many users and consumers. Courts that apply a ‘risk-utility’ balancing test recognize that these considerations are central to the finding that a substitute design is a reasonable alternative. It is for this reason that courts take the position that the availability of a safer design does not ipso facto mean that the actual design is defective. This also accounts for the oft-repeated statement that a manufacturer has no obligation to provide the safest design available or provide for the ultimate in safety.”*

#### **Reporter's Note; Comment d(II.)A:**

*“Alabama law unequivocally requires proof of a reasonable alternative design. Summary judgement has been granted for defendants in numerous cases where this requirement is not met. The leading case is General Motors Corp. V. Edwards, 482 So. 2d 1176 (Ala. 1985). The Alabama high court said that:*

*In order to prove defectiveness, the plaintiff must prove that a safer, practical alternative design was available to the manufacturer at the time it manufactured the automobile. The existence of a safer, practical alternative design must be proved by showing that:*

*(a) The plaintiff's injuries would have been eliminated or in some way reduced by use of the alternative design, and that;*

*(b) taking into consideration such factors as the intended use of the vehicle, its styling, cost, and desirability, its safety aspects, the foreseeability of the particular accident, the likelihood of injury,*

*and the probable seriousness of the injury if that accident occurred, the obviousness of the defect, and the manufacturer's ability to eliminate the defect, the utility of the alternative design outweighed the utility of the design actually used."*

*"In Illinois the statute mandates that plaintiff establish a reasonable alternative design. 735 Ill. Comp. Stat. Ann. § 5/2-2104 (West 1993 & Supp. 1996) provides that:*

*If the design of a product or product component is in issue in a products liability action, the design shall be presumed to be reasonably safe unless, at the time the product left the control of the manufacturer, a practical and technically feasible alternative design was available that would have prevented the harm without significantly impairing the usefulness, desirability, or marketability of the product. An alternative design is practical and feasible if the technical, medical, or scientific knowledge relating to safety of the alternative design was, at the time the product left the control of the manufacturer, available and developed for commercial use and acceptable in the marketplace."*

*"The Michigan Court of Appeals in Reeves v. Cincinnati, Inc., 439 N.W. 2d 326, 329 (1989), summarized the elements of a prima facie case of failure to provide adequate safety devices:*

*A prima facie case of a design defect premised upon the omission of a safety device requires first a showing of the magnitude of foreseeable risks, including the likelihood of occurrence of the type of accident precipitating the need for the safety device, and the severity of the injuries sustainable from such an accident. It secondly requires a showing of alternative safety devices and whether those devices would have been effective as a reasonable means of minimizing the foreseeable risk of danger. This latter showing may entail an evaluation of the alternative design in terms of its additional utility as a safety measure and its trade-offs against the costs and effective use of the product."*

*"Mississippi has established by statute that proof of a reasonable alternative design is necessary in order to maintain an action alleging a design defect. Miss. Code Ann. § 11-1-63 (1993) (Plaintiff must prove that 'there existed a feasible design alternative that would to a reasonable probability have prevented the harm. A feasible design alternative is a design that would to a reasonable probability have prevented the harm without impairing the utility, usefulness, practicality or desirability of the product to users or consumers.')."*

*"The long-standing reasonable alternative design requirement in Texas has been codified by statute:*

*The burden is on the claimant to prove that . . . there was a safer alternative design. . . . "Safer alternative design" means a product design other than the one actually used that in reasonable probability . . . would have prevented or significantly reduced the risks of the claimant's personal injury, property damage, or death without substantially impairing the product's utility; and was economically and technologically feasible at the time the product left the control of the manufacturer or seller. . . . Tex. Civ. Prac. & Rem. Code Ann. § 82.005 (West 1993)."*

The alternative design doctrine is only clearly defined by subparagraph 2(b) when taken together with the Restatement commentary. Our sampling of this commentary reflects the appeal that was made by the ALI to consensus, statutes, case law, legal scholars and the literature. Indeed, the development of engineering consensus standards follows similar lines.

