Exhibit 94

RECALL EFFECTIVENESS RESEARCH:
A REVIEW AND SUMMARY OF THE LITERATURE ON CONSUMER MOTIVATION AND BEHAVIOR

Prepared for the
U.S. Consumer Product Safety Commission
CPSC Order No. CPSC-F-02-1391
Contract No. GS23F9780H

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July 2003

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I. Introduction and Project Objectives

The mission of the U.S. Consumer Product Safety Commission (CPSC) is to protect the public against unreasonable risks of injury associated with consumer products. One element of the CPSC's work is to negotiate and monitor corrective action plans more commonly known as recalls and public notice of those recalls.

Manufacturers, distributors, and retailers conduct more than 300 recalls of products under the jurisdiction of the CPSC each year. Some of these occur when the CPSC staff makes a preliminary determination that a product is defective and presents a substantial hazard to consumers. In other cases, the manufacturer, distributor, or retailer voluntarily conducts the recall under the "fast track" option, under which the staff does not make a determination of defect and risk.

The CPSC compliance staff works with manufacturers, distributors, and retailers to develop mutually acceptable programs that include a variety of notification methods to alert affected owners about product recalls. Traditional methods include direct notification by mail and paid advertising in newspapers, magazines, radio, and (in rare instances) television, and point-of-sale/point-of-purchase posters. In recent years these communication techniques have been supplemented by newer approaches, such as the production and distribution of video news releases, posting of information on Web sites and via e-mail, and in some cases, the distribution of notices with product supplies or replacement parts.

However, not all notified consumers avail themselves of the remedy offered by a corrective action program. In some instances, the goal of hazard reduction may be accomplished through alternative means, such as discarding the product or removing the part that poses a risk. In other cases, however, the uncorrected product continues to pose an elevated risk to consumers.

To improve the effectiveness of recall programs, it is important to understand all of the steps required for consumers to notice, comprehend, evaluate, and act on recall program communications. These topics are only occasionally addressed with specific reference to product recalls. However, there is a large body of literature in a variety of disciplines that provides insights into consumer knowledge, motivation, and behavior in the context of compliance with safety-related warnings and instructions. Other research provides insights into the cognitive prerequisites for compliance—noticing, reading, and understanding recall program communications—and the elements that influence consumer perceptions of the risks associated with consumer products and their use.

The CPSC staff determined that a literature search on these topics would further the staff's ongoing efforts to understand these issues. The contract under which this search was conducted represents a substantial effort on the part of the Commission to collect and utilize information from a diverse range of sources that provide insights on consumer motivations and behavior. Work on this project involved a systematic review of available research in a number of relevant disciplines—including advertising, cognitive psychology, communication theory and media studies, consumer motivation and compliance, human factors and design research, marketing, recall management, risk perception, and social psychology.

This report summarizes the results of an extensive literature search and review of research in these areas of interest. The study was directed by the principals of Heiden Associates, Inc. (Dr. Edward Heiden), Independent Safety Consulting (Dr. Carol Pollack-Nelson), and XL Associates (Michael S. Jones). Identification, collection and review of the materials presented in this report was performed by the principals and by the following Heiden Associates staff members: Steve McGonegal (Senior Research Associate), Monica Groves (Senior Research Associate), Stephen Heiden (Staff Attorney), David Heiden (Research Associate) and Patricia Trammell (Office Manager). Several members of the CPSC staff, including the Project Officer (Celestine Kiss of the Division of Human Factors), provided valuable contributions and comments.

This report is a revised version of draft reports provided for CPSC review on January 7th and February 11th. Copies of all relevant materials that were collected and reviewed as part of this research are attached.

II. Overview of the Project Work Plan

The work plan for this research called for searches of numerous research databases, including EBSCO/Academic Search Premier, OCLC FirstSearch, InfoTrac, ProQuest, Psych Abstracts and Psych Info, Pub Med, ERIC, CSA Sociological Abstracts, the Index of Legal Publications, and Xlibris. Coverage and characteristics of each of these resources is documented in Appendix I. An extensive list of keywords was generated by the project team and used to guide the literature searches through the many databases. A complete list of data sources and keywords is attached as Exhibit 1.

In the course of this research, the project team determined that the keyword-based approach was not providing reasonably complete coverage of the research available in several areas of interest. Consequently, the keyword-based approach was expanded to incorporate other productive, but less automated, search techniques. These included reviews of holdings maintained by the principals, sources suggested in the text and references of articles already obtained and reviewed, and selective on-line searches for articles and bibliographies of interest. Recent research papers in Human Factors publications such as the Proceedings of the Human Factors and Ergonomics Society Annual Meetings were also consulted. CPSC staff provided additional materials and references.

Senior Heiden Associates staff and Dr. Carol Pollack-Nelson of Independent Safety Consulting reviewed the initial search results. Copies of all potentially relevant materials were obtained and screened by Steve McGonegal and Monica Groves of Heiden Associates and by Michael Jones of XL Associates. A complete annotated listing of all materials identified and reviewed is attached as Exhibit 2.

More extensive reviews of selected articles were prepared in the course of developing this report. This collection of article summaries includes reviews of supporting research on many of the major findings discussed in the report, as well as reviews of the articles that

provided the conceptual framework used to organize the results. Copies of these reviews are provided as Exhibit 3.

A more detailed description of the methodology and work plan used to conduct this research is provided in Appendix I.

III. Organizing Framework

The materials obtained and reviewed for this literature search were drawn from a broad spectrum of sources—books, professional journals, doctoral dissertations, government studies, and Web content. Some of this research relates directly to product recalls. However, there are relatively few quantitative studies of recall effectiveness, most of which were conducted in the early 1980s. These studies are reviewed in the next section below.

The literature search identified useful resources drawn from the much larger research literature on warnings, labels, and safety education. A recall notice is a safety communication that urges consumers to take a designated action in order to avoid harm, and as such, it is similar in many respects to warning labels or other safety-related instructions. One contribution of this literature is that it provides several conceptual frameworks to classify and organize research from diverse disciplines. Some researchers identify each step of the process by which a communication is received, processed, understood, stored, retrieved, and acted on (Goldhaber and deTurck, 1988; Lehto and Miller, 1988; Mazis and Staelin, 1982). Other researchers have developed frameworks that correspond to the observable results of behavioral experiments (Friedmann, 1988; Rogers, Lamson, and Rousseau, 2000; Zeitlin, 1994). Still others provide tools that are useful in structuring the large volume of research on the formation of risk perceptions (Oglethorpe and Monroe, 1994) and in specifying the critical elements of the consumer's ultimate decision to take a safety-related action (Edworthy, 1998).

We have used these sources to build a structural framework for presenting the results obtained in our literature search. In doing so, we have not attempted to evaluate whether a particular set of organizing principles is a more or less suitable or accurate representation of the actual process by which consumers respond to safety-related communications in general, and to recall program notices specifically. Rather, these frameworks help to illuminate the extended chain of events that must take place for a consumer to participate in a recall. Some research topics that have been placed into this organizing framework span more than one component of the process. The proper classification of these sources can be somewhat problematic. At a minimum, we have attempted to present these topics under headings in which a substantial amount of the research has been directed.

IV. Quantitative Studies of Recall Effectiveness

One group of resource materials available uses data from a cross-section of recall programs to determine the factors that contribute to higher effectiveness rates. In 1978 CPSC prepared a quantitative study of recall effectiveness. Based on an analysis of 97 recalls that were

accepted for closeout by July 1976, the study identified seven variables that exhibited strong relationships toward recall effectiveness:

1. Product sale price;
2. Average useful life of the product;
3. Number of affected units;
4. Time in distribution;
5. Percentage of units in consumers' hands;
6. Type of recall action; and
7. Level of direct consumer notification.

The 1978 CPSC report resulting from this study did not find a strong relationship between the nature or severity of the hazards and recall effectiveness, although the authors noted that "the classification of recalls as to severity level and nature of defect was highly subjective". The report also presented conditions under which a recall was likely to be "very ineffective": products with prices under two dollars; products with average useful lives of less than two years; cases in which the number of units in distribution exceeded 100,000; or recalls of products that had been in distribution for over five years.

Shortly thereafter, CPSC formed a Recall Effectiveness Task Force, which issued a report in August 1980. This report covered several relevant topics, including the measurement of recall effectiveness and the measurement of recall notification and participation at various steps of the process. The Task Force report reviewed a number of issues relating to the appropriate way to measure recall effectiveness, with the following recommendations:

1. Recall effectiveness rates should distinguish between units in consumers' hands and those still in the chain of distribution;
2. The number of affected units should be adjusted to reflect the retirement of units no longer likely to be in service at the time of the recall;
3. The existence of uncountable, but appropriate consumer responses to recall messages should be acknowledged; and
4. Successful communication of a hazard measure independent of consumers' response should be considered as one indicator of effectiveness, particularly in cases where response is likely to be understated by returns or repairs.

The Task Force report also presented results from a national survey designed to provide CPSC with information about consumer responses to a series of recalls involving hair dryers lined with asbestos. Because of the low product price and the short useful life, these recalls could be expected to have relatively low measured effectiveness rates. The survey provided a detailed map of the various challenges involved. Of those who owned a hair dryer, most (85 percent) were aware of the general concern about asbestos. However, only 44 percent of those who were aware of the hazard checked their hair dryer. About one-fifth of those who checked found that they had hair dyers with asbestos. Most (85 percent) reported that they stopped using the hair dryer, but only five of those 27 respondents took advantage of the recall remedy. Nine discarded the affected unit; the remaining 13 stopped using the hair dryer but did not throw it away.

These results were explained using a benefit-cost analysis of the type presented below in the discussion of recall message evaluation, in which the direct and indirect costs of compliance are shown to outweigh the benefits of a mail-in repair. The Task Force Report also presents a model of consumer recall response that in many respects parallels elements of the research presented in this paper. Four separate consumer decision steps are modeled:

1. Whether to do *anything* in response to the recall message;
2. Whether there is exposure to a hazardous product;
3. Whether to act to reduce or eliminate the hazard; and
4. Whether to take advantage of the remedy offered by the recall program.

In 1988 economists Dennis Murphy and Paul Rubin published a study that utilized multivariate techniques to estimate the quantitative significance of various factors on recall effectiveness. The Murphy-Rubin model was estimated using data from a sample of about 100 CPSC recalls during the early 1980s. The authors developed a predictive equation that provided a high degree of explanatory power with only a handful of independent variables:

1. The proportion of units that were in the hands of consumers;
2. The proportion of consumers directly notified about the recall;
3. The number of months between the end of distribution of the affected product and the initiation of the recall;
4. Whether the recall involved a home repair remedy; and
5. Whether the recalled product was used for mountain climbing or scuba diving.

Most of the recalls included in the Murphy-Rubin analysis involved low-risk hazards, although they note that the average hazard rating for their sample was similar to that for all CPSC recalls conducted during the 1983-1985 interval.

Two other studies provide additional evidence from that period. One source is a 1981 Heiden, Pittaway Associates study prepared for the White-Rodgers Division of the Emerson Electric Company. The report presents data on checking behavior by LP gas water heater owners, who had to determine whether their units had a thermostat control covered by the recall. Of the 850 owners contacted, 69 percent indicated that they had checked. More than half of those who did not check indicated that they had not received notice about the problem. Eight percent of the non-checkers reported having replaced the unit recently, another eight percent forgot, and five percent felt the problem was not important.

The White-Rodgers report also provides evidence on the efficacy of multiple sources of notification about recalls. Of those who heard about the recall through media notices and advertising, 57 percent reported checking their LP gas water heater. However, among those who first heard from the same sources but also received an Emerson recall notice in the mail, 74 percent checked to see if their water heater was included in the recall.

A Washington University Ph.D. dissertation (Thomas, 1985) presents the results of telephone survey research on consumer response to recalls. In contrast to the 1978 CPSC report conclusion, Thomas' study reported that both the nature of the defect and the severity of the

hazard involved, as well as the perceived fairness of the recall offer, were important determinants of whether respondents would participate in a hypothetical recall. The survey also collected data on the actions consumers would take if they were notified of a recall. Fifty-four of the 80 respondents indicated that they would actually participate in the hypothetical recall. Other responses that people indicated they would take are instructive:

- Nine respondents would stop using the product, but not discard it;
- Six respondents would attempt to fix the problem themselves;
- Five respondents would continue to use the product "with care"; and
- Four respondents would discard the affected product.

One limitation with this study is that the survey sample consisted of only 80 households in the Houston area. In addition, participant responses to a hypothetical recall may not actually be those that would be undertaken in actual product recalls.

Unfortunately, there appears to be a paucity of more recent quantitative recall effectiveness studies. The only worthwhile source we identified in our search was a recent study by the National Highway Transportation Safety Administration (2002). Although the analysis is restricted to recalls involving a single product, it provides useful results from the agency's experience with child seat recalls before and after the 1993 requirement for inclusion of postpaid registration cards attached to new child safety seats. Selected results from this study are presented in the report sections below.

Other reports we have located provide case studies of selected recalls. These sources include a review of U.S. Food and Drug Administration recalls of medical devices in the 1980s (U.S. GAO, 1989); a study of more recent product recalls in the United Kingdom (Simpson, 1998); and articles that report the experience of a single corrective action program (Warner, 1980; Pratt, 1994; Gibson, 1999).

V. Steps in the Recall Compliance Process

Communication theory, as described by Zeitlan (1994), suggests that consumers will act upon safety information if it is received, since: (1) consumers are rational and wish to avoid unpleasant outcomes; (2) if a hazard is known, the consumer will act to avoid it; (3) safety instructions provide knowledge of a hazard and how to minimize the risk; and (4) the clearer the communication, the more likely the instruction will be read, understood, remembered, and followed. This theory assumes that a rational consumer values personal safety above all else (e.g., inconvenience) and that, if he is provided with and receives information on how to avoid injuries, the consumer will comply.

However, incident data and research demonstrate that in some cases injured parties have been provided with and were aware of safety instructions or warnings, yet they chose to disregard them for reasons that seemed appropriate at the time. For example, Pollack-Nelson's 1995 study of the effects of methylene chloride, a known cancer-causing agent found in products such as paint stripper and adhesive remover, found that the overwhelming majority of product

users did not change the way they intended to use or dispose of the product as a result of label warnings. Thus, it is clear that while communication of safety information (e.g., recall notice) is a requisite to compliance, it may not be sufficient to motivate human behavior.

Other research studies have confirmed that consumers sometimes observe and read instructions, yet fail to act upon them. For example, in Friedmann's 1988 study of compliance with warning labels on liquid drain opener and wood cleaner products, she found that overall, 88 percent of subjects noticed the label, only 46 percent claimed to have read the label, and only 27 percent complied with it. Strawbridge (1986) observed a steady decline in the number of subjects who first noticed, then read, and finally followed a warning.

Given the relatively low rates of compliance with recall notices, it is quite possible that the same effect is happening. That is, for some consumers, it is quite possible that they are receiving and understanding the recall message, but are not responding to it. This hypothesis is supported by several relevant sources from the safety literature, which specify a series of steps that are required before the consumer responds to, or complies with, a recall notice or any other safety-related instruction. At each step, some proportion of users may drop off, leaving a smaller group who may actually comply.

These studies suggest a framework that can be used to organize the research located as part of this project. The main steps are based on results that are observable in behavioral experiments; the sub-headings group the major conceptual issues identified in the various disciplines that were part of the literature search:

1. Initial Receipt and Recognition of a Safety-Related Message
    a. Recall Notification Techniques
    b. The Initial Decision to Pay Attention
    c. Message Filtering

2. Message Reading and Comprehension
    a. Use of Pictures, Pictographs, and Symbols
    b. Text Content, Clarity, Wording, and Form of Address
    c. Extent of Processing Required
    d. Impact of User Characteristics

3. Storage and Recollection of Instructions for Compliance[1]
    a. Memory Limitations and Recall Decay Rates
    b. Facilitating Encoding of Messages

[1] In some framework discussions, encoding of the external information for internal use is placed before comprehension in the information processing sequence.

4. Evaluation of the Benefits and Costs of Compliance
   a. Formulation of Risk Perceptions: Hazard-Related Factors
   b. Formulation of Risk Perceptions: Product-Related Factors
   c. The "Acceptable" Level of Risk
   d. The Impact of Compliance Costs

5. Actual Compliance with the Message
   a. The Role of Motivation and Social Influence
   b. Task Overload
   c. Impact of Stress and Time Pressure

Each step in this framework may not occur in a sequential fashion. For example, reading and comprehension of the message often takes place simultaneously with message encoding and storage. Researchers have also noted that some factors can be categorized in more than one component of the framework (e.g. signal words perform both attention-getting and comprehension functions), and some—such as product familiarity—create interactive effects among the different components (Rogers, Lamson, and Rousseau, 2000).

This list of elements suggests that a great deal must take place before compliance with a recall message is achieved. The research obtained and reviewed for this report demonstrates that the potential for non-compliance exists at numerous steps along the way.

VI. Initial Receipt and Recognition of a Safety-Related Message

A. Recall Notification Techniques

Consumer notification of a recall is the first step to achieve compliance. The obvious importance of consumer awareness of a hazard was noted by William Boehly, formerly NHTSA's Associate Administrator for Enforcement, who cited a lack of public knowledge as "the single greatest weakness" to recall success for NHTSA (Gibson, 1995). A new study reports that in the case of child safety seats, the mandatory inclusion of product registration cards helped address that weakness with direct notification of registered consumers (NHTSA, 2002).

Specific approaches to consumer notification are discussed in turn.

Direct Notification

If the names and addresses of a significant fraction of product owners are available, the manufacturer can contact them directly. Direct notification of consumers was found to have a powerful positive relationship to recall success by Murphy and Rubin (1988) in their regression analysis of the determinants of recall effectiveness rates and in CPSC's 1978 study of the determinants of recall effectiveness. The recent NHTSA study (2002) reports that there has been a 24 percentage point increase in the return rate for car seat registration cards since 1993, and a corresponding seven percentage point increase in the average effectiveness rate for child safety seat recalls.

The availability of continually updated registration lists (via state motor vehicle agencies) makes direct notification a more frequent and more effective option for vehicle recalls under the jurisdiction of NHTSA. Heisler and Bernstein (1980) found that most owners (72 percent) became aware of recalls when they received official recall notices. The value of direct notification is reflected in NHTSA recall effectiveness rates, which reportedly have averaged 68 percent for those involving vehicles, 51 percent for recalls of accessory equipment, and 28 percent for tire recalls (Gibson, 1995).