The essence of the alternative design doctrine may be stated as follows:

*My dog is prettier than your dog; therefore your dog is ugly.*

#### **Observation 6:**

The term reasonable, as used in subparagraph 2(b)(i), is to be taken as a risk-utility balancing test for judging the defectiveness of product designs. The cited commentary in our Observations 4 and 5 overwhelmingly support this interpretation. Risk-utility uses the technical definition of risk to characterize danger or safety as a function of damage severity and damage frequency.

ALI Commentary f indicates that a broad range of factors may be considered in determining whether an alternative design is reasonable and whether its omission renders a product not reasonably safe. The factors include the following:

1. Magnitude of the foreseeable risks of harm (severity).
2. Probability of the foreseeable risks of harm (frequency).
3. Product instructions.
4. Product warnings.
5. Nature and strength of consumer expectations regarding the product.
6. The relative advantages and disadvantages of the product as designed and as it alternatively could have been designed.
7. The effects of the alternative design on:
  - a. Production costs.
  - b. Product longevity.
  - c. Maintenance.
  - d. Product repair.
  - e. Product esthetics and styling.
  - f. Intended product use.
  - g. Product desirability.
  - h. Overall product safety.
  - i. Product utility.
8. Range of consumer choice among products.
9. The financial cost of an improved design.
10. Codes and Standards

A very alarming shortcoming of balancing risk and utility is related to comparing apples and oranges. For example, are three units of utility greater than two units of risk? Add to this problem the fact that most of the factors are subjective. Do we expect the same evaluation among different people or from the same person at different times?

#### **Observation 7:**

The following excerpts from the Restatement commentary outline the plaintiff's burden when invoking the alternative design doctrine:

#### **ALI Comment d:**

*"Assessment of a product design in most instances requires a comparison between an alternative design and the product design that caused the injury, undertaken from the viewpoint of a reasonable person."*

*"Under prevailing rules concerning allocation of burden of proof, the plaintiff must prove that such a reasonable alternative was, or reasonably could have been, available at time of sale or distribution."*

*"If the plaintiff introduces expert testimony to establish that a reasonable alternative design could practically have been adopted, a trier of fact may conclude that the product was defective notwithstanding that such a design was not adopted by any manufacturer, or even considered for commercial use, at the time of sale."*

**ALI Comment f:**

*"In many cases, the plaintiff must rely on expert testimony. Subsection (b) does not, however, require the plaintiff to produce a prototype in order to make out a prima facie case. Thus, qualified expert testimony on the issue suffices, even though the expert has produced no prototype, if it reasonably supports the conclusion that a reasonable alternative design could have been practically adopted at the time of sale."*

*"The requirements in subsection (6) relate to what the plaintiff must prove in order to prevail at trial. This Restatement takes no position regarding the requirements of local law concerning the adequacy of pleadings or pretrial demonstrations of genuine issues of fact."*

*"A test that considers such a broad range of factors in deciding whether the omission of an alternative design renders a product not reasonably safe requires a fair allocation of proof between the parties. To establish a prima facie case of defect, plaintiff must prove the availability of a technologically feasible and practical alternative design that would have reduced or prevented the plaintiff's harm. Given inherent limitations on access to relevant data, the plaintiff is not required to establish with particularity the costs and benefits associated with adoption of the suggested alternative design."*

**Reporter's Note; Comment d (Pennsylvania Law):**

*"... Comment d provides that there is no absolute state-of-the-art defense, and that a plaintiff is always free to prove that an alternative design was both practical and feasible. The plaintiff is not precluded from proving the viability of an alternative design merely because it had not been previously commercially adopted or constructed by any manufacturer."*

**Reporter's Note; Comment f(4):**

*"The overwhelming majority of courts place the burden of proving that a product design failed to meet risk-utility standards on the plaintiff. ... As a practical matter, of course, once the plaintiff introduces evidence of a technologically feasible design, the defendant will address the risk-utility issues by justifying its design and demonstrating why the alternative design is not reasonable. Technically, though, the burdens of production and persuasion are on the plaintiff."*

Those engineers and scientists who applauded *Daubert v. Merrell Dow Pharmaceuticals* [509 U.S. 579 (1993)] as starting a trend to eliminate "junk science" in the courtroom will take no solace in the Restatement. Scientific discipline is characterized by objective criteria, hypothesis formulation and testing, prototype development, state-of-the-art demonstration and specificity in the representation of costs and benefits. All are absent in the Restatement; discipline is *de minimis*.