In other instances, quasi-direct notification can be achieved by direct mailings to purchasers of the class of products that includes the recalled units. This approach was used in the liquid propane (LP) gas valve recalls conducted by White-Rodgers, Robertshaw, and Honeywell in the 1980s, and more recently, by a consortium of appliance and pipe manufacturers to address problems with first-generation high-efficiency furnaces. Because of the potential disconnect between the customer lists available and the universe of actual product purchasers and users, the effectiveness of this variant of direct notification is generally more difficult to assess. Some evidence is available, however, from Heiden, Pittaway Associates'1981 evaluation of the White-Rodgers program. White-Rodgers notified LP gas dealers about a potentially hazardous control valve that it had manufactured and that was used on a significant proportion of LP gas water heaters in their customers' households. White-Rodgers obtained customer lists from the dealers and sent notification letters to these customers asking them to check their heaters to determine whether their valve was affected by the recall. In a follow-up survey of a sample of customers on the lists, 74 percent of these customers reported having received the notice.

Product registrations are tied to the consumer addresses at the time of purchase. One challenge faced by firms who use direct notification in a recall is the high degree of mobility characterizing both people and products. In their child seat study, NHTSA (2002) noted that census statistics indicate that 54 percent of households with children will have moved within three years.

In addition, there are active second-hand markets for many categories of products that are subject to recall. In one study on the availability of owner's manuals for second-hand products, significant proportions of the participating consumers had purchased used products such as bicycles (38 percent of respondents), washers/dryers (29 percent), and lawnmowers (21 percent) (Wogalter and Baneth, 1994). Some of this recycling of products is done through thrift stores and flea markets. In its November 1999 study the Commission found that nearly 70 percent of the thrift stores in its sample had at least one hazardous product for sale (CPSC, 1999).

Press Releases and Paid Media Advertising

Where direct notification of most consumers is not possible, manufacturers may have to rely on mass media to notify the public of a recall. According to the CPSC staff, press releases are now issued for nearly all recalls involving products that are thought to be in the hands of consumers.

Even in recalls with a substantial direct notification component, media coverage provides notification for those who cannot be reached by mailings, and perhaps more importantly, it reinforces the message for those who received direct notice. Heisler and Bernstein (1980) found that television and newspaper notification reached about 17 percent of domestic vehicle owners who were also directly notified. Participants in their survey suggested better use of the media as a way to increase campaign recall responsiveness.

Recall advertising can be complicated by problems in reaching the affected consumers. For example, there may be a divergence between reaching potential purchasers—who are likely to be receptive to advertisers—and prior purchasers—who are probably not interested in advertising messages about the product, unless they are contemplating replacement (Finegan, 2001).

Point of Purchase Approaches

Other tools are also available to supplement the outreach function performed through direct notification and mass media. Point-of-purchase notification is a potentially attractive way to reach consumers who purchase supplies or replacement parts for the recalled product or for similar products. However, Hackney (1997) notes that retailers have responded to the rapid growth in this form of advertising by imposing new guidelines and restrictions on its use.

One way of avoiding these limitations—and the overall clutter of the retail environment—is to attach the recall notification message directly to a replacement part or supplies used with the affected product. An early example of this approach was the insertion of notices for the early 1980s recall of North American Systems' coffeemakers into replacement filter packs. More recently, Bernzomatic (collar ring notices on replacement propane cylinders for camping heaters) and Emerson Tool Company (notices in packages of replacement blades for radial arm saws) have both used this approach to bolster notification efforts for recalls.

New Approaches: VNRs and the Internet

A growing number of recalls are also accompanied by video news releases (VNRs). In a paper presented at the 1999 CPSC Product Registration Conference, Dirk Gibson indicated 140 television stations broadcast the VNR for the most recent CPSC Recall Round-up (Gibson, 1999).

Use of the Internet for recall notification is increasingly common. Program-specific Web site notices and e-mailings by manufacturers are supplemented by central clearinghouse sites such as the CPSC home page and the cross-agency recall information portals maintained by SafetyAlerts.com and RecallAnnouncements.com. However, research on the effectiveness of the web in conveying recalls is not available.

B. The Initial Decision to Pay Attention

Once a recall message is disseminated, it must then be received and recognized by the affected product users. Outreach programs for recalls are typically designed and evaluated on an

individual basis—the objective is how best to reach the target population of consumers with one specific safety message. More importantly, safety-related messages in the form of recall notices, warnings, educational campaigns, and other instructions for product use are only a small percentage of the torrent of persuasive messages received by users. Cialdini (1993) estimates that consumers are presented with more than 3,000 persuasive messages daily, mostly in the form of advertising.

Because of this information overload, consumers typically employ heuristics (i.e., rules of thumb), rather than systematic processing, to respond to persuasive messages. Some common heuristics include (Eagley and Chaiken, 1984; cited in Wogalter, Allison, and McKenna, 1989):

1. Trust in expert opinions;
2. Trust in those who are perceived to be friendly;
3. Reliance on the sheer quantity of persuasive arguments in the message;
4. Influence by the use of statistics in the message; and
5. Reliance on social cues and context.

All of these heuristics potentially reduce attention to the message. The first two involve reliance on the source, rather than examination of the content. Users of the next two heuristics are influenced by the format of the message, in addition to (or instead of) its content. The final heuristic involves the use of others' behavior, rather than the content of the message, to infer the appropriate response.

Wright, Creighton, and Threlfall's 1982 study of user attention to instructions for 60 products demonstrated that a significant portion of consumers do not make it past the attention step. Half of the products studied were electrical devices, which were drawn from three categories: those with complex operating procedures, those with simple operating procedures, and those that were battery operated. According to the authors, on "53% occasions subjects claimed that they would read *All* of the instructions, and on 34% occasions that they would read *None* of the instructions." Product complexity affected the willingness to read at least some of the instructions—almost 83 percent of the participants indicated that they would read at least some of the instructions for complex electrical products, but almost half would not read any of the instructions that accompanied hand-powered tools.

The research literature does provide some guidance as to the elements that encourage a consumer to pay attention to a warning or other safety-message. Edworthy (1988) distinguishes between the *informational* and *iconic*, or attention-getting, elements of warning messages. Color, lettering, and use of signal words are devices that can affect the extent to which a warning is noticed, as well as facilitate reading and recall of the information being communicated.

While the physical characteristics and layout of safety-related messages are somewhat outside the scope of this review, we identified several sources that highlighted the importance of using signal words such as "Warning" to secure attention. The use of the highest risk level signal words (e.g., "deadly" or "danger") has been shown to be effective in producing a high level of perceived risk, and thus a motivation to devote further attention to the warning (Wogalter, Kalsher, et. al., 1998). However, users were sometimes less clear on the meaning and relative significance of "warning" and "caution" (Lehto and Miller, 1986).

While recall notices share many characteristics with warnings and other safety communications, getting users to recognize and process these messages involves overcoming additional hurdles that are not faced by a warning label that is affixed to a product. The most obvious difference is that this type of safety message is presented after the product is on the market and in use. In a product recall the temporal and spatial separation of the warning from product purchase and use, as well as user familiarity with the product, act to reduce the chance that the message will be actively processed, retained, and complied with (Stoltman and Morgan, 1995). Mazis and Staelin (1982) cite "inappropriate timing"—receipt of a message at a time other than when the relevant cognitive or behavioral task is being performed—as an important factor presenting challenges in gaining exposure and attention to warnings. Placement of safety information has been found to have a substantial effect on the likelihood that warnings will be noticed, as well as complied with (Rogers, Lamson, and Rousseau, 2000; Magurno and Wogalter, 1994; Wogalter, Kalsher, and Racicot, 1993; Dingus, Hathaway, and Hunn, 1991).

While it is more complicated to employ it in a recall, one device that may stimulate user attention is to place the message in a manner that causes temporal interruption of the task being performed. One study showed that a warning about proper loading of a file cabinet was noticed by none of the participants when it was placed on the shipping carton, but by nearly all of those who were presented with a cardboard bridge placed across the width of the top drawer. The authors hypothesized that the warning is more likely to be noticed if it interrupts the user's pre-existing "script" for performing a task (Frantz and Rhoades, 1993). Similarly, Wogalter (1999) notes that interactive warnings can be used to attract attention during the habitual performance of a familiar task.

C. Message Filtering

Given this large stream of safety-related messages, and the much larger flow of other daily communications via phone, mail, e-mail, and mass media, research studies indicate that individuals employ selective screening, or "filtering", strategies to determine which messages receive further attention and which are effectively ignored (Cialdini, 2001).

Several studies have identified familiarity—both with the product and with the hazard—as an important factor that influences the operation of the filtering process. Product familiarity and years of experience without injury may lessen the caution a user exhibits with a product and his or her concern about its safety. The effect of familiarity on attention to warning labels is noted in the literature (Burnett, Purswell, Purswell, and Krenek, 1998; Wogalter, Barlow, and Murphy, 1995; Goldhaber and deTurck, 1988; Otsubo, 1988). Slovic, Fischhoff, and Lichtenstein (1980) cited studies showing that people also tend to consider themselves relatively immune to common hazards. In some cases, this perception of invulnerability is based on having repeatedly used a product in the past without a negative outcome (Rethans, 1979; Svenson, 1979).

Familiarity with a specific warning has a similar effect on users' decisions as to whether to pay attention to the warning (Hadden, 1991). Wogalter (1999) noted that habituation is a particular concern when safety messages are standardized to reduce time and effort demands on processing information. Moreover, a lack of actual familiarity with the product is not always

enough to induce heightened interest in safety messages. One study found that "people are relatively insensitive to the extent of their own knowledge" about new products (Fischhoff and Merz, 1994). This problem is most commonly encountered in the situation where a new product closely resembles another product, but is potentially more dangerous to use (Godfrey and Laughery, 1984; cited in Wogalter, 1999).

The advertising and marketing literature suggests the possibility that even *unfavorable* experience with a product may lead to reduced user concern about risk. When faced with a mismatch between expected and actual product performance, consumers may engage in dissonance-reducing behavior, such as post-purchase gathering of additional information, to confirm the soundness of their buying decision (Mitchell, 1992).

Some studies have identified ways to improve the chances that a safety warning will survive the filtering process. One consistent result is that placing the most important elements of the safety message in the first one or two sentences reduces the filtering that comes from a limited attention span (Friedmann, 1988; Latin, 1994). Research has also demonstrated that warning labels containing pictorials are more likely to be read than warnings without pictorials (Kalsher, Pucci, Wogalter, and Racicot, 1994; Sojourner and Wogalter, 1996). These findings are reflected in recent CPSC recall press releases, which increasingly include pictures or diagrams of the affected product.

VII. Message Reading and Comprehension

After a recall message has been selected for attention and storage, the recipient typically needs to process the information further before it can be translated into a potential response. The first element of this processing involves the extent to which the consumer is willing and able to read and understand the message being communicated. A distinct, but related, set of issues involves the factors that influence whether people can store and remember things they initially notice. There is an ample body of literature on warnings and safety education, as well as more general research on cognitive psychology, that cover each of these topics.

A. Use of Pictures, Pictographs, and Symbols

One consistent finding from the literature is that properly designed and pre-tested visual aids, such as a photograph of the product and/or a pictorial that demonstrates the hazard, can help to improve comprehension. Meingast (2001) found that pictorials and safety icons (along with other physical enhancements) increased warning salience and the recollection of warning information. Several studies have shown that symbols facilitate the comprehension of pharmaceutical warnings (Ndhlovu and Morton, 1986; Wolff and Wogalter, 1993; Magurno, Wogalter, Kohake, and Wolff, 1994).

While pictographs/symbols may attract attention to the safety message, pre-testing of these images is desirable to detect and avoid misinterpretation. Akerboom and Trommelen (1998) found that test subjects were able to determine that pictographs of a tree and a fish were related to the environmental hazards associated with product use. However, symbols were less

effective in conveying distinctions about the level of hazard posed by a particular product. This finding is an elaboration on the results of studies such as Dixon (1982).

B. Text Content, Clarity, Wording, and Form of Address

The construction of the text portion of a safety-related message is also critical to communicating the hazard and the steps to be taken to avoid it. Numerous researchers have addressed the essential elements for adequate instructions (Cutts and Maher, 1980; Hartley, 1981; Redish, 1979; Wright, 1981). In addition to product identification, and an indication of the hazard, the recall notice should clearly *specify the desired response*—what the manufacturer wants the consumer to do. This includes giving precise information for compliance. Trommelen (1997) found that warning comprehension was improved for explicit warnings about child-care products. Viscusi and Magat (1987) also found that increased specificity of warnings improved both comprehension and response, a finding corroborated by Heaps and Henley (1999). This more recent study found that test participants thought that warnings for a hypothetical cleaning product were more believable when an explicit statement of the hazard-causing agent and the consequences that could result from exposure were included on the label.

In addition to content, the *layout of information* in the recall notice can facilitate or hinder reading and comprehension. In their consumer product labeling study, Viscusi and Magat (1987) demonstrated that presenting hazard information in a hierarchical fashion (i.e., with a one or two sentence summary at the top of the label) outperformed other label designs. Friedmann (1988) has shown, perhaps somewhat counter-intuitively, that there are potential benefits to placing the *proactive* information (i.e., what you should do to reduce the risk of exposure) before the information relating to the nature of the hazard (the "reactive" information). Wright (1981) suggests the use of "sign posts" (e.g., headings and typographical distinctions) to help readers find particular sections within the text. This issue is important since lack of thematic organization slows down the consumer's comprehension of the information (Kieras, 1978).

C. Extent of Processing Required

Another important determinant of whether a message can be comprehended and utilized is the extent to which the information provided requires further analysis by the recipient. Mazis and Staelin (1982) cite the use of the miles-per-gallon measure of automobile fuel efficiency as an example of a metric that is presented to consumers in an immediately understandable and usable format. In contrast, they find that the cluster of indices used to compare costs across life insurance policies fails on both understandability and ease of encoding grounds.

D. Impact of User Characteristics

Several studies have investigated the differences between various groups of potential product users in understanding safety warnings. Of particular interest is the research conducted on the impact of user gender, age, and education on message comprehension.

Goldhaber and DeTurck (1988) report that males were more likely than females to form an opinion about a safety-related message before reading all of it. However, the proportion of

male and female study participants who *recalled* the warning—in this case, one about diving in the shallow end of the pool—was not significantly different.

Hancock, Rogers, and Fisk (2001) found that older consumers are more likely to read, and take heed of, warnings for certain types of products, including personal care products, cleaners, and small appliances. Middle-aged users showed a greater propensity to read warnings for power tools, however. Those in the older age group showed less familiarity with and comprehension of safety symbols even though they believed them to be more useful on average than the younger age groups of study participants did. However, this analysis found that these age-related differences explained very little of the overall variance.

Lepkowska-White and Parsons (2001) found that the wording of a message affected the receipt of it by both highly educated and relatively uneducated people. A test of two alternative labels constructed with different vocabulary levels showed that the message with a higher vocabulary level was less well understood by the lower-education group. Both groups indicated that the product had a higher risk associated with use when they were presented with the more difficult label, however.

VIII. Storage and Recollection of Instructions for Compliance

Even if a safety message passes through the relevant filtering mechanisms and has been adequately read and comprehended, the potential for loss before the message is evaluated and acted upon remains. The literature reviewed for this report identified a number of challenges associated with storing the message in memory and recalling it at a later date for further action.

A. Memory Limitations and Recall Decay Rates

Messages that survive the filtering process need to be transferred from short-term memory to long-term memory. Information overloads will preclude transfer—a problem that creates particular challenges for messages that are broadcast. Mazis and Staelin (1982) indicate that this limitation means that advertising spots will only be effective if they attempt to communicate simple concepts or impressions. Similarly, use of specific concepts rather than abstractions in written communications will facilitate the transfer to long-term memory.

Even when the information has been written to long-term memory, there is only a limited window of time for action before it will be difficult or impossible to retrieve this information. The problem of limited message retention over even very short time periods has been documented for high-profile placements such as traffic signs. One old, but widely cited study, provided the following time-profile of memory deterioration in an experiment involving six traffic safety posters (Belbin, 1956; cited in Lehto and Miller, 1986):

- Same day retention averaged 42 percent;
- By the next day only 28 percent recalled the poster message;
- After one week retention levels declined to 15 percent; and
- After two weeks only three percent of the test subjects recalled the poster.

Wright (1979; cited in Lehto and Miller, 1986) conducted research on rates of recall for safety-related messages displayed at the point of purchase. Consumers who were observed to be reading the message while shopping were asked about its contents upon leaving the store; less than ten percent of the respondents had stored and retained the message for even this relatively short period of time.

Seemingly plausible strategies have been evaluated and found *not* to yield measurable results in terms of retention and response. Trommelen's (1997) study of baby carriers and feeding bottles showed that providing explicit information about the consequences of the hazard increased comprehension of the message, but without a discernible effect on intended compliance with the warning.

Forgetting to comply with safety instructions has been observed in research on warning label effectiveness as a reason for noncompliance. Strawbridge (1986) noted that some subjects were able to fully recall the warning in her study, yet had failed to carry out its instructions. In fact, 77 percent of the subjects in the control group correctly recalled the cause, danger, and way to prevent the hazard, yet did not follow the warning. "These subjects reported that they simply 'forgot' to comply with the warning". Vredenburgh and Cohen's (1995) study of compliance with warnings for high-risk recreational activities also found that forgetting was a reason for non-compliance.

B. Facilitating Encoding of Messages

These results underscore the importance of reducing impediments to storing and retrieving the recall message. Researchers have proposed a number of strategies to mitigate the impact of memory degradation. One example from the advertising literature is that media ads are more effective if they are clustered in a limited time-span, instead of being dispersed over a long period (Surmanek, 1996). For written communications, researchers have found that placing the most important elements of the safety message in the first one or two sentences can help to counteract the impact of a limited attention span (Friedmann, 1988; Latin, 1994).

Provision of messages in both visual and written form also enhances recipients' ability to encode the information into memory. Booher (1975) previously found that a combination of pictorial information and text facilitated the speed of message comprehension and reduced miscommunication. He concluded that, "...the human processing system is most efficient in comprehension of instructions when the pictorial mode is used". More recently, Laughery and Young (1991) found that pictorials enhanced the ability to encode the information presented on a product label. Otsubo's 1988 study of warnings on circular and jigsaws found that (for products perceived as most hazardous) the highest compliance was achieved with warning signs that used a combination of words and a pictograph.

IX. Evaluation of the Benefits and Costs of Compliance

The research literature has identified a number of variables that influence decision-making and behavior in safety settings, including the perception of the hazard involved and the expected costs of compliance with the message. Edworthy (1998) incorporates these factors into

a model of consumer decision-making in which there is an implicit balancing of perceived risk from not complying with a safety message that is weighed against the costs of complying, including the possible loss of product utility. In this model, a number of factors influence the consumer's judgment of the risk associated with non-compliance, including those associated with the hazard (e.g., seriousness and obviousness), the product/user interaction (e.g., familiarity and skill level), and context (e.g., social cues provided by others). Warnings influence these perceptions by providing both information and basic alerting cues—color, lettering, and signal words.[2].

A. Formulation of Risk Perceptions: Hazard-Related Factors

There is an extensive literature on the factors that influence the risk perceptions formed about both products and hazards. One important concept in this literature is that risk perceptions are based on a foundation that precedes the receipt of any recall messages. Another common finding is that the evaluation of perceived risk depends on a number of factors, including the attributes of the hazard, the product, and the user.

Hazard perception has been found to be a predictor of compliance with warning labels. Friedmann (1988) and Otsubo (1988) both found that increased hazard perception was associated with increased warning label compliance. Wogalter, Desaulniers, and Brelsford (1986) found product hazardousness was highly correlated with the level of precaution subjects reported that they would take.

Oglethorpe and Monroe (1994) provide an analytical framework containing eight factors that influence the perceived level of risk associated with various product/activity hazards:

1. Hazard severity;
2. Hazard probability;
3. Availability—the vividness of the negative outcome;
4. Controllability—the degree to which a consumer believes that the probability of a negative outcome can be reduced by personal skill, diligence or the use of a safeguard;
5. "Dreadedness"—a person's emotional, "gut" reaction of horror to a particular negative consequence;
6. Irreversibility;
7. Catastrophic potential—the likelihood that a negative outcome will affect others (either directly or indirectly); and
8. Immediacy of effect.

The roles and relative importance of each of these hazard-related factors have been investigated in a number of studies and experiments. While hazard severity and probability are the most frequently cited determinants of risk perceptions, Oglethorpe and Monroe were able to show that taking into account other factors improved the explanatory power of the model in their study.

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[2] As noted above in Section V, this type of model was also presented and utilized in the 1980 CPSC Recall Effectiveness Task Force report.

1. Hazard Severity

Hazard severity has been demonstrated to play a significant role in risk perception. Wogalter, Young, Brelsford, and Barlow (1999) found that the severity of the potential outcome was the single best predictor of hazard perception. Similarly, Hammond (1995) found hazard severity to be a powerful determinant of risk assessment.

Some researchers have found a link between hazard severity and compliance with safety instructions. Young, Brelsford, and Wogalter (1990) found that severity of injury played a role in people's judgments of whether or not to act cautiously. In Vredenburgh and Cohen's 1995 study of compliance with warnings associated with high-risk recreational activities (skiing and scuba diving), subjects who responded that they had complied with warnings and safety instructions believed that the activity was more dangerous.

Heisler and Bernstein (1980) also found a strong relationship between owners' perceptions of severity of the defect and the reason for participating in a recall. Fifty-three percent of the respondents who considered the defect to be very serious gave self-protection reasons for complying. The authors concluded that, "...responders who perceived the alleged defect in their vehicles to be serious were much more likely to respond on the basis of self-protection". However, this study also found that responders and non-responders to recalls were equally likely to have perceived the defect to be very serious, serious, or not serious. Therefore, while perceived severity may induce some towards compliance, it does not assure it.

2. Hazard Likelihood/Probability

One somewhat surprising result of our research is that there has been less support in the literature about the impact of injury likelihood (or hazard probability) on compliance with safety instructions. For example, Young, Brelsford, and Wogalter (1990) found that people did not typically factor the likelihood of injury into their judgments of product safety. Similarly, while Conzola and Wogalter (1998) found that the addition of injury statistics to warning labels led to higher ratings of warning importance, vividness, explicitness, and persuasiveness, they also found that it did not have a significant effect on the perceived likelihood of injury.

Evaluation of risk probabilities is also influenced by the ways in which hazard information is provided. Slovic, Fischhoff, and Lichtenstein (1980) noted the impact of media attention on consumers' risk perceptions; events that received inordinate media coverage led to the overestimation of risks. The effectiveness of media attention to a recall is dependent not only upon the consumer's viewing and reading habits, but also on the placement and timing of these announcements. Combs and Slovic (1979) also noted that people generally overestimate the likelihood of dramatic or sensational causes of death that are heavily reported in the news media.

3. Availability

Availability, or vividness, is also cited as a determinant of perceived risk in several studies. Oglethorpe and Monroe (1994) describe an available or vivid event as one that is more concrete and less abstract. Kisielius and Sternthal (1986) studied the effect of vividness on product risk judgments and found that an outcome that is vivid in a person's mind may also be

perceived as being more severe.[3]

According to Slovic, Fischhoff, and Lichtenstein (1980), the extent to which one can easily imagine or recall a hazard influences risk perceptions. Further, more frequent events are generally easier to recall or imagine. Personal experience with the subject hazard may increase vividness or availability of a negative outcome. Glik, Kronenfeld, and Jackson (1991) conducted a telephone survey of households with preschool children to study the factors related to parents' perceived risk of childhood injuries. They found that parents whose children had sustained a recent injury had higher risk perception overall. Otsubo (1988) also found that prior personal injury using a product led to greater compliance with on-product warnings.

4. Controllability

An individual's perceived control over a hazard may also influence the degree of perceived risk. The role of perceived control over a hazard was evident in Friedman's (1988) study of warning labels on chemical products. She found that the majority of those who read the warning but did not follow it thought the product was hazardous, but also felt that if they used the product safely, they would not get hurt. This included holding the product a "reasonable" distance. Wogalter, Desaulniers, and Brelsford (1986) also found that users' confidence about their knowledge of hazards related to a product provided a marginal but significant contribution to explaining risk perceptions.

Rogers, Lamson, and Rousseau (2000) cite research that shows the influence of personal risk-taking styles on users' feelings of control over a hazard. Oglethorpe and Monroe (1994) provided additional references on the link between controllability and judgments of risk in the research literature (Otway and Fishbein, 1976; Slovic, Fischhoff, and Lichtenstein, 1980; Vlek and Stallen, 1981).

5. Dreadedness

According to Oglethorpe and Monroe (1994), some hazard consequences (e.g., burn injuries) inspire emotional responses, rather than attempts to evaluate the level of risk using systematic processing. Previous studies have also linked "dreadedness" to risk perception (Bechtel and Ribera, 1983; Slovic, Fischhoff, and Lichtenstein, 1980).

6. Irreversibility

Consequences that have permanent outcomes are perceived as more serious than those that are reversible (Oglethorpe and Monroe, 1994).

7. Catastrophic Potential

The potential for harm to others may increase individuals' risk perceptions. Slovic, Fischhoff, and Lichtenstein (1980) cited this factor as an important explanation for the level of

[3] According to the model presented by Oglethorpe and Monroe, availability and the other factors discussed below can influence risk perceptions both directly and by altering the perceived severity or likelihood of the hazard.

perceived risk ascribed to nuclear power plants by study participants.

This consideration may be especially applicable to consumer products for which an adult assumes responsibility for a child—e.g., products that instruct parents to supervise use, but for which the child is not directly supervised. A number of studies have examined parents' perceptions of risks in the home and to children. Hammond (1995) summarizes a large body of research that indicates that, "Adults systematically overestimate children's abilities, indicating a gap in knowledge which could lead adults to provide inadequate protection from possible injury".[4] The overestimation of a child's abilities or knowledge and the underestimation of personal risk can have a detrimental impact on recall effectiveness in the case of children's toys. For example, for stuffed dolls and other toys that are recalled because of small parts, a parent who believes that his or her child is beyond the mouthing stage or "knows better" may not respond to the recall, particularly if the toy is a favorite of the child. Such a parent may not feel that his or her child is at high risk of injury for that particular toy/hazard.

Along with an overestimation of a child's abilities, parents may also underestimate risks to children in general. Coffman, Martin, Prill, and Langley (1998) assessed the perceptions, safety behaviors, and learning needs of parents who brought children to the emergency room. They found that parents tended to underestimate their children's risks for motor vehicle accidents and immersion injuries and were more concerned about kidnapping and assault. Parents reported relatively low use of safety measures, both inside and outside the home.

In a study of supervision of children ages two to six years old, Pollack-Nelson and Drago (2001) found that although three-quarters of children in the study got out of bed in the morning before a parent, the overwhelming majority of parents did not perceive their child to be at risk of injury. Ninety-five percent of parents perceived that their child was at no or slight risk of injury. Despite the low perceived risk, injury statistics demonstrate that serious injuries often occur in the early morning hours while parents are asleep.

Garling and Garling (1993) also observed relatively low concern with hazards in the home. Their study of parent's supervision practices with children ages one through three years found that although risk was consistently rated higher for the one-year olds and two-year-olds than for three-year-olds, overall perception of risk when the parent was in a different room was generally not high. Furthermore, when the parent was in a different room than the child, perception of risk was lowest if the child was in his bedroom, regardless of age. Ironically, situations or rooms that were considered to be low risk, such as the living room and bedroom, have been associated with the largest numbers of childhood injuries. Hu, Wesson, and Kenney (1993) found that two-thirds of home injuries to children occurred in the living room or bedroom. Furthermore, the bedroom was the most common location where child fire-setters experimented with lighters.

Another potentially response-inhibiting factor to a recall involving children's toys is the perception that "accidents happen", are not preventable, or are a normal and acceptable part of childhood. Mulligan-Smith, Puranik, and Coffman (1998) studied parental perceptions of injury

[4] Among the studies cited by Hammond that were obtained and reviewed for this project are Eichelgberger et. al., 1990 and Garling and Garling, 1991. Additional references are provided in the Hammond paper.

and found that fewer than half of caretakers believed that most injuries can be prevented. They noted that other studies have found that caretakers with greater education were more likely to believe that injuries can be prevented (Eichelberger, Gotschall, Feely, Harstad, and Bowman, 1990; Durkin, Davidson, and Kuhn, 1994). Liller, Kent, and McDermott (1991) observed similar perceptions in their study of 100 postpartum patients at a hospital known for its high number of low-income patients. They found that a common perception was that injuries in some children were unavoidable.

Morrongiello and Dayler's (1996) study of parents' knowledge of injury risks for children and attitudes towards childhood injuries found that parents viewed injuries largely as a natural consequence of childhood (82 percent) and believed that children learned about risk avoidance from injury experiences. Similarly, Langley and Silva (1982) found that when asked why children behave cautiously, most responded that children naturally fear danger and can recognize danger for themselves. Respondents placed much of the responsibility for safe behavior on the children themselves, as opposed to assigning adults the responsibility of teaching children to behave safely. The authors concluded that parents were reactive, responding after an incident. They had not anticipated or taken proactive measures to prevent childhood injury-prevention on a day-to-day basis.

Eichelberger, Gotschall, Feely, Harstad, and Bowman (1990) conducted a national phone survey of 404 parents having at least one child aged 13 or younger. Respondents frequently mentioned "being careful" when describing precautions to reduce the risk of unintentional injury, rather than mentioning proven safety measures. These researchers also found that parents of lower socioeconomic status demonstrated a more limited understanding of child safety.

A number of studies have found that parents are not adequately educated about risks to children in and around the home. Eichelberger, Gotschall, Feely, Harstad, and Bowman (1990) found that parents knew little about the dangers of burns, drowning, pedestrian, and bicycle injuries. Liller, Kent, and McDermott (1991) found that although respondents demonstrated some knowledge of injury prevention strategies, deficits were noted in the areas of burns, motor vehicle injuries, drownings, and falls.

Glik, Greaves, Kronenfeld, and Jackson (1991) conducted a telephone survey of 1,200 households with a preschool child in an effort to understand the factors related to parents' perceived risk of childhood injuries. Researchers found that parents underestimated the risks of some hazards and injuries and overestimated the risks of others. Parents whose children had sustained a recent injury had higher risk perception overall. While some parents seemed to understand the seriousness dimension accurately (i.e., burns are serious), they were less likely to accurately perceive the likelihood dimension (i.e., parents may underestimate the likelihood of burns, poisoning, head injuries, and broken bones) for their children. The likelihood of certain common hazards causing injuries—electrical outlets, hot water, electrical appliances, and bathtubs—was underestimated, particularly by the parents (92 percent of the sample) whose children had not been previously injured.

8. Immediacy of Negative Outcome

Wilson and Crouch (2001) cite the immediacy of consequences as a factor that shapes risk perceptions: delayed consequences may not be as salient to consumers. Empirical support was provided by Pollack-Nelson's (1995) study of compliance with methylene chloride labeling. She found that about 25 percent or fewer respondents reported having health concerns when working with these products. Further, they were more concerned with the possibility of skin contact and poor ventilation, than with cancer. The author suggested that this may be due to the fact that skin contact and inhalation of vapors have more easily visualized and immediate effects than cancer.

B. Formulation of Risk Perceptions: Product-Related Factors

Other research has examined the impact of product, rather than hazard, characteristics on consumers' risk perceptions. Chaudhuri (2002) focused on the role of both objective ("utilitarian") and subjective ("hedonic") factors in the determination of perceived risk for a broad range of products and services. Negative emotional ratings (e.g., worry, disappointment, or irritation) had a strong positive influence on perceived risk, while positive feelings (e.g., joy, pleasure, or delight) had a modest negative effect on risk perception. The author interpreted these results to indicate that users may underestimate the risks associated with products or activities that are related to pleasure, such as sporting goods and recreational vehicles.

There are several limitations with this study, however. First, the dependent variable in the experiment was a summary measure of five types of risk (financial, performance, physical, psychological, and social), of which only one component (physical) was related to safety. In addition, the direction of causality was not considered: it is completely plausible that products or activities with higher degrees of perceived risk increase users' negative feelings about them.

The role of "utilitarian" factors such as price and perceived product quality has also been explored (Tse, 1999). An experiment involving undergraduate students' perceptions of the risk of harmful radiation from the use of a computer monitor was used to test the impact of these factors on the level of perceived risk. Higher product prices, national brands, sales through specialty stores (vs. mass discounters), promotion through specialty magazines and experts, and longer warranty periods were all associated with a higher perceived level of safety. However, we have not yet found research that examines the influence of these factors on more generalized groups of products and product users.

C. The "Acceptable" Level of Risk

A consumer's decision to respond to a recall notice is also influenced by the level of risk that is judged to be *acceptable*. Rethans and Albaum (1980) began by drawing a distinction between risk estimation and risk evaluation. Study participants rated a set of 30 consumer products on a series of dimensions that included both perceived risk level and their subjective assessment of the acceptability of that level of risk. Participant ratings for voluntariness of product use, the level of risk knowledge, the opportunity for risk control, and the necessity of the product were all positively correlated with the acceptable level of risk. The foreseeability of the

hazard, the extent of exposure to the hazard, the ease with which risk reduction could be effected, the possibility of user error, and the degree of risk to children were negatively correlated with the assessments of the acceptable level of risk.

Rethans and Albaum established that the most important explanatory factors among this group are product necessity, user error, voluntariness, risk knowledge, and foreseeability. They point to these factors to explain why some products with high degrees of perceived risk—such as skiing, knives, and swimming pools—were judged by the respondents to have acceptable levels of risk. The role of choice is also stressed in Starr (1982; cited in Wilson and Crouch, 2001), who indicates that people are more willing to take risks by choice than to have risks imposed on them by factors beyond their control.

Variations in acceptable levels of risk depend not only on the characteristics of the product, but also of the user. Consumers who are risk-averse may be more likely to act upon a recall notice. On the other hand, those who enjoy taking risks may be less likely to comply with safety information, even if they have arrived at the same assessment of the actual level of risk associated with the product or activity (Purswell, Schlegel, and Kejriwal, 1986).

D. The Impact of Compliance Costs

In addition to assessing the costs of *not* participating in a recall, in the form of elevated hazard exposure, the research on recalls and other safety-related behavior indicates that consumers are also sensitive to the costs of participating in a recall. These costs can take many forms:

1. Financial costs—e.g., postage required to return the product;
2. Time costs—time involved in contacting program representatives or customer service, taking the product to a repair shop or post office, or completing an in-home repair;
3. Disutility costs—loss of use of the product or restriction of its functionality;
4. Social costs—e.g., if the repair or retrofit involves use of protective safety gear that the consumer perceives as embarrassing;
5. Resources—the skills or tools needed to complete the task; and
6. Effort—the physical effort that must be expended to comply.

A substantial body of research, as discussed below, confirms the impact of these potential obstacles to recall and safety compliance.

Evidence from CPSC Recalls

Even modest inconvenience has been shown to have significant effects on responses to safety information, a phenomenon that was noted in the CPSC recall effectiveness studies (1978, 1980). The impact of compliance costs was also highlighted in the Murphy and Rubin (1988) analysis of recall effectiveness rates. Provision of an in-home repair, instead of a remedy that required consumers to return the product to the manufacturer or retailer, was associated with an increase of 14 percentage points in the average recall effectiveness rate.

A study by Warner (1980) also found that the loss of the use of the affected product was an important factor suppressing participation in the 1976 Corning recall of electric percolators. Of those who did not return the percolator as instructed by the recall notice, nearly half indicated that the lack of an alternative unit was a reason. An additional four percent cited the inconvenience of returning the product.

Evidence from NHTSA Recalls

The time incurred in having repairs performed is a particular problem for auto-related recalls. A mid-1990s study found that response rates were substantially lower for Japanese cars (24 percent on average) than for vehicles manufactured in the United States or Europe (52 percent and four percent, respectively). One explanation is that the Japanese cars needed the fewest repairs for non-recall related reasons, so there were fewer opportunities for owners to "bundle" safety repairs with other work that needed to be done (Hoffer, Pruitt, and Reilly, 1994).

The negative impacts of time and inconvenience costs on compliance with vehicle recalls were also observed by Heisler and Bernstein (1980). They found consumer response to automotive recalls was contingent, in part, upon the barriers to responding. They asked responders to a national phone and mail survey if they encountered any problems in obtaining repairs to vehicle recalls. Approximately 11 percent of respondents reported some difficulty in getting repairs done. The typical problems cited included unavailability of parts and an excessive length of time for completion of repair work. Respondents were also asked for recommendations to encourage consumer response to recalls. About 30 percent of the respondents offered suggestions about making the process easier and less burdensome: getting faster service, having dealers do better work, making dealers more cooperative, emphasizing that the repair is free, compensating owners for the inconvenience, and/or making the recall process more convenient.

Evidence from Other Safety Studies

The significance of these factors and their detrimental impact on compliance was corroborated in other safety compliance studies conducted in the 1980s. Wogalter, Allison, and McKenna (1989) studied the effects of cost on compliance with a warning pertaining to personal safety. Subjects performing chemistry laboratory tasks were provided with instructions that contained a warning directing them to wear a safety mask and gloves. The researchers found that when the safety gear was readily accessible on the laboratory demonstration table, compliance was significantly higher than when the safety gear was located in a different room.