**Observation 8:**

Two comments in the Restatement that bear directly on safety philosophy are especially important to designers:

**ALI Comment f:**

*"the overall safety ... of the product must be considered. It is not sufficient that the alternative design would have reduced or prevented the*

*harm suffered by the plaintiff if it would also have introduced into the product other dangers of equal or greater magnitude."*

**ALI Comment a:**

*"Society does not benefit from products that are excessively safe – for example, automobiles designed with maximum speeds of 20 miles per hour – any more than it benefits from products that are too risky. Society benefits most when the right, or optimal, amount of product safety is achieved."*

**III. Alternative Design Doctrine**

**§2(b) – A Design Methodology**

An injured plaintiff may use the alternative design doctrine, §2(b), to analyze a challenged product to establish whether it's a defective design. To do this the plaintiff is required to prove the availability of a *single* safer reasonable alternative design. This is the nature of analysis.

Design, on the other hand, cannot be satisfied with such a demonstration. To create a product that is not defective according to the alternative design doctrine requires, as a first step, that a functional product be designed. This candidate must then be challenged by a safer reasonable alternative design whose existence renders the first design defective. This new candidate, in turn, will be challenged by a safer reasonable alternative design. In this fashion, the designer is caused to consider a sequence of ever improving designs that, except for the latest candidate, are all defective based on this comparison methodology.

This design procedure is actually an optimization process that will theoretically terminate with the production of the safest reasonable product. This, of course, is an outcome devoutly to be wished. Unfortunately, no formal design methodology exists that will search out this optimum product. Each designer can only follow the protocol until his or her imagination and/or resources are exhausted. This does not guarantee that another designer could not pick up the baton and create yet another safer reasonable alternative design which would render his or her predecessor's last candidate defective.

It is instructive to pursue the notion of a safer alternative design without considering reasonableness. We begin with the fact that it is axiomatic in the field of safety that nothing created by humankind or nature is completely incapable of inflicting harm. This notion is recognized in the Restatement which quotes Professor David Owen [Defectiveness Restated: Exploding the "Strict" Products Liability Myth, 1996 U. Ill. L. Rev. 754-755] to wit, "It is true, of course, that danger inheres in every product, so that the central question of 'How much safety is enough?' that arises in every design case in fact must turn on whether the amount of danger was excessive (unreasonable) in view of a broad-based calculus of costs and benefits." The fact that total safety is unachievable does not mean it doesn't serve as a design goal. Technologists approach total safety asymptotically. For example, one can approach a wall by a series of steps that halve the remaining distance each step. You never reach the wall; but, you may get as close as you like. Any product can be made safer if the designer is given the assignment, the time and the resources.

Consequently, each time a new product candidate is conceived the designer knows that a safer alternative design exists.

If safety alone is considered, a sequence of ever safer designs terminates when the candidates approach 100% safety. When reasonableness is appended as a subsidiary condition that must be fulfilled, the sequence of designs terminates with the safest reasonable alternative product. Both protocols require infinite resources to achieve their optimums. Theoretically, alternate design theory leads to absolute liability.

#### IV. "How To" Analysis and Design Summary:

This paper has culled about 150 pages of the Restatement to reflect the thinking of the legal profession on the formulation of a defective design analysis based on the doctrine of alternative design. It is highly unlikely that the entire Restatement will be studied by product designers. Furthermore, the commentary, which is so vital to the doctrine's definition, is in a user unfriendly format that will be foreign to technologists. This paper has distilled this commentary and organized it into categories that should be considered by a product designer. In this section we shall simplify the doctrine even further and indicate how it is used as a safety analysis tool and as a product development tool.