Dingus, Hathaway, and Hunn (1991) also observed the effects of compliance costs in their study, which unobtrusively observed 920 racquetball players. Warning signs placed on the door to the racquetball court as well as on the front wall inside the court warned people who were about to play racquetball of the potential for eye injuries. The warning instructed users to "wear eye protection". The warning followed an ANSI format and included a pictograph. The warning also provided a list of "Racquetball Facts" which included statistics regarding eye injuries. Cost of compliance was manipulated by varying the location and availability of goggles. In the low-cost condition, goggles were provided in a box just outside the door to every

court. In the high-cost condition, no eyewear was provided on-site. For the middle cost condition, goggles were available at a checkout booth 60 feet away from the court. While 60 percent complied in the low-cost condition, for the middle and high-cost conditions, compliance rates were zero percent.

Dingus, Hathaway, and Hunn performed a second study (1991) of warning label compliance in which subjects were asked to take home and use a "new formulation" cleaning product for a week. In the low-cost condition, where subjects were provided gloves for use with the cleaner, approximately 87 percent of subjects wore the gloves. When gloves were not provided, compliance was 25 percent overall. The authors concluded that, "cost must be very low to achieve the highest possible compliance with a warning's intent. Increasing the cost even a seemingly minor amount can have devastating effects on compliance".

Dingus, Hunn, and Wreggit (1991) conducted similar studies and found similar outcomes. One study involved an "industrial strength tile de-scaler". Users were asked to wear a filter mask and protective gloves. Consistent with their previous findings, they found that the inclusion of protective gear as part of the product packaging dramatically influenced compliance.

The findings relating to the cost of compliance associated with warning labels may be applied to recall notices. Response rates for recalls that require action on the part of the consumer must make every effort to minimize the physical effort, time, cost, and inconvenience required. Recall effectiveness is potentially reduced if postage, packaging (when materials are not available at home), and a trip to the post office are required. In-home repairs that do not provide the necessary tools to complete the task may also experience lower participation.

Finally, consumers may be reluctant to part with a recalled product if they perceive it as necessary (e.g., car seat) or valuable or if they perceive the likelihood or severity of the hazard to be low. For example, Warner (1980) found that among consumers who did not participate in the 1976 recall of Corning electric percolators, nearly half cited lack of another available unit as the reason.

X. Actual Compliance with the Message

Once consumers have determined that the risk described by the safety message is sufficient to warrant a response, they must then translate the motivation into the actions required to reduce or eliminate susceptibility to the hazard. Even a consumer who has concluded that participation in a recall is in his/her best interests may still fail to complete the actions required to eliminate the hazard—or at the least, perform the actions that confirm that the hazard has been eliminated.

A. The Role of Motivation and Social Influence

The Heisler and Bernstein (1980) study provided quantitative information on a number of factors that underscore the role of motivation in translating a decision to act into a behavioral response. When non-participants in recall programs were asked the major reasons for not

responding to a recall, 23 percent provided answers demonstrating a lack of perceived hazard or motivation to comply. Such answers included: "didn't have time", "didn't believe anything was wrong", inconvenience, "didn't think it was important", "laziness", and "don't drive the vehicle much". The authors described these responses as "owner apathy". They concluded that negative owner attitudes toward the recall campaign were a significant cause of campaign non-compliance. Furthermore, they believe this statistic may be understated. "Respondents may have felt pressure to blame manufacturers and dealers for their behavior rather than admitting their own apathy".

The 1989 Wogalter, Allison, and McKenna study on compliance costs also shows that social influence has an impact on subjects' compliance with safety warnings. In the first set, participants were asked to perform tasks in a chemistry lab that required use of safety equipment (see discussion above). Compliance rates increased modestly when another subject in the lab (a "confederate") was observed to follow the safety precautions, while confederate non-compliance reduced the likelihood that subjects would use the recommended equipment. In a field study involving a warning about a lower-risk hazard (a sign that indicated an elevator might stick between floors), the positive influence of confederate compliance (in the form of using nearby steps instead of the elevator) was much more pronounced.

B. Task Overload

Any decision to take action must be implemented by multi-tasking consumers who are faced with a large and increasing cognitive load—characterized by Cialdini (2001) as "information overload". Wogalter and Usher (1999) found that the burdens of such a load reduced compliance with product instructions. The authors concluded that, "warning effectiveness can be reduced when the mental resources necessary to carry out compliance are being absorbed by other concurrently performed tasks". They also noted that familiarity with the primary task (in this case, installing an external disk drive on a computer) increased the likelihood that precautions would be followed, while simultaneously improving the ability to perform a secondary task concurrently.

C. The Impact of Stress and Time Pressure

Other researchers have found that stress affects the quality of judgments and decision-making and narrows attentional focus (Zakay and Wooler, 1984; Baradell and Klein, 1993; Ben Zur and Breznitz, 1981). Janis, Defares, and Grossman (1979) found that people under stress make judgments based on incomplete information. The impact of time and social pressure on compliance with safety instructions was demonstrated in another chemistry lab experiment. A significantly lower proportion of test participants wore gloves and a mask while weighing and measuring various compounds when they were given a time limit to perform the activity and when the evaluator stood immediately adjacent to them (Magurno and Walter, 1994).

XI. Summary and Conclusions

The research collected and reviewed for this project details the large number of steps required for a recall message to achieve an active response from an affected product user. Users must receive the message, internalize and comprehend its instructions, determine that a response is necessary, and be willing to perform that response even if there are costs associated with doing so. In the case of product recalls, they must follow through on that willingness to check if they have an affected product, then take additional actions to eliminate or reduce the hazard.

The materials obtained and reviewed for this project provide an expansive listing of the factors that affect the survival of a recall message to the point at which a consumer evaluates whether or not to take action. There is also ample research available on consumer motivation and behavior with respect to recalls and other safety-related messages.

It would be possible to update and expand this literature search periodically. However, we believe that the materials identified and reviewed for this report provide a more-than-adequate foundation for an assessment of ways in which recall programs—and particularly recall communications—might be modified to improve potential response rates.

Finally, one problem in assessing recall effectiveness that is obvious from our search is that the available quantitative documentation of current recall effectiveness rates and determinants of success is very much out-of-date. The last systematic quantitative study of factors impacting recall success was based on data from recalls of the early 1980s. Since then thousands of CPSC negotiated recalls have been conducted, and new channels for increasing recall notification and awareness such as video news releases and the internet have become important components of recall program efforts. These recalls over the past several years constitute a large repository of data that could be successfully mined through an updated statistical analysis effort to address important recall issues, including which channels for promoting consumer awareness of recalls have worked best, which media or program elements have been most successful in stimulating actual consumer response, and which product and user characteristics are the best predictors of recall success rates.

Appendix I: Methodology

This appendix provides more detailed information on several aspects of the methodology used to conduct the literature search that is the subject of this contract:

- Scope of data collection;
- Description of tasks;
- Data sources utilized; and
- Data collection procedures and documentation.

A. Scope of Data Collection

The objective of this project was to conduct an extensive search of literature and research that may relate to consumer response (or non-response) to product recalls. The types of resources searched included:

- Textbooks, studies, journal articles, and other publications publicly available from the academic press, research institutes, and government agencies;
- Additional material available from Internet sites, including online databases, bibliographies, and collections of source material and links;
- Studies of recalls by the CPSC, other government agencies and companies that have conducted corrective action programs; and
- Internal research done by product safety consulting firms, including Heiden Associates and its outside consultants on this project.

The literature included in the search involved research in the following disciplines:

- Advertising;
- Cognitive psychology;
- Communication theory and media studies;
- Consumer motivation and compliance;
- Human factors and design research;
- Marketing;
- Recall management;
- Risk perception; and
- Social psychology.

B. Description of Tasks

- Developed work plan;
- Identified facilities and resources that efficiently search a large volume of published material;
- Developed a master list of search terms to be included in the search process;
- Trained staff members conducting the initial review of indexes, listings, and abstracts;
- Identified and collected material from the subject areas of interest;
- Reviewed and abstracted relevant materials collected;
- Compiled the source listings and abstracts;
- Prepared status reports;
- Participated in conference calls with CPSC staff;
- Completed second-stage review of collected materials;
- Wrote summaries of relevant material collected;
- Evaluated the contributions of the collected material toward understanding each of the aspects of the recall participation process identified above;
- Discussed and revised these preliminary assessments to provide direction for the draft report;
- Prepared the draft report;
- Reviewed and abstracted material collected after the initial draft report;
- Reviewed comments received from the CPSC staff and incorporated these comments and new material in the second draft report; and
- Prepared a second draft report.
- Verify, compile, and index copies of all materials collected;
- Assemble the annotated bibliography and copy the materials required for submission with the final report;
- Integrate CPSC staff comments on the second draft; and
- Prepare the final report.

C. Data Sources Utilized

Much of the research was conducted at the Library of Congress and the National Library of Medicine at the National Institute of Health (NIH), as well as the George Mason University Law Library. On-line research was also conducted. We also utilized resources we had in-house, as well as those suggested by CPSC staff. In addition, some materials were identified from references in articles found during the search process. The databases we used to conduct the computerized searches were:

EBSCO/Academic Search Premier

EBSCO*host* Electronic Journals Service (EJS) includes full-text articles from thousands of electronic journals including, for example, Atlantic Monthly, American Behavioral Scientist, and U.S. News and World Report. Databases available online are Business Source Elite,

Business Source Premier, Social Sciences Abstracts, Newspaper Source, and Psychology and Behavioral Sciences Collection.

OCLC FirstSearch

OCLC FirstSearch contains over ten million articles from sources such as Psychology and Marketing, Human Factors: The Journal of the Human Factors Society, and Journal of Products Liability.

InfoTrac

This resource focuses on business information, including case studies and competition data. Examples of journals included in this database are Journal of Marketing and Journal of Consumer Affairs. This source covers 1994 to the present and is owned by Thomson-Gale.

ProQuest

The online information service ProQuest provides access to articles in thousands of journals and newspapers. It contains numerous periodicals that cover business topics including trends, management strategies, and industry-specific issues. Examples of the periodicals in this database are European Journal of Marketing, Harvard Business Review, Professional Safety, and Science. ProQuest includes periodicals from 1986 to the present.

Google

Google is an Internet search engine that provides web-page links for specific search terms.

Psych Abstracts and Psych Info

Psych Abstracts and Psych Info provide abstracts of psychology-related articles, journals, books, and technical reports. Psych Abstracts is the print version (produced monthly) of the Psych Info database.

Books in Print and Books Out of Print

Books in Print and Books Out of Print are computerized databases that can be searched by topic for text publications.

ERIC-Educational Resources Information Center

ERIC-Educational Resources Information Center is a national information system designed to provide users with ready access to an extensive body of education-related literature. This database provides abstracts of the most recent articles and papers on assessment, evaluation, research methods and learning theory.

Pub Med

Pub Med is a service of NIH's National Library of Medicine. It provides access to over twelve million citations dating back to the mid-1960s. Pub Med includes links to many sites providing full-text articles and other related resources.

CSA Sociological Abstracts

CSA Sociological Abstracts is a primary resource for accessing the latest research sponsored in sociology and related disciplines in the social and behavioral sciences. The database draws information from an international selection of over 2,600 journals and other serial publications, plus conference papers, books, and dissertations. Records added after 1974 contain in-depth and nonevaluative abstracts of journal articles.

Index to Legal Periodicals

The Index to Legal Periodicals covers 620 legal periodicals including journals, yearbooks, bar association publications, law reviews, and government publications from 1981 to the present.

Xlibris

Xlibris is the database containing all of the holdings of the George Mason University Law Library.

D. Data Collection Procedures and Documentation

We developed a matrix of search terms and databases in order to track the progress of the literature search. The matrix shown in Exhibit 1 indicates each of the search terms employed and the specific databases that were searched.

We have also maintained a list of all of the relevant materials that we have located during our literature search. This source listing with brief descriptions of the articles is attached as Exhibit 2.

Exhibit 3 presents all of the individual article reviews that were prepared in the course of reviewing and summarizing material for the project report.

Exhibit 1
Databases Searched by Search Terms and Date Searched

	Database										
Search Terms	EBSCO/ Academic Search Premier	OCLC First Search	Google	InfoTrac	ProQuest	Psych Abstracts/ Psych Info	Books in Print	Books Out of Print	ERIC	Pub Med	CSA Sociological Abstracts
Recall	08-Nov	08-Nov	08-Nov	08-Nov	08-Nov	27-Sep	27-Sep	27-Sep	27-Sep	27-Sep	27-Sep
Effectiveness	08-Nov	08-Nov	08-Nov	08-Nov	08-Nov	27-Sep	27-Sep	27-Sep	27-Sep	27-Sep	27-Sep
Consumer	08-Nov	08-Nov	08-Nov	08-Nov	08-Nov	27-Sep	27-Sep	27-Sep	27-Sep	27-Sep	27-Sep
Product	08-Nov	08-Nov	08-Nov	08-Nov	08-Nov	27-Sep	27-Sep	27-Sep	27-Sep	27-Sep	27-Sep
Product recall data	21-Oct	08-Nov	08-Nov	08-Nov	22-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Product recall consumer notification	08-Nov	08-Nov	08-Nov	08-Nov	22-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Product recall consumer reaction behavior	08-Nov	08-Nov	08-Nov	08-Nov	22-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Product recall safety	21-Oct	15-Oct	15-Oct	08-Nov	22-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Product recall safety announcement	08-Nov	08-Nov	15-Oct	08-Nov	22-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Product recall safety attention	21-Oct	08-Nov	15-Oct	08-Nov	22-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Product recall safety awareness	17-Oct	08-Nov	15-Oct	08-Nov	22-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Product recall safety informative	08-Nov	08-Nov	08-Nov	08-Nov	22-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Product recall safety notify consumer	08-Nov	08-Nov	15-Oct	08-Nov	22-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Product recall safety participation	21-Oct	08-Nov	15-Oct	08-Nov	22-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Product recall safety success	08-Nov	08-Nov	15-Oct	08-Nov	22-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Product safety	21-Oct	15-Oct	15-Oct	21-Oct	21-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Product safety psychographics	23-Oct	08-Nov	08-Nov	23-Oct	22-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Consumer behavior safety concern	08-Nov	08-Nov	08-Nov	08-Nov	22-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Consumer decision choice processes	08-Nov	08-Nov	08-Nov	08-Nov	21-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Safety reaction	08-Nov	08-Nov	15-Oct	21-Oct	21-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov
Safety recall	21-Oct	15-Oct	15-Oct	21-Oct	21-Oct	29-Nov	29-Nov	29-Nov	22-Nov	15-Nov	22-Nov

Exhibit 1
Databases Searched by Search Terms and Date Searched

	Database										
Search Terms	EBSCO/ Academic Search Premier	OCLC First Search	Google	InfoTrac	ProQuest	Psych Abstracts/ Psych Info	Books in Print	Books Out of Print	ERIC	Pub Med	CSA Sociological Abstracts
Tier 1											
Product recall	15-Nov	06-Dec	06-Dec	06-Dec	06-Dec	13-Dec	13-Dec	13-Dec	22-Nov	15-Nov	22-Nov
Consumer product recall	15-Nov	06-Dec	06-Dec	06-Dec	06-Dec	13-Dec	13-Dec	13-Dec	22-Nov	15-Nov	22-Nov
Manufacturer recall	15-Nov	06-Dec	06-Dec	06-Dec	06-Dec	13-Dec	13-Dec	13-Dec	22-Nov	15-Nov	22-Nov
Corrective action	15-Nov	06-Dec	06-Dec	06-Dec	06-Dec	13-Dec	13-Dec	13-Dec	22-Nov	15-Nov	22-Nov
Recall effectiveness	15-Nov	06-Dec	06-Dec	06-Dec	06-Dec	13-Dec	13-Dec	13-Dec	13-Dec	15-Nov	13-Dec
Recall response rate	06-Dec	06-Dec	06-Dec	06-Dec	06-Dec	13-Dec	13-Dec	13-Dec	13-Dec	15-Nov	13-Dec
Recall response	06-Dec	06-Dec	06-Dec	06-Dec	06-Dec	13-Dec	13-Dec	13-Dec	13-Dec	15-Nov	13-Dec
Recall return rate	06-Dec	06-Dec	06-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	15-Nov	13-Dec
Recall returns	06-Dec	13-Dec	06-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	15-Nov	13-Dec
Recall compliance	06-Dec	13-Dec	06-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	15-Nov	13-Dec
Recall consumer behavior	06-Dec	13-Dec	06-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	15-Nov	13-Dec
Recall consumer motivation	06-Dec	13-Dec	06-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	15-Nov	13-Dec
Recall consumer participation	06-Dec	13-Dec	06-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	15-Nov	13-Dec
Recall consumer response	06-Dec	13-Dec	06-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	15-Nov	13-Dec
Recall consumer reaction	06-Dec	13-Dec	06-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	15-Nov	13-Dec
Tier 2											
Consumer recall risk perception	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec
Consumer retention recall safety message	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec
Recall risk perception	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec
Recall perceived vulnerability	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec
Recall injury likelihood	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec
Recall injury severity	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec
Compliance injury severity	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec
Compliance injury likelihood	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec	13-Dec

Exhibit 1
Databases Searched by Search Terms and Date Searched

	Database										
Search Terms	EBSCO/ Academic Search Premier	OCLC First Search	Google	InfoTrac	ProQuest	Psych Abstracts/ Psych Info	Books in Print	Books Out of Print	ERIC	Pub Med	CSA Sociological Abstracts
Tier 3											
Recall bounty	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall incentive	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall rebate	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Product rebate	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall communication	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall hazard communication	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall safety communication	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall message	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall risk message	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall safety-related message	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall notice	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall notification	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Direct consumer notification	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Direct mail notification	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall internet notification	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall resistance	20-Dec	20-Dec	07-Nov	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Tier 4											
Recall warning	20-Dec	20-Dec	07-Nov	20-Dec		20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall warning perception	20-Dec	20-Dec		20-Dec		20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Post-sale warning	20-Dec	20-Dec		20-Dec		20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Remedial action	20-Dec	20-Dec		20-Dec		20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Product remedy	20-Dec	20-Dec		20-Dec		20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
In-home repair	20-Dec	20-Dec				20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Recall retrofit	20-Dec	20-Dec				20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec
Warranty card	20-Dec	20-Dec				20-Dec	20-Dec	20-Dec	20-Dec	20-Dec	20-Dec

Exhibit 1
Databases Searched by Search Terms and Date Searched

Search Terms	InfoTrac	Google	Library of Congress Online
Consumer behavior	07-Feb	07-Feb	07-Feb
Consumer behavior product danger	07-Feb	07-Feb	07-Feb
Consumer communication	07-Feb	07-Feb	07-Feb
Consumer communication model	07-Feb	07-Feb	07-Feb
Consumer communication process	07-Feb	07-Feb	07-Feb
Consumer communications	07-Feb	07-Feb	07-Feb
Consumer influence	07-Feb	07-Feb	07-Feb
Consumer language barriers	07-Feb	07-Feb	07-Feb
Consumer marketing	07-Feb	07-Feb	07-Feb
Consumer motivation	07-Feb	07-Feb	07-Feb
Consumer persuasion	07-Feb	07-Feb	07-Feb
Consumer product danger	07-Feb	07-Feb	07-Feb
Consumer risk response	07-Feb	07-Feb	07-Feb
Consumer warning reaction	07-Feb	07-Feb	07-Feb
Consumer warning response	07-Feb	07-Feb	07-Feb
Influence consumers	07-Feb	07-Feb	07-Feb
Language barriers in product recalls	07-Feb	07-Feb	07-Feb
Language barriers in product safety recalls	07-Feb	07-Feb	07-Feb
Persuade consumers	07-Feb	07-Feb	07-Feb
Persuasion of consumers	07-Feb	07-Feb	07-Feb
Persuasive communication	07-Feb	07-Feb	07-Feb
Persuasive communications	07-Feb	07-Feb	07-Feb
Persuasive consumer communication	07-Feb	07-Feb	07-Feb
Product risk	07-Feb	07-Feb	07-Feb
Risk communication	07-Feb	07-Feb	07-Feb
Risk communication to consumers	07-Feb	07-Feb	07-Feb
Social influences on consumer purchasing	07-Feb	07-Feb	07-Feb

Exhibit 1
Databases Searched by Search Terms and Date Searched

Search Terms	Xlibris	Index to Legal Periodicals
Case studies on product recalls	08-Nov	08-Nov
Children's products	08-Nov	08-Nov
Class action	08-Nov	08-Nov
Comprehensive product recall/retrofit	08-Nov	08-Nov
Consumer Product Safety Commission	08-Nov	08-Nov
Defense (defending) product manufacturer	08-Nov	08-Nov
Determinants of recall success	08-Nov	08-Nov
Direct notice	08-Nov	08-Nov
Duty to manufacture	08-Nov	08-Nov
Duty to recall and/or retrofit	08-Nov	08-Nov
Increasing recall effectiveness	08-Nov	08-Nov
Legal obligations of manufacturer/supplier	08-Nov	08-Nov
Liability prevention	08-Nov	08-Nov
Management strategy	08-Nov	08-Nov
Manufacturer/supplier legal advice to	08-Nov	08-Nov
National Highway Transportation Safety Administration	08-Nov	08-Nov
Notification strategy	08-Nov	08-Nov
Point of purchase posters	08-Nov	08-Nov
Post sale duty to warn	08-Nov	08-Nov
Products liability	08-Nov	08-Nov
Recall authority	08-Nov	08-Nov
Recall (other countries)	08-Nov	08-Nov
Recall effectiveness	08-Nov	08-Nov
Recall plan	08-Nov	08-Nov
Recall success	08-Nov	08-Nov
Recall task force	08-Nov	08-Nov
Registration cards	08-Nov	08-Nov

Response rate	08-Nov	08-Nov
Restatement of torts	08-Nov	08-Nov
Symposium on products liability/safety/product recall	08-Nov	08-Nov
Tort	08-Nov	08-Nov

Exhibit 2
Product Recall Effectiveness Source Listing

Adams, Austin S. and Edworthy, Judy, *Quantifying and Predicting the Effects of Basic Text Display Variables on the Perceived Urgency of Warning Labels: Tradeoffs involving Font Size, Border Weight and Colour*, Ergonomics, 1995, 38: 2221-2237.

Study found a linear relationship between the individual variables--font size, border weight, and color--and perceived urgency. Font size had the greatest effect on perceived urgency.

Adams, Chris, *Product Recalls are Rising Amid Concern Public Ignores Them*, Wall Street Journal, March 22, 2002, p. B1.

The number of recalls has increased substantially during the past few years. Provides estimates of effectiveness rates including the Lane chest recall (about two percent).

Akerboom, Simone and Trommelen, Monica, *Environmental Labeling on Household Chemicals: Comprehensibility and Impact on Warning Information*, International Journal of Cognitive Ergonomics, 1998, 2 (1-2): 107-122.

European study found that some symbols on chemical products are not well understood by a significant portion of consumers. The personal safety warning message on the label may be diluted by the environmental warning message on the same label.

American Society for Quality Product Safety and Liability Prevention Interest Group, *The Product Recall Planning Guide*, Second Edition, 1999, Milwaukee, Wisconsin: ASQ Quality Press.

Provides management strategies and considerations for planning and conducting an effective product recall.

Ball, Leslie W., *Hazard Control by Warnings*, Journal of Products Liability, 1988, 11: 285-291.

Behavior change by warnings discussed. The nature of a hazard and its potential severity need to be understood for one to react to a warning.

Exhibit 2
Product Recall Effectiveness Source Listing

Baradell, Janet Garvey and Klein, Kitty, *Relationship of Life Stress and Body Consciousness to Hypervigilant Decision Making*, Journal of Personality and Social Psychology, 1993, 64 (2): 267-273.

This study found that life stress is linked to faulty information processing and impaired decision making.

Beauvais, Paul Jude, *Strategies of Containment in Recall Notices*, IEEE Transactions on Professional Communication, September 1998, 41 (3): 205-208.

This article discusses how recall notices can create a positive or negative impression of the company in the readers' mind, and ways that recall notices can emphasize the importance of acting on the recall--i.e., the notice should have information on the specific danger posed by the product in question.

Bechtel, Gordon G. and Ribera, Jaime, *Risk Acceptability in Segments with Distinct Value Orientations*, in Advances in Consumer Research, Vol. 10 (ed. Bagozzi, R.P. and Tybout, A.M.), 1983, Ann Arbor, MI: Association for Consumer Research, pp. 590-595.

This study measured consumers' acceptance of risk for several products and activities.

Bellas, Michael C., *Facing Product Recall: Four Critically Important Moves*, Beverage World International, July-August 1999, 17 (4): 64.

When faced with a recall, firms need to communicate, take responsibility, keep the public's interest in mind, and must thoroughly investigate what went wrong.

Ben Zur, Hasida and Breznitz, Shlomo J., *The Effect of Time Pressure on Risky Choice Behavior*, Acta Psychologica, 1981, 47: 89-104.

This study found that people filter information more when they are under time pressure. The participants also undertook less risky choices as the time pressure was increased.

Exhibit 2
Product Recall Effectiveness Source Listing

Bergland, Bob, *The Car Recall Notice (My Favorite Assignment)*, Business Communication Quarterly, September 1997, 6 (3): 89-92.

Describes how one teacher of a business writing course uses a car recall notice to address business writing principles of purpose, readers, information, organization, and style in relation to a specific example. Students revise it into the type of letter they would like to receive as car owners.

Bettman, James R.; Payne, John W.; and Staelin, Richard, *Cognitive Considerations in Designing Effective Labels for Presenting Risk Information*, Journal of Public Policy and Marketing, 1986, 5: 1-28.

A brief review of how people process information when thinking about risk and general guidelines for designing labels to present risk information.

Booher, Harold R., *Relative Comprehensibility of Pictorial Information and Printed Words in Proceduralized Instructions*, Human Factors, 1975, 17 (3): 266-277.

This study compared the relative comprehensibility of pictorial information and printed words in instructions.

Braun, Curt C. and Shaver, Eric F., *Warning Sign Components and Hazard Perceptions*, Proceedings of the Human Factors and Ergonomics Society 43rd Annual Meeting, 1999, pp. 878-882.

Study evaluated the effects of warning sign components such as color, signal words, hazard symbols, and text descriptions.

Bruhn, Christine M., *Consumer Concerns: Motivating to Action*, Emerging Infectious Diseases, October-December 1997, 3 (4): 511-516.

Knowledge of the consequences of unsafe food handling through communication efforts would motivate people to adhere to food safety guidelines.

Exhibit 2
Product Recall Effectiveness Source Listing

Bryce, G. and Fakher, N., *Public Awareness of Home Accident Risks-Some Implications for Health Promotion*, Archives of Emergency Medicine, 1992, 9: 225-229.

This survey found that consumers are aware of most hazards in the home. However, consumers are not very knowledgeable about the precautions that can be taken to reduce injuries from these hazards.

Burnett, Tammy J.; Purswell, Jerry L.; Purswell, J.P.; and Krenek, Richard F., *Hot Water Burn Hazards: Warning Label Influence on User Temperature Adjustment*, International Journal of Cognitive Ergonomics, 1998, 2 (1-2): 145-157.

This study evaluated consumer's responses to warnings on a water heater regarding the issue of setting the temperature control to avoid the risk of scalding injuries.

Calabresi, Guido and Klevorick, Alvin K., *Four Tests for Liability in Torts*, The Journal of Legal Studies, December 1985, 14 (3): 585-627.

Proliferation of recall notices makes consumers ignore recall notices. "Numbing" or "desensitization" of the hazard urgency is a cost of a recall.

Carstens, Adelia, *When is a Warning Adequate? Perspectives from Document Design*, http://www.sun.ac.za/taalsentrum/Warning.htm (Suniversiteit Stellenbosch University, South Africa), 2000.

Warning information often fails to reach consumers--prior knowledge and familiarity with product use hinders one's attention to warnings. Effective warnings should have alerting function and informative/instructional functions. Users need a clear indication of the level of the hazard and more elaborate risk information.

Celuch, Kevin; Lust, John; and Showers, Linda, *A Test of a Model of Consumers' Responses to Product Manual Safety Information*, Journal of Applied Social Psychology, 1998, 28 (5): 377-394.

Discusses protection motivation theory including severity and probability perceptions of warnings. Safety information in product manual should contribute to some self efficacy by user, but not too much so that user does not feel over confident.

Chartier, Jean and Gabler, Sandra, *Risk Communication and Government: Theory and Application for the Canadian Food Inspection Agency*, Spring 2001.

Discusses strategies for government communications about risk.

Chaudhuri, Arjun, *A Study of Emotion and Reason in Products and Services*, Journal of Consumer Behavior, February 2002, 1 (3): 267-279.

There are emotional factors affecting one's tolerance of risk--if one associates positive feelings with a product (hedonist products for example ATVs rather than utilitarian such as a coffeemaker) they are more risk tolerant. Emotion and perceived risk are related because emotion and knowledge affects risk.

Cheatham, Deane B. and Wogalter, Michael S., *Connoted Hazard and Perceived Conspicuity of Warning Configurations*, Proceedings of the Human Factors and Ergonomics Society 43rd Annual Meeting, 1999, pp. 883-887.

Study of warning configurations including color of wording, background color, font size, overall size of warning, and signal words used. Signal words in white type on a red background conveyed a larger hazard than other ANSI color options.

Chen, Jessie Y.C.; Gilson, Richard D.; and Mouloua, Mustapha, *Perceived Risk Dilution With Multiple Warnings*, Proceedings of the Human Factors and Ergonomics Society 41st Annual Meeting, 1997, pp. 831-835.

Risk assessment for individual warning messages associated with a product and the overall perceived risk level for the product were examined and compared in this study.

Chipman, Helen; Kendall, Patricia; Slater, Michael; and Auld, Garry, *Audience Responses to a Risk Communication Message in Four Media Formats*, Journal of Nutrition Education, May-June 1996, 28 (3): 133-139.

The study compared consumer reactions to four media formats – video news release, video public service announcement, print news release, and newsprint column. The study identified the difficulties in balancing the presentation of objective data while maintaining the viewer's interest. These issues may also apply to consumer notifications for product recalls.

Cialdini, Robert B., *Influence: Science and Practice*, Fourth Edition, 2001, Boston, MA: Allyn and Bacon.

This book provides explanations for why people are influenced to comply with requests to believe, do, and/or purchase something. As a response to the large amount of information available today, consumers increasingly use an information cue as a short cut to make decisions, rather than processing all of the available information.

Cialdini, Robert B., *Influence: The Psychology of Persuasion*, Revised Edition, 1993, New York: William Morrow.

An earlier edition of Cialdini's Influence: Science and Practice.

Coffman, Sherrilyn; Martin, Vicci; Prill, Noreen; and Langley, Beverly, *Perceptions, Safety Behaviors, and Learning Needs of Parents of Children Brought to an Emergency Department*, Journal of Emergency Nursing, April 1998, 24 (2): 133-139.

A study that assesses the perceptions, safety behaviors, and learning needs of parents who brought their children to the emergency department. This study found that parents underestimated the risk to children of motor vehicle injuries. Less than 50 percent of the parents participating in this study thought that most injuries could be prevented.

Combs, Barbara and Slovic, Paul, *Newspaper Coverage of Causes of Death*, Journalism Quarterly, Winter 1979, 56: 837.

This study found that newspapers overemphasize deaths caused by accidents and underemphasize deaths caused by diseases.

Consumer Federation of America, *Nearly One in Five Child-Safety Recall Hotlines Defective; CFA Urges Action by CPSC and Launches Safechild.net*, Press release, June 21, 2001.

While creating the safechild.net site, CFA found that they were unable to contact the company or participate in the recall for 18 percent of the recalls listed on CPSC's web site.

Exhibit 2
Product Recall Effectiveness Source Listing

Consumer Product Safety Commission, *CPSC Study of Hazardous Products in Thrift Stores*, November 1999.

Sixty-nine percent of thrift, consignment, or resale stores in this study sold at least one product that was banned, recalled, or did not meet current voluntary safety standards.

Consumer Product Safety Commission, *Report of the Recall Effectiveness Task Force of the Consumer Product Safety Commission*, August 25, 1980.

This report addressed the proper way to measure recall effectiveness. It also discussed the measurement of recall notification and participation at various steps of the process.

Consumer Product Safety Commission, *Recall Effectiveness Study*, May 1978.

This report identified seven variables that effect recall effectiveness: product price, product life, number of units, amount of time in distribution, percentage of units in consumer hands, recall action, and amount of direct notification.

Conzola, Vincent C. and Wogalter, Michael S., *Consumer Product Warnings: Effects of Injury Statistics on Recall and Subjective Evaluations*, Proceedings of the Human Factors and Ergonomics Society 42nd Annual Meeting, 1998, pp. 559-563.

This study investigated the effect of embedding injury outcome statistics in the safety instructions for electric power tools.

Coppens, Nina M., *Cognitive Characteristics as Predictors of Children's Understanding of Safety and Prevention*, Safety and Prevention, 1986, 11 (2): 189-202.

Interviews with 112 children, between the ages of three and eight years, indicated that the ability to differentiate between safe and unsafe situations occurred prior to the ability to specify preventive measures.

Cutts, Martin and Maher, Chrissie, *Writing Plain English*, Plain English Campaign, 78 Wiltshire Street, Salford, December 1980.

Guide to writing printed information simply and plainly.

DeFleur, Margaret H., *Developing an Integrated Theory of Recall of Spot News Stories*, Mass Communication & Society, Summer/Fall 1999, 2 (3/4): 123-145.

People do not remember what they hear on the news.

Depoe, Steve, *Risk Communication Bibliography*, http://excellent.com.utk.edu/~mmmiller/bib.html, June 21, 1995.

Bibliography on risk communication.

DeRodes, Deneen M., *Risk Perception and Risk Communication in the Public Decision- Making Process*, Journal of Planning Literature, February 1994, 8 (3).

Discusses the elements of a risk message and the challenges involved in communicating risk.

Dershewitz, Robert A. and Williamson, John W., *Prevention of Childhood Household Injuries: A Controlled Clinical Trial*, American Journal of Public Health, December 1977, 67 (12): 1148-1153.

Reports the results of a clinical trial which evaluated a health education program of household injury risk to children.

Dingus, Thomas A.; Hathaway, Jill A.; and Hunn, Bruce P., *A Most Critical Warning Variable: Two Demonstrations of the Powerful Effects of Cost on Warning Compliance*, Proceedings of the Human Factors Society 35th Annual Meeting, 1991, pp. 1034-1038.

Study shows that compliance with warnings increases when the costs of compliance are reduced.

Dingus, Thomas A.; Hunn, Bruce P.; and Wreggit, Steven S., *Two Reasons for Providing Protective Equipment as Part of Hazardous Consumer Product Packaging*, Proceedings of the Human Factors Society 35th Annual Meeting, 1991, pp. 1039-1042.

This study explored how compliance costs in conjunction with other factors effects the perception of risk and behavior associated with product use.

Dixon, Peter, *Plans and Written Directions for Complex Tasks*, Journal of Verbal Learning and Verbal Behavior, 1982, 21: 70-84.

This study found that consumers read instructions faster when the action instructions are presented first and the conditional instructions are presented last.

Drottz-Sjoberg, Britt-Marie, *Risk Communication through Safety Data Sheets*, BMD Research, Prepared for Swedish EPA.

Discusses issues involving risk communication--information overload hinders one's ability to process information. Moving warning information from the beginning of the label to the end cuts compliance rates dramatically. It is difficult to communicate warning information--we have limited attention spans and filter out much of the information that reaches our senses. When safety information reaches the conscious level, behavior determined by factors such as genetics, experience, and personal development.

Durkin, Maureen S.; Davidson, Leslie L.; and Kuhn, Louise; O'Connor, Patricia; and Barlow, Barbara, *Low-income Neighborhoods and the Risk of Severe Pediatric Injury: A Small-area Analysis in Northern Manhattan*, American Journal of Public Health, April 1994, 84 (4): 587-592.

This study found that low income was a significant predictor of childhood injury.

Edworthy, Judy, *Warnings and Hazards: An Integrative Approach to Warnings Research*, International Journal of Cognitive Ergonomics, 1998, 2 (1-2): 3-18.

The warning and consumer's experience with the product determine the response to a warning. Only a couple of variables are significant in determining a warning response. The utility judgment is at the heart of any framework of understanding warnings.

Eichelberger, Martin R.; Gotschall, Catherine S.; Feely, Herta B.; Harstad, Paul; and Bowman, Leon M., *Parental Attitudes and Knowledge of Child Safety*, American Journal of Diseases of Children, June 1990, 144: 714-720.

A national telephone survey of 404 parents having at least one child aged 13 and younger was conducted to assess their understanding of child safety.

Exhibit 2
Product Recall Effectiveness Source Listing

Evans, Sian A. and Kohli, Harpreet S., *Socioeconomic Status and the Prevention of Child Home Injuries: A Survey of Parents of Preschool Children*, Injury Prevention, 1997, 3: 29-34.

Examines the effect of socioeconomic status on the attitudes that parents of preschool children have towards child home safety issues and the practice of home safety measures.

Finegan, Jeanne, *High-Profile Product Recalls Need More than the Bat Signal*, http://www.irmi.com (International Risk Management Institute), July 2001.

Discusses aspects of media advertising that can be used to promote awareness of high-profile recalls.

Fischhoff, Baruch and Merz, Jon F., *The Inconvenient Public: Behavioral Research Approaches to Reducing Product Liability Risks*, in Product Liability and Innovation: Managing Risk in an Uncertain Environment (ed. Hunziker, Janet R. and Jones, Trevor O.), 1994, Washington, D.C.: National Academy Press, pp. 159-189.