##### A. Doctrine of Alternative Design – Defective Design:

A product is defective in design if a safer reasonable alternative design could have been adopted at the time of sale where reasonableness is judged by a broad based safety-utility balancing analysis. (Barnett summary)

##### B. Analysis Tool (Is a product defective?):

1. A product is defective if a safer alternative design was actually available at the time of sale, developed for commercial use and acceptable in the marketplace. When possible, this is the easiest and most economical course to pursue.  
  
or
2. A product is defective if the plaintiff can find an expert to establish that a safer reasonable alternative design could have been adopted by the manufacturer of the challenged design.
  - a. The alternative design need not have been adopted by any manufacturer or even considered for commercial use at the time of sale.
  - b. An alternative design must be proposed that is hypothetically safer than the challenged design. The hypothesis does not have to be proved by testing.
  - c. The plaintiff does not have to produce a prototype of the proposed alternative design.
  - d. The proposed alternative design must be compared to the challenged design to show that it is reasonable. Reasonableness is established by a

safety-utility balancing analysis of the two designs which takes a broad array of factors into account. The techniques of advanced salesmanship will suffice for this safety-utility analysis. Just as in sections a, b and c, the safety-utility analysis shows a complete abandonment of technical discipline. Other than the mantle of expertise as a persuasion device, the objective need for real expertise is *de minimis*.

- i. Some of the safety-utility factors are: foreseeability of the harm, severity of the harm, frequency of the harm, codes and standards, consumer expectations, intended product use, product utility, esthetics, maintainability, longevity, costs, etc.. Most of these factors are subjective.
- ii. The plaintiff need not establish the safety-utility factors, such as cost or utility, with particularity.
- iii. Sufficient evidence must be presented so that reasonable persons could conclude that a reasonable alternative design could have been practically adopted.
- iv. With respect to level of proof, a trier of facts, (jury, judge, tribunal) must be persuaded that it is more probable than not that a safer reasonable alternative design could have been practically adopted. "More probable than not" is an extremely low level of proof which would never satisfy any scientific protocol.
- v. The safer alternative design must be practical and technically feasible without *significantly* impairing the usefulness, desirability, or marketability of the product.

##### C. Design Tool (Product Development)

1. As completely as practical, develop a specification for the desired product. Properly done this can be a very ambitious task <sup>5</sup>.
2. Adopt the analysis protocol described in IV.A and the Restatement commentary. This is a comparison methodology.
3. Develop candidate designs that fulfill the specification for all reasonably foreseeable uses of the product. The inspiration for the original candidates may arise from the following sources:
  - a. A previous or current product that the manufacturer is redesigning.
  - b. Products contained in the patent literature.
4. Apply the comparison methodology of Step 2 among all pairs of candidates identified in Step 3 and establish in this manner the best initial product candidate.

5. Challenge the best initial product candidate found in Step 4 by comparing it to a potentially safer reasonable alternative design.

- a. Note: A safer product can always be found if resources are available.
- b. Note: Reasonableness is judged by the same safety-utility balancing factors referenced in either section IV B(2)(d)(i) or II (Observation 6).

Whereas the law allows the plaintiff to relax every requirement for technical discipline in his or her application of the alternative design doctrine, this is not the case with manufacturers. Except for those safety-utility factors that are intrinsically subjective, all other elements should follow strict technical protocols.

6. Repeat the foregoing challenge to the latest safer reasonable alternative design by comparing it to another potentially safer reasonable alternative design candidate.
  - a. Note: A sequence of candidate products is generated in this fashion with ever increasing safety.
  - b. Note: When each new safer reasonable alternative design is introduced, it causes all previous candidates to become defective in design by definition.
  - c. Generally, the next challenge to the current design arises as a matter of systematic plodding; however, the inspired idea, the brilliant flash and the happy accident are always lurking in the background.
  - d. State-of-the-art candidates must be considered where all three definitions of state-of-the-art apply:
    - i) Product designs that conform to industry custom.
    - ii) Products that reflect the safest and most advanced technology developed and in commercial use.
    - iii) Products that reflect technology at the cutting edge of scientific knowledge.
7. Termination of the design process occurs when the design team exhausts its imagination and/or its resources.
  - a. Note: The final safer reasonable alternative design is the best the manufacturer can produce under prevailing circumstances. It is not; however, the optimum safer reasonable alternative product design. Another design team, given the assignment, the time and the resources may best the previous "final" design. This immediately renders the "final" design a defective product.