Discussion of consumer perception of inconvenience impacts recall returns.

Fischhoff, Baruch; Slovic, Paul; and Lichtenstein, Sarah, *Knowing with Certainty: The Appropriateness of Extreme Confidence*, Journal of Experimental Psychology: Human Perception and Performance, 1977, 3 (4): 552-564.

This study discusses how people's knowledge is influenced by perceptions and memories which can lead to overconfidence.

Frantz, J. Paul, *The Warning-Development Process--A Case Study*, Proceedings of the Human Factors and Ergonomics Society 45th Annual Meeting, 2001, pp. 1507-1510.

Describes development of a product warning for personal watercraft.

Frantz, J. Paul, *Effect of Location and Presentation Format on Attention to and Compliance with Product Warnings and Instructions*, Journal of Safety Research, Fall 1993, 24: 131-154.

Research suggests product warnings should be integrated into the directions for use. If warnings are isolated, it is more likely they will be ignored.

Frantz, J. Paul and Miller, James M., *Communicating a Safety-Critical Limitation of an Infant-Carrying Product: The Effect of Product Design and Warning Salience*, International Journal of Industrial Ergonomics, 1993, 11: 1-12.

It is a challenge to get consumers who are not intending to process warnings to notice them. It is hard to absorb warnings when the mind is busy elsewhere--perhaps assembling the product. Bright colors did not increase likelihood of noticing warning.

Frantz; J. Paul; Miller, James M.; and Main, Bruce W., *The Ability of Two Lay Groups to Judge Product Warning Effectiveness*, Proceedings of the Human Factors and Ergonomics Society 37th Annual Meeting, 1993, pp. 989-993.

In general, ordinary consumers do not have the ability to determine the effectiveness of a warning or to predict whether the behavioral instructions will be followed.

Frantz, J. Paul and Rhoades, Timothy P., *A Task-Analytic Approach to the Temporal and Spatial Placement of Product Warnings*, Human Factors, 1993, 35 (4): 719-730.

The effect of warning placement was investigated using a task-analytic approach to generate altenative warning locations.

Frantz, J. Paul; Rhoades, Timothy P.; Young, Stephen L.; and Schiller, Jean A., *Assessing the Effects of Adding Messages to Warning Labels*, Proceedings of the IEA 2000/HFES 2000 Congress, 2000, 4: 818-821.

Study examines the issue of overusing warnings and the impact that adding warnings with varying characteristics may have on safety and hazard communication.

Friedmann, Keyla, *The Effect of Adding Symbols to Written Warning Labels on User Behavior and Recall*, Human Factors, 1988, 30 (4): 507-515.

This study found that users appear to read only the first sentence of a warning label and then move on to the directions. Therefore, it is important to raise the perceived hazardness of the product in a warning statement, label or symbol.

Garling, Anita, *Parents' Heuristics for Judging Children's Accident Risk*, Scandinavian Journal of Psychology, 1989, 30: 134-145.

This study investigated the heuristics that parents use for judging the risk or likelihood of accidents to children.

Garling, Anita and Garling, Tommy, *Mothers' Supervision and Perception of Young Children's Risk of Unintentional Injury in the Home*, Journal of Pediatric Psychology, 1993, 18 (1): 105-114.

Mothers of children aged 3 years and younger rated the risk of their child having an injury and indicated what injuries they anticipated in different rooms of the home under four conditions of supervision.

Gass, Robert H. and Seiter, John S., *Persuasion, Social Influence and Compliance Gaining*, 1999, Boston: Allyn & Bacon.

Citation only--full text not obtained.

Gerritsen, Marinel; Van Meurs, Frank; and Diepstraten, Wendy, *Consumers' Views on Text Characteristics of Product Recall Notices*, Document Design, 2000/2001, 2 (3): 258-271.

This study reports on experiments with 128 female shoppers assessing how a recall notice should be worded in order to protect the company's image and yet be clear.

Gibson, Dirk, *Firestone's Failed Recalls, 1978 and 2000: A Public Relations Explanation*, Public Relations Quarterly, Winter 2000, 45 (4): 10.

Identifies eight public relations errors that Firestone made in two separate recalls.

Exhibit 2
Product Recall Effectiveness Source Listing

Gibson, Dirk, *An Academic Communication Perspective on Enhancing Product Recall Effectiveness*, Presentation at the CPSC Product Registration Conference, March 23, 1999.

This article discusses the communication perspective of recalls and provides suggestions for improving recall effectiveness.

Gibson, Dirk C., *Print Communication Tactics for Consumer Product Recalls: A Prescriptive Taxonomy*, Public Relations Quarterly, Spring 1997, 42: 42-46.

Effective recalls depend on effective communication. Effective press releases, newspaper placement, direct mail, and flyers/posters can all play a significant role in a recall.

Gibson, Dirk C., *Public Relations Considerations of Consumer Product Recall*, Public Relations Review, Fall 1995, 21 (3): 225-240.

Points out that consumer product recalls are a pervasive phenomenon of enormous consequence.

Glik, Deborah C.; Greaves, Peggy E.; Kronenfeld, Jenny J.; and Jackson, Kirby L., *Safety Hazards in Households with Young Children*, Journal of Pediatric Psychology, 1991, 18 (1): 115-131.

Study based on both an in-home and a random-digit dial survey of mothers of children under 5 years old in a medium-size Southeastern city.

Glik, Deborah; Kronenfeld, Jennie; and Jackson, Kirby, *Predictors of Risk Perceptons of Childhood Injury Among Parents of Preschoolers*, Health Education Quarterly, Fall 1991, 18 (3): 285-301.

Assesses the relationship between parents' perceived risk of childhood injuries and familial, sociocultural, and situational variables.

Godfrey, Sandra S.; Rothstein, Pamela R.; and Laughery, Kenneth R., *Warnings: Do They Make a Difference?*, Proceedings of the Human Factors Society 29th Annual Meeting, 1985, pp. 665-669.

Determines effectiveness of warnings and identifies factors that influence their effectiveness.

Goldberg, Marvin E.; Liefeld, John; and Madill, Judith, *The Effect of Plain Packaging on Response to Health Warnings*, American Journal of Public Health, September 1999, 89 (9): 1434-1435.

Warnings on plain white cigarette packs were more effective at getting users' attention and in enhancing recall of the warning than the same warnings on "regular" (non-white) packages.

Goldhaber, Gerald M. and deTurck, Mark A., *Effectiveness of Warning Signs: Gender and Familiarity Effects*, Journal of Products Liability, 1988, 11: 271-284.

Consumers have different levels of familiarity with products, thus it is difficult to tailor a warning message that is appropriate for all consumers. Article provides an information processing model.

Greenberg, Brigitte, *Wanted: More Recall Awareness*, Detroit Free Press, April 23, 2000, http://www.freep.com/money/consumer.

As part of new notification strategy, 33,000 post offices--serving 7 million customers--will display recall posters.

Griffin, Mitch; Babin, Barry J.; and Attaway, Jill S., *Anticipation of Injurious Consumption Outcomes and its Impact on Consumer Attributions of Blame*, Journal of the Academy of Marketing Science, Fall 1996, 24 (4): 314-327.

This study found that warning labels and advertisements addressing product safety increased consumers' anticipated negative consequences of a product and decreased their assignment of blame for accidents onto manufacturers.

Griffith, L.J. and Leonard, S. David, *Effectiveness of Warning Labels as a Function of Visual Impressions*, Proceedings of the Human Factors and Ergonomics Society 39th Annual Meeting, 1995, p. 931.

Study of warnings found that enhanced warnings aided consumers' recall of hazards. Abstract only--full text not obtained.

Hackney & Associates, *Point of Purchase Handbook*, http://www.hackneyonline.com, 1997.

Point of purchase notification works best when combined with traditional marketing approaches.

Hadden, Susan G., *Regulating Product Risks Through Consumer Information*, Journal of Social Issues, 1991, 47 (1): 93-105.

Many warning labels are a catch 22--people read them if they know product is potentially dangerous; only know its dangerous if they read the label.

Halperin, Sharon F.; Bass, Joel L.; and Mehta, Kishor A., *Knowledge of Accident Prevention Among Parents of Young Children in Nine Massachusetts Towns*, Public Health Reports, November-December 1983, 98 (6): 548-552.

This analysis demonstrated that parents in all communitites need a wide range of educational counseling about how to prevent accidents to children.

Hammond, Amy J., *Adult Notions of Adults' and Children's Perceptions of Consumer Product Risk*, Proceedings of the Human Factors and Ergonomics Society 39th Annual Meeting, 1995, pp. 321-325.

Study examined adults' perceptions of the risk perceptions held by other adults and children.

Hancock, Holly E.; Rogers, Wendy A.; and Fisk, Arthur D., *An Evaluation of Warning Habits and Beliefs across the Adult Life Span*, Human Factors, Fall 2001, 43 (3): 343-354.

Warning processing is affected by a number of factors--age, text and symbol comprehension, utilization of knowledge, and memory for learned information.

Hartley, James, *Eighty Ways of Improving Instructional Text*, Institute of Electrical and Electronic Engineers Transactions on Professional Communication, March 1981, PC-24 (1): 17-27.

This article provides guidelines for presenting instructions including prose, graphics, and typographic issues.

Havlena, William J. and DeSarbo, Wayne S., *On the Measurement of Perceived Consumer Risk*, Decision Sciences, 1991, 22 (4): 927-939.

This article presents a model for measuring perceived risk and the effects of brand, marketing, and product features on perceived risk.

Hayward, Gordon, *Risk of Injury per Hour of Exposure to Consumer Products*, Accident Analysis and Prevention, January 1996, 28 (1): 115-121.

Study shows a disconnect between people's perception of the riskiness of a product and the actual number of accidents caused by the product. Consumers were asked about 30 products.

Heaps, Christopher M. and Henley, Tracy B., *Language Matters: Wording Considerations in Hazard Perception and Warning Comprehension*, The Journal of Psychology, 1999, 133 (3): 341-351.

Warning labels that identified the hazard-causing agent and stated the worst possible scenario or consequence increased believability of the warning. However, this may not transfer to safer consumer behavior.

Heiden, Edward J.; O'Connor, Rosalind S.; and Pittaway, Alan R. (Heiden, Pittaway Associates), *Audit and Effectiveness Evaluation of the White-Rodgers Thermostat Control Recall*, November 4, 1982.

Evaluation of various aspects of a widely publicized 1980 recall program involving liquid propone gas valves for water heaters. Report presents statistics on consumer notification and response rates.

Heisler, J.T. and Bernstein, A. (Market Facts), *Study To Determine Why Vehicle Owners Respond to or Ignore Recall Notifications*, Prepared for National Highway Traffic Safety Administration, July 1980, DOT HS-805-591.

Factors influencing effective vs ineffective auto recalls from 1972-1980.

Hellier, Elizabeth; Wright, Daniel B.; Edworthy, Judy; and Newstead, Stephen, *On the Stability of the Arousal Strength of Warning Signal Words*, Applied Cognitive Psychology, 2000, 14: 577-592.

A warning itself can calibrate one's behavior as does one's experience with the product. Hazard matching improves informativeness of warnings. The warning signal word (e.g. danger, caution) has garnered the most research attention compared with use of pictorials and color. There is evidence of a consistent relationship between signal words and arousal strength. Signal words have a wide range of semantic connotations. Changes in signal words can alter arousal state.

Hendricks, Charlotte M. and Reichert, Ann, *Parents' Self-Reported Behaviors Related to Health and Safety of Very Young Children*, Journal of School Health, September 1996, 66 (7): 247-251.

This survey documented self-reported health and safety behaviors of parents of children enrolled in Head Start programs.

Hermer, Joe and Hunt, Alan, *Official Graffiti of the Everyday*, Law & Society Review, 1996, 30 (3): 455-480.

Society is overrun with signs, warnings, and disclaimers. The question arises as to where is the proper place to look for product hazard or recall information--we know where to look for traffic lights, directions on medicine bottle.

Hintzman, Douglas L. and Curran, Tim, *Retrieval Dynamics of Recognition and Frequency Judgments: Evidence for Separate Processes of Familiarity and Recall*, Journal of Memory and Language, 1994, 33: 1-18.

A distinction is offered between familiarity and recognition. Familiarity is an automatic process; recollection is intentional. Both are relevant to the recognition decision.

Hoffer, George E.; Pruitt, Stephen W.; and Reilly, Robert J., *When Recalls Matter: Factors Affecting Owner Response to Automotive Recalls*, Journal of Consumer Affairs, Summer 1994, 28 (1): 96-106.

Response rates to auto recall and factors affecting consumer's response to them--mechanisms in place (e.g. vehicle registration) to notify.

Hu, Xiaohan; Wesson, David; and Kenney, Brian, *Home Injuries to Children*, Canadian Journal of Public Health, May-June 1993, 84 (3): 155-158.

Study of various aspects of injuries to children at home.

Jacobs, Michael S., *Toward a Process-Based Approach to Failure-to-Warn Law*, North Carolina Law Review, November 1992, 71 (1): 121-199.

Role of risk frequency and severity of harm in recall effectiveness.

Janis, Irving; Defares, Peter.; and Grossman, Paul, *Hyperviligant Reactions to Threat*, in Selye's Guide to Stress Research (ed. Selye, Hans), 1979, New York: Free Press.

This study found that under stress people do not process information well.

Kabak, Irwin W. and Siomkos, George J., *Replacement After a Product Harm Crisis*, Industrial Management, September-October 1991, 33 (5): 25-26.

If a company is replacing a recalled product, consumers are more likely to be interested in buying the replacement product when the company is well known, rates high in reputation, faces positive external effects during the crisis, and voluntarily recalls the product in question.

Kalsher, Michael J.; Brantley, Kimberly A.; Wogalter, Michael S.; and Snow-Wolff, Jennifer, *Evaluating Choking Child Pictorial Symbols*, Proceedings of the IEA 2000/HFES 2000 Congress, 2000, 4: 790-793.

The most important measure of a symbol's effectiveness is comprehension. Multiple panel pictorials provide more information and can reduce comprehension errors.

Kalsher, Michael J.; Gallo, Jason B.; Williams, Kevin J.; and Wogalter, Michael S., *High Levels of Behavioral Compliance in a Realistic Product Assembly Task*, Proceedings of the IEA 2000/HFES 2000 Congress, 2000, 4: 822-825.

The level of experience in this experiment was positively related to compliance. Also, while the findings did not reach statistical significance, "loss framed condition" in a warning statement pointed to higher compliance (e.g., thousands are injured using this product because they fail to use protective safety equipment).

Kalsher, Michael J.; Kellner, Rudy; Johnson, Brandi; Silver, N. Clayton; and Wogalter, Michael S., *The Interrelationship of Warning Variables in a Realistic Product Assembly Task*, Proceedings of the Human Factors and Ergonomics Society 42nd Annual Meeting, 1998, p. 1626.

A study involving the use of hand and power tools showed that perceived hazard predicts compliance with warnings regarding the use of safety equipment. Abstract only -- full text not obtained.

Kalsher, Michael J.; Pucci, Shari; Wogalter, Michael S.; and Racicot, Bernadette M., *Enhancing the Perceived Readability of Pharmaceutical Container Labels and Warnings: The Use of Alternative Designs and Pictorials*, Proceedings of the Human Factors and Ergonomics Society 38th Annual Meeting, 1994, pp. 384-388.

This study investigated the effects of: (1) alternative ways of increasing the available surface area of prescription drug labels, and (2) the presence versus absence of pictorials on prescription drug labels.

Kaplan, Andrew, *PM Gets Good Grades for Recall*, U.S. Distribution Journal, July 15, 1995, 222 (7): 6.

A concerted effort helped Phillip Morris smoothly conduct what is thought to be the largest consumer product recall in history.

Kelley, Craig A.; Gaidis, William C.; and Reingen, Peter H., *The Use of Vivid Stimuli to Enhance Comprehension of the Content of Product Warning Messages*, The Journal of Consumer Affairs, Winter 1989, 23 (2): 243-266.

Vivid imagery and concrete language in warning symbols make it easier to process and recall even if motivation to absorb it is low.

Keown, Charles F., *Consumer Reactions to Food and Drug Product Recalls: A Case Study of Hawaiian Consumers*, Journal of Consumer Policy, 1988, 11: 209-221.

Study was inconclusive in answering why some consumers continue to use recalled food or drug products, and why others do not. The 30-50 percent effectiveness rates in this study appear to be in the same range of recall rates for non-food products.

Kieras, D., *Beyond Pictures and Words: Alternative Information-Processing Models for Imagery Effects in Verbal Memory*, Psychological Bulletin, 1978, 85 (3): 532-554.

This article discusses how images are developed from written materials.

Kisielius, Jolita and Sternthal, Brian, *Examining the Vividness Controversy: An Availability-Valence Interpretation*, Journal of Consumer Research, March 1986, 12: 418-431.

This study found that vividness effects attitudinal judgments and the favorableness of the information processing determines whether vividness increases or decreases a message's impact.

Koslow, Scott; Shamdasani, Prem N.; and Touchstone, Ellen E., *Exploring Language Effects in Ethnic Advertising: A Sociolinguistic Perspective*, Journal of Consumer Research, Inc., March 1994, 20: 575-585.

The authors investigated the effects of Spanish language advertising on Hispanic consumers. Results from the study could potentially also be applied to making recall notification of Hispanic consumers more effective.

Krulwich, Andrew S. (ed.), *Recalls: Legal and Corporate Responses to FDA, CPSC, NHTSA, and Product Liability Considerations*, The Business Lawyer, February 1984, 39 (2): 757-780.

Includes a case study on notification methods for the 1982 Tylenol recall.

Lamken, Jeffrey A., *Efficient Accident Prevention as a Continuing Obligation: The Duty to Recall Defective Products*, Stanford Law Review, November 1989, 42 (1): 103-162.

Discussion of post-sale duty to warn and list of cases where courts have said manufacturer could have done more to recall product.

Langley, John and Silva, Phil, *Childhood Accidents-Parents' Attitudes to Prevention*, Australian Pediatric Journal, 1982, 18: 247-249.

This study investigated attitudes towards accident prevention of mothers whose children have experienced an accident requiring medical attention.

Latin, Howard A., *Problem-Solving Behavior and Theories of Tort Liability*, California Law Review, May 1985, 73 (3): 677-746.

Information processing imposes a cognitive strain that may reduce people's ability to examine all facets of complex problems.

Latin, Howard A., *'Good' Warnings, Bad Products, and Cognitive Limitations*, U.C.L.A. Law Review, June 1994, 41 (5): 1193-1295.

This article discusses whether warnings should be treated as "substitutes" or "supplements" to safer product designs.

Laughery, Kenneth R.; Vaubel, Kent P.; Young, Stephen L.; Brelsford Jr., John W.; and Rowe, Anna L., *Explicitness of Consequence Information in Warnings*, Safety Science, 1993, 16: 597-613.