- b. Note: The discovery of the optimum safer reasonable alternative design will theoretically and practically terminate the design process.
- c. Note: As a practical matter, the search for the optimum safer reasonable alternative design requires infinite resources.

## V. Conclusions:

1. The introduction of the doctrine of alternative design by the ALI does not imply that it will be adopted in all the legal forums in the country. Many of the states will continue to judge products using combinations of previous doctrines such as negligence, implied warranty of merchantability, strict liability, comparative fault and risk-utility. Because the works of technology carry into every state and territory, a product designer is required to simultaneously meet every rule in every forum with the added complication that the rules change every day through the mechanism of appeal. We are asking technologists to measure the world with a rubber ruler.

2. A detailed study of the Restatement commentary indicates the virtual disappearance of requirements for formal scientific protocol in the presentation of the plaintiff's criticism; even a modicum of reasonable technical integrity has been expunged as a predicate to courtroom presentation of a proposed safer reasonable alternative design. Taken together with the subjective nature of so many of the safety-utility comparison factors and the unpredictability of local evidence rules, what is left is salesmanship pure and simple.

Every technologist would view with alarm the notion that a plaintiff's expert position may be supported when "more probable than not" as opposed to "within a reasonable degree of technical certainty." Can one imagine that engineers have built the world's techno-structure using a level of 51% certainty?

3. The Restatement, through its commentary, recognizes the undesirability of limiting the range of consumer choice among products. This is expressed as a factor in the safety-utility balancing test. Nevertheless, when formulated as a product design tool, the doctrine of alternative design drives the proposed products inexorably toward a single optimum safer reasonable alternative design.
4. It is disappointing that the alternative design doctrine does not move to restore users' responsibility for their own safety as does negligence theory and comparative fault. The deemphasis of personal responsibility and training and the shift toward safety devices and warnings that was led, aided and abetted by the legal profession has doubled the accident rate<sup>6</sup>. Personal injury awards have enjoyed exponential growth. This trade-off is unacceptable.
5. Restatement Third continues the products liability tradition of treating code and standard compliance as a necessary

but not sufficient condition for a safe product. And yet standard compliance is the only known system for dealing rationally with reasonably foreseeable uses and misuses or with trade-offs among disparate elements such as cost, safety, health and utility. Furthermore, the system is simple, flexible, rapidly correctable, certain and easy to administer. The achievement of uniform safety and the elimination of internal and external inconsistencies are hallmarks of the code and standard systems. These are among the reasons why the European Community has adopted standards as the backbone of its products liability activities.

The only viable argument against a system of standard compliance is the possible inadequacy of the standards themselves as expressed in 1932 by Judge Learned Hand. This contingency has been nicely handled by a legal concept called rebuttable presumption which allows the veracity of the standard to be challenged<sup>7</sup>.

## References

- <sup>1</sup> American Law Institute, *Restatement of the Law Third: Restatement of the Law, Torts-Products Liability*. Washington, D.C., American Law Institute, May 20, 1997.
- <sup>2</sup> Barnett, Ralph L., "Reasonably Foreseeable Use." New York, American Society of Mechanical Engineers, paper accepted for publication in November 1998.
- <sup>3</sup> National Society of Professional Engineers, NSPE Code of Ethics for Engineers, 1996.
- <sup>4</sup> Barnett, Ralph L. and William G. Switalski, "Principles of Human Safety," *Forensic Engineering* Vol. 1, No. 3, 1988: 154.
- <sup>5</sup> Hales, Crispin, *Managing Engineering Design*. Harlow, U.K, Addison Wesley Longman Group Ltd., 1993.
- <sup>6</sup> Poczynok, Peter J. and Ralph L. Barnett, "Risk Analysis," *Safety Bulletin* Vol. 1, No. 2, (June 1995).
- <sup>7</sup> Barnett, Ralph L., "On Codes and Standards," *Safety Brief* Vol. 2, No. 1, (July 1983).

## SAFETY BRIEF

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