People in study were not more likely to buy products with less explicit information about dire consequences on warning labels. Explicit warning messages have a minimal effect on sales.

Laughery, K.R. and Wogalter, M.S., *Warnings and Risk Perception*, in Handbook of Human Factors and Ergonomics (ed. Salvendy, G.), 1998, New York: John Wiley & Sons, Inc.

A review of the important principles and facts that have evolved on the topic of warnings and a discussion on criteria and procedures for developing and testing warnings.

Laughery Sr., Kenneth R. and Young, Stephen L., *An Eye Scan Analysis of Accessing Product Warning Information*, Proceedings of the Human Factors Society 35th Annual Meeting, 1991, pp. 585-589.

Eye tracking procedures were employed to study eye scan patterns of subjects searching for warning messages on product labels.

Laughery, Kenneth R.; Young, Stephen L.; Vaubel, Kent P.; and Brelsford, Jr., John W., *The Noticeability of Warnings on Alcoholic Beverage Containers*, Journal of Public Policy & Marketing, 1993, 12: 38-56.

This study found that current warnings on alcoholic containers were not very noticeable. These warnings could be improved using pictorials, color, signal icons, and borders.

Lehto, Mark R., *Determining Warning Label Content and Format Using EMEA*, Proceedings of the IEA 2000/HFES 2000 Congress, 2000, 4: 774-777.

Discusses Error Modes and Effects Analysis (EMEA) as a means of applying appropriate content for warning signs and labels. Regulation appears to be an effective intervention, given the high rate of ATV riders who wear helmets. EMEA aims to identify hazards associated with product use and misuse and addresses user expectations and behaviors.

Lehto, Mark R. and Miller, James M., *The Effectiveness of Warning Labels*, Journal of Products Liability, 1988, 11: 225-270.

Processing information--the linear sequence of outputs that must be elicited for a warning to be effective: exposure, attention, comprehension, storing and retrieving message, selecting response, and responding.

Leonard, S. David, *To Do?, Or Not To Do?: Both Are the Questions*, Proceedings of the IEA 2000/HFES 2000 Congress, 2000, 4: 786-789.

Safety communication often relies on symbols as a means of communication. Obviously symbols need to be understood in order for the warning to be adhered to. Symbols can either instruct prohibitive behavior, or give instructions on correct behavior.

Leonard, S. David and Woglater, Michael S., *What You Don't Know Can Hurt You: Household Products and Events*, Accident Analysis and Prevention, 2000, 32: 383-388.

Study of consumers' awareness of product hazards involving toys, carbon monoxide, and gas leaks. Consumers were aware of hazards, but not the specific activities that could create a substantial hazard.

Lepkowska-White, Elzbieta and Parsons, Amy L., *Comprehension of Warnings and Resulting Attitudes*, The Journal of Consumer Affairs, Winter 2001, 35 (2): 278-294.

Education level and warning vocabulary affect consumer reactions to warnings.

Liller, Karen D.; Kent, Ellen; and McDermott, Robert J., *Postpartum Patients' Knowledge, Risk Perceptions, and Behaviors Pertaining to Childhood Injuries*, Journal of Nurse-Midwifery, November/December 1991, 36 (6): 355-360.

Assesses postpartum patients' knowledge, risk perceptions, and behaviors pertaining to a variety of childhood injuries.

Loubeau, Patricia R., *Exploration of the Barriers to Bicycle Helmet Use Among 12 and 13 Year Old Children*, Accident Analysis and Prevention, 2000, 32: 111-115.

Despite efforts to increase helmet usage, kids routinely fail to wear helmets. Proposes ideas for educational programs to instill importance of wearing helmets to avoid injury.

Lowrance, W.W., *Of Acceptable Risk*, 1976, Los Altos, CA: William Kaufman.

Citation only--full text not obtained.

Magurno, Amy Barlow and Wogalter, Michael S., *Behavioral Compliance with Warnings: Effects of Stress and Placement*, Human Factors Perspectives on Warnings, 1994, 2: 159-163.

Research examining the effects of stress and warning placement on compliance behavior.

Magurno; Wogalter; Kohake; and Wolff, *Iterative Test and Development of Pharmaceutical Pictorials*, Proceedings of the 12th Triennial Congress of the International Ergonomics Association (Human Factors Association of Canada), 1994, pp. 360-363.

Citation only--full text not obtained.

Maley, Matthew P., *Children Under Age Five and Butane Cigarette Lighters*, Burn Prevention Forum, July/August 1988, pp. 423-424.

Suggests behavioral changes of adults responsible for children under five years of age to prevent the children from gaining access to lighters.

Mano, Haim, *Affect and Persuasion: The Influence of Pleasantness and Arousal on Attitude Formation and Message Elaboration*, Psychology & Marketing, July 1997, 14 (4): 315-335.

This study examined the impact of pleasantness and arousal on ad-based persuasion outcomes.

Exhibit 2
Product Recall Effectiveness Source Listing

Martin, B. Jay, *The Value of Explicit Hazard and Consequence Warnings for Products with Hidden Hazards*, Proceedings of the IEA 2000/Human Factors and Ergonomics Society 2000 Congress, 2000, 4: 302-305.

Explicit warnings improve risk perception of products with "hidden hazards".

Mazis, Michael B. and Staelin, Richard, *Using Information-Processing Principles in Public Policymaking*, Journal of Marketing & Public Policy, 1982, pp. 3-13.

When a customer is watching television they are not in information seeking mode, so retention of what is seen on television is not high. Summarizes processing of information and which external factors influence one's ability (and inability) to process information.

McGuire, E. Patrick, *Product Recall Effectiveness*, Trial, January 1986, 22: 61-64.

The company's recall plan, policies, and procedures can measure the effectiveness of a recall for product liability litigation.

Meingast, Melissa, *Increasing Attention and Retention of Warnings: Effects of Container Hazardousness, Warning Quality, and Severity of Injury*, Proceedings of the Human Factors and Ergonomics Society 45th Annual Meeting, 2001, pp. 1482-1486.

Examining the influence of warning quality, container hazardousness, and severity of the potential injury on attention to and retention of warning information.

Mischel, Walter and Underwood, Bill, *Instrumental Ideation in Delay of Gratification*, Child Development, 1974, 45: 1083-1088.

Study of preschool children who ideated about objects while waiting to receive them.

Mitchell, Vincent-Wayne, *Consumer Perceived Risk: Conceptualisations and Models*, European Journal of Marketing, 1999, 33 (1/2): 163-195.

Perceived risk from consumer's point of view discussed.

Mitchell, V-W., *Understanding Consumers' Behavior: Can Perceived Risk Theory Help?*, Management Decision, 1992, 30 (3): 26.

Examines four types of buying behavior and classifies them on the extent of consumer involvement and significance of brand differences. Discusses post-purchase behavior when there is a mismatch between actual and expected purchase performance.

Monical, John S. and Risch, Charles J., *The Post Sale Duties to Warn and Recall--Are They Preempted When NHTSA or the CPSC Oversees the Manufacturer's Conduct?*, Lawrence Kamin Saunders & Uhlenhop newsletter, 2000, http://www.lksu.com/articles.

Recalls and retrofit programs are better left to administrative agencies and the legislature. Administrative agencies have the expertise to locate potentially hazardous products--state courts do not.

Morrongiello, Barbara A. and Dayler, Linda, *A Community-Based Study of Parents' Knowledge, Attitudes and Beliefs Related to Childhood Injuries*, Canadian Journal of Public Health, November-December 1996, 87 (6): 383-388.

Assesses parents' knowledge of injury risks for children, attitudes towards children's injury-risk behaviours, and beliefs related to a number of aspects of childhood injuries.

Mulligan-Smith, Deborah; Puranik, Subhash; and Coffman, Sherrilyn, *Parental Perception of Injury Prevention Practices in a Multicultural Metropolitan Area*, Pediatric Emergency Care, 1998, 14 (1): 10-14.

Survey of parents of children seen in the emergency department regarding parent and child safety-related behaviors, parents's perceptions of their children's risks for injury, and educational needs.

Murphy, R. Dennis and Rubin, Paul H., *Determinants of Recall Success Rates*, Journal of Products Liability, 1988, 11: 17-28.

Different factors influence the success of a product recall--e.g. it is easier to get distributors and retailers to comply (and to notify them) than individual consumers.

National Highway Traffic Safety Administration (Walz, Marie C.), *Evaluation of Child Safety Seat Registration*, October 2002, DOT HS-809-518.

This study found that the mandatory provision of postage-paid registration cards with sales of new child seats increased product registration from 3 to 27 percent. The repair rate for recalled child seats also increased from 13.8 to 21.5 percent.

Ndhlovu, T.R. and Morton, D.J., *Pictorial Labels as an Aid to Increased Patient Compliance*, The Central African Journal of Medicine, January 1986, 32 (1): 10-11.

This study in Zimbabwe found that pictograms increased consumers' comprehension of drug labels.

Oglethorpe, Janet E. and Monroe, Kent B., *Determinants of Perceived Health and Safety Risks of Selected Hazardous Products and Activities*, Journal of Consumer Affairs, Winter 1994, 28 (2): 326-346.

More to understanding perception of risk than severity of outcome and probability--availability, controllability, "dreadedness", etc.

O'Keefe, Daniel J., *Persuasion, Theory & Research*, Second Edition, 2002, Thousand Oaks: Sage Publications.

A general, current text on the discipline of persuasion, describing a variety of contributing theories related to communications models, cognition and cognitive dissonance, and other behaviors.

Ortiz, Julio; Resnick, Marc L.; and Kengskool, Khokiat, *The Effects of Familiarity and Risk Perception on Workplace Warning Compliance*, Proceedings of the IEA 2000/Human Factors and Ergonomics Society 2000 Congress, 2000, 4: 826-829.

Study of consumer risk perception including the effects of the consumer's familiarity with the product and the brand. Compliance was higher for riskier products.

Otsubo, Shirley M., *A Behavioral Study of Warning Labels for Consumer Products: Perceived Danger and Use of Pictographs*, Proceedings of the Human Factors Society 32nd Annual Meeting, 1988, pp. 536-540.

This study focuses on the effectiveness of warning labels placed on consumer products differing in perceived "danger" or "hazard".

Otway, H.J. and Fishbein, M., *The Determinants of Attitude Formation: An Application to Nuclear Power*, International Institute for Applied Systems Analysis, RM-76-80, Laxenburg, Austria, 1976.

Citation only--full text not obtained.

Pfau, Michael and Parrott, Roxanne, *Persuasive Communications Campaigns*, 1993, Boston: Allyn & Bacon.

Citation only--full text not obtained.

Pines, Wayne L., *Communications Strategies in Product Liability Crises*, Food and Drug Law Journal, 1993, 48 (1): 153-159.

Discussion of best ways to communicate in food and drug recalls.

Pollack-Nelson, Carol, *Analysis of Methylene Chloride Product Labelling*, Ergonomics, 1995, 38 (11): 2176-2187.

A survey analysis of a post-labelling study of products that contained the chemical methylene chloride (DCM).

Pollack-Nelson, Carol and Drago, Dorothy A., *Supervision of Children Aged Two Through Six Years*, Injury Control and Safety Promotion, 2001, 9 (2): 121-126.

Examines the actual supervision practices of parents of children between the ages of two and six years.

Pratt, Cornelius B., *Applying Classical Ethical Theories to Ethical Decision Making in Public Relations: Perrier's Product Recall*, Management Communication Quarterly, August 1994, 8 (1): 70-94.

Links ethical theories to the management of the product recall of the Perrier Group of America. Argues for a nonsituational theory-based eclectic approach to ethics in public relations to enable public relations practitioners, as strategic communication managers, to respond effectively to potentially unethical organizational actions.

Price, Vincent and Czilli, Edward J., *Modeling Patterns of News Recognition and Recall*, Journal of Communication, Spring 1996, 46 (2): 55-78.

People who already possess a certain type of information have a cognitive scheme in place to efficiently process new information--informationally rich get richer. Education is mentioned as an indicator of public affairs knowledge. Both frequency and recency of exposure to news information increase the ease with it is recognized and recalled. News stories seem to be better recognized and recalled when they focus on a particular person.

Purswell, Jerry L.; Schlegel, Robert E.; and Kejriwal, Sashi K., *A Prediction Model for Consumer Behavior Regarding Product Safety*, Proceedings of the Human Factors Society 30th Annual Meeting, 1986, pp. 1202-1205.

The objective of this study was the development of a model to predict whether a consumer would use a product safely as a function of sixteen different variables.

Redish, J., *How to Draft More Understandable Legal Documents*, Document Design Centre, American Institutes for Research, Washington, DC, 1979, Report C4.

Citation only--full text not obtained.

Resnick, Marc L.; Zanotti, Adriano; and Jacko, Julie A., *Cultural Differences in the Perception of Responsibility for Child Safety*, Proceedings of the Human Factors and Ergonomics Society 41st Annual Meeting, 1997, pp. 836-839.

Compares the perceptions of safety responsibility of two of the fastest growing minority populations in the U.S.--Hispanics and Asians--to a previous study which quantified those of the general U.S. population.

Rethans, Arnoldus Johannes Cees Maria, *An Investigation of Consumer Perceptions of Product Hazards*, Ph.D. Dissertation, University of Oregon, September 1979.

This study found that consumer risk perceptions were only moderately related to the actual risk associated with consumer products.

Rethans, Arno J. and Albaum, Gerald S., *Towards Determinants of Acceptable Risk: The Case of Product Risks*, Advances in Consumer Research, 1980, 8: 506-510.

There is a distinction between risk estimation and risk evaluation in the determination of product safety. 84% of variance in risk acceptability judgments can be explained by characteristics of product necessity, user error, voluntariness, product knowledge and foreseeability.

Rhoads, Kelton, *Persuasion and Influence Sources*, http://www.workingpsychology.com/bibliog.html, 1997.

Bibliography on persuasion and influence.

Richards, Jef I., *Knowledge and Memory Bibliography*, http://advertising.utexas.edu/research/biblio/Memory.html, 1997.

Bibliography on knowledge and memory.

Riley, Donna M. and Fischhoff, Baruch, *An Integrative Approach for Label Evaluation and Design*, Proceedings of the IEA 2000/HFES 2000 Congress, 2000, 4: 778-781.

The effectiveness of a warning label is reflected in changes in model parameters. How much change occurs depends on how well consumers understand how their actions affect their exposures. Arrangement and clarity of warning information on a label or product is critical to its effectiveness.

Riley, Kathryn, *Telling More than the Truth: Implicature, Speech Acts, and Ethics in Professional Communication*, Journal of Business Ethics, March 1993, 12 (3): 179-196.

The author investigates the use of implicature and indirectness in communications of negative messages to the public. The study further attempts to understand under what circumstances indirectness becomes an unethical transmission. This may apply to consumer notifications so far as they may distrust the message or the sender's motives and thus discount the value of the communication.

Rivara, Frederick P. and Howard, David, *Parental Knowledge of Child Development and Injury Risks*, Developmental and Behavioral Pediatrics, June 1982, 3 (2): 103-105.

The hypothesis that the risk of injury to children is related to parents' assessment of the child's developmental abilities and parents' knowledge of injury prevention measures was tested by a two-part self-administered questionnaire.

Rodgers, Gregory Boyd, *Risk Compensation: An Analysis of Consumer Behavior in a Risky Recreational Activity*, Purdue University Dissertation, August 1991, DAI, 52, no. 07A 2649.

Thesis on ATV use and rider behavior.

Rogers, Wendy A; Lamson, Nins; and Rousseau, Gabriel K., *Warning Research: An Integrative Perspective*, Human Factors, Spring 2000, 42 (1): 102-139.

Memory, personal risk-taking style, familiarity with product, degree of information-seeking behavior, and warning variables that compose the message all play a part in whether people comply with the warning.

Schacherer, Christopher William, *Toward a General Theory of Risk Perception*, Proceedings of the Human Factors and Ergonomics Society 37th Annual Meeting, 1993, pp. 984-988.

Article develops a model of consumer risk perception which incorporates "confirmatory factor analysis" in order to understand the cognitive process of risk perception.

Shaver, Eric F. and Braun, Curt C., *Effects of Warning Symbol Explicitness and Warning Color on Behavioral Compliance*, Proceedings of the IEA 2000/HFES 2000 Congress, 2000, 4: 290-293.

Study assessed the impact of two warning colors, two warning sign types, and two levels of symbol explicitness on college student behavior.

Shuv-Ami, Avichai, *The Impact of Product Safety Hazard Communication on Consumer Behavior*, The City University of New York Dissertation, 1982, DAI, 43 no. 09A 3055.

Study of consumers' responses to safety hazard communications.

Simpson, Ian, *Product Safety Recalls: Proposals for Practical Improvement*, Institute of Trading Standards Administration, Great Britain, 1998.

This report provides guidelines for conducting a product recall and includes some information on specific recalls in the U.K.

Siwolp, Sana, *Amid a Flood of Recalls, Who's Paying Attention?*, http://www.nytimes.com (New York Times), April 14, 2002, 151: 8.

Increase in number of product recalls may be function of CPSC's increased willingness to fine companies for the failure to report product hazards. The "Fast Track" program decreases notification time.

Slovic, Paul, *Perception of Risk*, Science, April 17, 1987, 236: 280-285.

Characteristics such as control, familiarity, catastrophic potential influence relation between perceived risk, perceived benefit, and risk acceptance.

Slovic, Paul; Fischhoff, Baruch; and Lichtenstein, Sarah, *Facts and Fears: Understanding Perceived Risk*, in Societal Risk Assessment: How Safe is Safe Enough? (ed. Schwing, R. and Albers, Jr., W.A.), 1980, New York: Plenum Press, pp. 181-216.

Studies how subjective judgments affect consumer risk perception.

Smith-Jackson, Tonya; Balasubramanian, Venkat; and Sridharan, Sriram, *Descriptive Survey of Household Product Warning Labels and Consumer Knowledge*, Proceedings of the IEA 2000/HFES 2000 Congress, 2000, 4: 814-817.

Several household products were surveyed to determine conformity of labels to principles known to enhance warning label effectiveness and to determine consumer knowledge of product hazards identified by experts to be unfamiliar to consumers.

Smith-Jackson, Tonya and Durak, Tolga, *Posted Warnings, Compliance, and Behavioral Intent*, Proceedings of the IEA 2000/HFES 2000 Congress, 2000, 4: 115-118.

From an experiment, it was concluded that warnings embedded in task-related instructions lead to more compliance than posted warning signs. Lack of experience in working in a hazardous environment precludes people from seeking information about hazards. Increasing salience of the posted warnings would likely draw more attention.

Sojourner, Russell J. and Wogalter, Michael S., *The Influence of Pictorials on Evaluations of Prescription Medication Instructions*, Drug Information Journal, 1997, 31: 963-972.

Consumers prefer prescription instructions to be provided in both verbal and pictorial formats.

Spake, Amanda, *Kids Safety is on the Line as Recalled Products Stay in Use*, U.S. News and World Report, August 13, 2001, 131 (6): 48-50.

Addresses shortcomings in recall process that are preventing parents from hearing about unsafe products.

Staelin, Richard, *The Effects of Consumer Education on Consumer Product Safety Behavior*, Journal of Consumer Research, June 1978, 5 (1): 30-40.

Knowledge about a product does not necessarily lead to a change in consumer behavior.

Exhibit 2
Product Recall Effectiveness Source Listing

Stevens, Suzanne L. and Dingus, Thomas A., *Effects of Information on Risk Perception Regarding the Use of Booster Seats*, Proceedings of the Human Factors and Ergonomics Society 45th Annual Meeting, 2001, pp. 880-884.

A field study using pre- and post-intervention questionnaires to test the hypotheses that informational pamphlets will induce an increase in risk perception regarding the use of booster seats.

Stiff, James B. and Mongeau, Paul A., *Persuasive Communication*, Second Edition, 2003, New York: The Guilford Press.

A general, current text that is organized around specific facets of persuasive communications while supporting the presentation with various theories of persuasion. Includes a specific section on persuasive communications campaigns.

Stoltman, Jeffrey J. and Morgan, Fred W., *Product Safety, Information, and Behavior*, American Behavioral Scientist, February 1995, 38 (4): 633-645.

Consumers do not seek information about products and manufacturers do not provide necessary information. Consumers lack knowledge and often ignore what knowledge may be offered. If thrill seeking, more tolerant of inherent risk in these products and more apt to ignore safety information.

Strawbridge, Jill Annette, *The Influence of Position, Highlighting, and Imbedding on Warning Effectiveness*, Proceedings of the Human Factors Society 30th Annual Meeting, 1986, pp. 716-720.

An experiment investigating the behavoral influence of varying warning position, highlighting and imbeddedness on warning detection, recall and compliance.

Surmanek, Jim, *Media Planning: A Practical Guide*, Third Edition, 1996, Chicago, IL: NTC Business Books.

Clustering of ads over a short period of time increases recollection. The optimal number of messages to give is about three.

Svenson, Ola, *Are We All Less Risky and More Skillful than Our Fellow Drivers?*, Acta Psychologica, 1981, 47: 143-148.

The majority of respondents in this study viewed themselves as being a less risky driver than the average driver in the study group.

Thomas, Linda Cravens, *Analysis of Consumer Attitudes and Behavior Regarding Product Recalls at the Consumer Level*, Washington University Dissertation, May 1985.

This survey found that consumer response to recalls is influenced by the perceived severity of the hazard, the recall offer, the nature of the defect, and the cost of participating in recall.

Trommelen, Monica, *Effectiveness of Explicit Warnings*, Safety Science, 1997, 25 (1-3): 79-88.

People intend to comply with instructions when explicit warnings are given, but there does not appear to be any more adherence to explicit warning compared to a "regular" warning.

Trommelen, Monica and Akerboom, Simone P., *Explicit Warnings for Child-Care Products*, in Visual Information for Everyday Use (ed. Zwaga, Harm J.G.; Boersema, Theo; and Hoonhout, Henriette C.M.), 1999, Philadelphia, PA: Taylor & Francis Inc., pp. 119-125.

This study found that more explicit warnings increased consumer's hazard perception.

Tse, Alan Ching Biu, *Factors Affecting Consumer Perceptions on Product Safety*, European Journal of Marketing, 1999, 33 (9/10): 911-925.

A number of product-related attributes affect perceived product safety. Higher prices (e.g. brand name) led consumers to believe these were safer.

United Kingdom Department of Trade and Industry, *Consumer Product Recall: A Good Practice Guide*, 2000, http://www.dti.gov.uk/cacp/ca/advice/productrecall.

Guide to recalls in the United Kingdom. Discussion of innovative recall strategies, case studies, whom the recall needs to reach, follow-up, issue of consultants in the recall program.

Ursic, Michael, *The Impact of Safety Warnings on Perception and Memory*, Human Factors, 1984, 26 (6): 677-682.

Safety warnings effect on user's perception--some see warning as surrogate indicator of a high quality product.

U.S. General Accounting Office, *Medical Device Recalls: Examination of Selected Cases*, October 1989, GAO/PEMD-90-6.

Case studies of various medical device recalls from 1980-1989.

VanSickle, *Working on a Global Product Recall*, Public Relations Tactics, October 1999, 6 (10): 12.

Case study from PR perspective in handling a recall of an electronic product. Sense of urgency emphasized.

Van Waes, Luuk and Van Wijk, Carel, *The Influence of Politeness on the Perception of Product Recall Notices*, Document Design, 2000/2001, 2 (3): 272-279.

This article deals with the question of whether politeness strategies lead to differences in the appreciation, acceptance, and perception of product recall notices.

Venkatesan, M., *Consumer Behavior and Acceptable Risk: Some Research Issues*, Advances in Consumer Research, 1980, 8: 503-504.

Various characteristics associated with risk perceptions--e.g. voluntariness, severity, control, overconfidence, etc.

Victor, Julie; Lawrence, Pringle; Munster, Andrew; and Horn, Susan D., *A Statewide Targeted Burn Prevention Program*, The Journal of Burn Care & Rehabilitation, July/August 1988, 9 (4): 425-429.

Describes the implementation, distribution, and evaluation of an educational prevention program presented to two groups which have a high risk of being burned.

Viscusi, W. Kip and Magat, Wesley A., *Learning about Risk*, 1987, Cambridge, MA: Harvard University Press.

When a risk information program forces people to focus on the probability that some rare injury will occur, they may treat the probability as if it were higher than its objective value because of the cognitive difficulties in making risky choices when the probabilities are extremely low.

Vlek, Charles and Stallen, Pieter-Jan, *Judging Risks and Benefits in the Small and in the Large*, Organizational Behavior and Human Performance, 1981, 28 (2): 235-271.

This study of personal risk judgments for 26 activities did not find a relationship between judgments of overall riskiness and judgments of overall beneficiality.

Vredenburgh, Alison G. and Cohen, H. Harvey, *Compliance with Warnings in High Risk Recreational Activities: Skiing and Scuba*, Proceedings of the Human Factors and Ergonomics Society 37th Annual Meeting, 1995, pp. 945-949.

Examines whether the perception of danger affected the reading of, and compliance with warnings; whether familiarity with an activity affected reading and compliance; and whether there was any difference in responses between men and women.

Vredenburgh, Alison G. and Zackowitz, Ilene B., *Evaluating the Effectiveness of a Pictorial-Only Warning on a Trolley Coupler*, Proceedings of the Human Factors and Ergonomics Society 45th Annual Meeting, 2001, pp. 848-851.

Evaluates a pictorial as the sole source of warning information.

Warner, Harland W., *Recall Effectiveness and the Communications Clutter*, Public Relations Quarterly, Fall 1980, pp. 21-24.

People need to be both informed of a recall and motivated to act on it; fear normally functions as an attention getter and thus fear may not be best way to get people to respond to a recall. Recalls can be too complex--forms, paperwork, etc. not effective.

Weinstein, Neil D.; Roberts, Nancy E.; and Pflugh, Kerry Kirk, *Evaluating Personalized Risk Messages*, Evaluation Review, June 1992, 16 (3): 235-246.

An experiment with 766 homeowners compared three strategies for delivering radon test results. It does not appear that a personalized letter helps induce consumers to remember the recommended action or to comply with it.

Weissman, Kenneth Ian, *A 'Comment J' Parry to Howard Latin's 'Good' Warnings, Bad Products, and Cognitive Limitations*, St. John's Law Review, Fall 1996, 70 (4): 629-691.

Argues against Howard Latin's position that warnings are ineffective and therefore manufacturers should design products to minimize risk.

Wicks, Robert H., *Remembering the News: Effects of Medium and Message Discrepancy on News Recall over Time*, Journalism & Mass Communication Quarterly, Autumn 1995, 72 (3): 666-681.

Inability to recall information may be more a case of not being able to retrieve information than of actually forgetting the news information. It can take a few days for news to be properly processed and put in proper context to fully understand its implications. Search of Associative Memory (SAM) theory posits that information will likely be recalled in the future if it is stored with similar items; these items can cue one another to trigger recall.

Wilde, Gerald J.S., *Effects of Mass Media Communications on Health and Safety Habits: An Overview of Issues and Evidence*, Addiction, 1993, 88: 983-996.

Study on the use of mass communications to induce changes in health and safety behaviors.

Williams, Kevin J.; Kalsher, Michael J.; Maru, Michelle; and Wogalter, Michael S., *Emphasizing Non-Obvious Hazards Using Multi-Frame Pictorials and Color on*

Allocation of Blame, Proceedings of the IEA 2000/HFES 2000 Congress, 2000, 4: 124-127.

When hazards are not well known or easily recognized, proper precautions are not taken, and chance of injury increases.

Wilson, Richard and Crouch, Edmund A.C., *Risk-Benefit Analysis*, Second Edition, 2001, Cambridge, MA: Harvard University Press.

Discusses the assessment of risk and decision-making about risk.

Wogalter, Michael S., *Factors Influencing the Effectiveness of Warnings*, in Visual Information for Everyday Use (ed. Zwaga, Harm J.G.; Boersema, Theo; and Hoonhout, Henriette C.M.), 1999, Philadelphia, PA: Taylor & Francis Inc., pp. 93-110.

Discusses the factors that influence consumers noticing and understanding warnings, and motivating consumers to follow warnings.

Wogalter, Michael S.; Allison, Scott T.; and McKenna, Nancy A., *Effects of Cost and Social Influence on Warning Compliance*, Human Factors, 1989, 31 (2): 133-140.

An effective warning needs to inform the consumer of the danger and to attempt to get the consumer to comply with the warning. Warnings are more likely to be followed when others are complying and when complying does not require a significant diversion.

Wogalter, Michael S. and Baneth, Robin C., *Availability of Owner's Manuals for 'Second -Hand' Consumer Products*, Human Factors Perspectives on Warnings, 1994, 2: 217-220.

A study of one hundred people about the availability of owner's manuals for second-hand (used or resold) consumer products.

Wogalter, Michael S.; Barlow, Todd; and Murphy, Sean A., *Compliance to Owner's Manual Warnings: Influence of Familiarity and the Placement of a Supplemental Directive*, Ergonomics, 1995, 38 (6): 1081-1091.

This study found that consumers complied more frequently with warnings that were located on the product or packaging than with warnings that were located in the manual.

Wogalter, Michael S.; Conzola, Vincent C.; and Smith-Jackson, Tonya L., *Research-based Guidelines for Warning Design and Evaluation*, Applied Ergonomics, 2002, 33: 219-230.

Effective warnings need to have salience, appropriate wording, and strategic layout and placement. A warning needs to entice the reader to remember the warning when a hazard situation occurs.

Wogalter, Michael S.; DeJoy, David M.; and Laughery, Kenneth R. (eds.), *Warnings and Risk Communication*, 1999, Philadelphia, PA: Taylor & Francis Ltd.

Discusses the theories and principles of warnings and risk communications and their effectiveness.

Wogalter, Michael S.; Desaulniers, David R.; and Brelsford, Jr., John W., *Perceptions of Consumer Products: Hazardousness and Warning Expectations*, Proceedings of the Human Factors Society 30th Annual Meeting, 1986, pp. 1197-1200.

This research examined several characteristics of consumer products that influence warning communication.

Wogalter, Michael S.; Godfrey, Sandra S.; Fontenelle, Gail A.; Desaulniers, David R.; Rothstein, Pamela R.; and Laughery, Kenneth R., *Effectivness of Warnings*, Human Factors, 1987, 29 (5): 599-612.

Identifies some of the factors that influence the effectiveness of warnings.

Wogalter, Michael S.; Jarrard, Stephen W.; and Simpson, S. Noel, *Influence of Warning Label Signal Words on Perceived Hazard Level*, Human Factors, 1994, 36 (3): 547-556.

Signal words (e.g. caution, danger) on a product label are capable of changing people's perception of a risk hazard.

Wogalter, Michael S.; Kalsher, Michel J.; Frederick, Linda J.; Magurno, Amy B.; and Brewster, Blair M., *Hazard Level Perceptions of Warning Components and Configurations*, International Journal of Cognitive Ergonomics, 1998, 2 (1-2): 123-143.

In this study there were two levels of warning that consumers distinguish between: danger vs. warning and caution. The word "deadly" and the skull icon produced the highest hazard perception ratings.

Wogalter, Michael S.; Kalsher, Michael J.; and Racicot, Bernadette M., *Behavioral Compliance with Warnings: Effects of Voice, Context, and Location*, Safety Science, 1993, 16: 637-654.

This study found that warning compliance increased when the warning was in an uncluttered location and when the warning was vocal. Warning compliance was also positively influenced by memory of the warning, perception of hazard, and reported carefulness.

Wogalter, Michael S.; Magurno, Amy Barlow; Dietrich, David A.; and Scott, Kevin L., *Enhancing Information Acquisition for Over-the-counter Medications by Making Better Use of Container Surface Space*, Experimental Aging Research, January-March 1999, 25 (1).

This study found that consumers prefer supplemental cap labels on over-the-counter medications.

Wogalter, Michael S. and Sojourner, Russell J., *Comprehension and Retention of Safety Pictorials*, Ergonomics, 1997, 40 (5): 531-542.

Pictorials are effective in conveying safety messages. Some pictorials need a brief verbal description. The message in the pictorial tends to be remembered once the description is read.

Wogalter, Michael S. and Usher, Mary O., *Effects of Concurrent Cognitive Task Loading on Warning Compliance Behavior*, Human Factors Perspectives on Warnings, 1999, 2: 251-255.

Research examining whether increased cognitive task loading decreases warning compliance behavior.

Wogalter, Michael S.; Young, Stephen L.; Brelsford, John W.; and Barlow, Todd, *The Relative Contributions of Injury Severity and Likelihood Information on Hazard-Risk Judgments and Warning Compliance*, Journal of Safety Research, Fall 1999, 30 (3): 151-162.

The potential severity of an injury determines the perception of hazard risk and it is a significant factor in predicting compliance behavior. Injury likelihood is not always a factor in consumers' assessment of hazard risk.

Wolff and Wogalter, *Test and Development of Pharmaceutical Pictorials*, Proceedings of Interface '93: Humanizing Technology (Human Factors and Ergonomics Society), 1993, pp. 187-192.

Citation only--full text not obtained.

Wright, Patricia, *Printed Instructions: Can Research Make a Difference?*, in Visual Information for Everyday Use (ed. Zwaga, Harm J.G.; Boersema, Theo; and Hoonhout, Henriette C.M.), 1999, Philadelphia, PA: Taylor & Francis Inc., pp. 45-66.

The design of printed instructions can affect how consumers process the information.

Wright, Patricia, *'The Instructions Clearly State…' Can't People Read?*, Applied Ergonomics, September 1981, pp. 131-141.

This study explores how people deal with the instructions that accompany consumer products.

Wright, P.; Creighton, P.; Threlfall, S.M., *Some Factors Determining when Instructions Will be Read*, Ergonomics, 1982, 25 (3): 225-237.

This study explores the extent to which a person's attitude towards a consumer product influences the likelihood of their reading the instructions.

Young, Stephen L.; Brelsford, John W.; and Wogalter, Michael S., *Judgments of Hazard, Risk, and Danger: Do They Differ?*, Proceedings of the Human Factors Society 34th Annual Meeting, 1990, pp. 503-507.

This article suggests that designers of warnings and education materials should focus their attention on communicating how severely a person can get hurt, rather than (or to a lesser extent) the likelihood of getting hurt.

Young, Stephen L. and Laughery, Kenneth R., *Components of Perceived Risk: A Reconciliation of Previous Findings*, Proceedings of the Human Factors and Ergonomics Society 38th Annual Meeting, 1994, pp. 1063-1067.

A study using principal components analysis (PCA) to see if stable multidimensional solutions could be extracted from two qualitatively (and significantly) different item lists.

Young, Stephen L. and Wogalter, Michael S., *Relative Importance of Different Verbal Components in Conveying Hazard-Level Information in Warnings*, Proceedings of the Human Factors and Ergonomics Society 42nd Annual Meeting, 1998, pp. 1063-1067.

This study demonstrates that the way in which a dangerous situation is described can influence people's hazard perceptions.

Young, Stephen L. and Wogalter, Michael S., *Memory of Instruction Manual Warnings: Effects of Pictorial Icons and Conspicuous Print*, Proceedings of the Human Factors Society 32nd Annual Meeting, 1988, pp. 905-909.

Study examines whether the salience of warning messages would improve the memory of warnings in proceduralized instructions.

Zakay, D. and Wooler, S., *Time Pressure, Training, and Decision Effectiveness*, Ergonomics, 1984, 27: 273-284.

This study found that the quality of decision-making decreases when there is a time constraint.

Zeitlin, Lawrence R., *Failure to Follow Safety Instructions: Faulty Communication or Risky Decisions?*, Human Factors, 1994, 36 (1): 172-181.

A laboratory experiment exploring faulty communication versus risky decision hypotheses of failure to follow safety instructions.

Zwaga, Harm J. and Mijksenaar, Paul, *The Development and Standardization of Warning Symbols; The Role of Design and Human Factors*, Proceedings of the IEA 2000/HFES 2000 Congress, 2000, 4: 782-785.

Graphic symbols have obvious advantages over text symbols--no language barrier, easier to discern message from a distance. Manufacturers and organizations do not want to pay for testing of standards, because the results will be available to everyone. There is a need for graphic symbols to become standardized to improve comprehension of product warnings.

Consumer Motivation Bibliography, http://www.shef.ac.uk/~is/publications/infbehav/bibliog1.html.

Bibliography on consumer motivation.

Making the Recall Decision and Establishing an Effective Recall, Food Processing, May 2, 2002.

In the food industry companies must have a proactive, comprehensive plan in place to minimize negative effects of a recall. Risk management, customer service, and marketing are among important aspects of an effective recall.

Visual Literacy Bibliography-IV. Psychology,
http://www.ivla.org/news/rdocs/vlbib/vbl4.htm.

Bibliography on the pyschology aspects of visual literacy.

Exhibit 3
Article Reviews

Bryce, G. and Fakher, N., *Public Awareness of Home Accident Risks-Some Implications for Health Promotion*, Archives of Emergency Medicine, 1992, 9: 225-229.

This article reports the results of a questionnaire administered to United Kingdom emergency room (ER) patients in the fall of 1989. Participants were asked about the home accidents sustained, their awareness of these risks, previous experience with similar accidents, estimates of the recovery period and knowledge of other known risks from high-risk activities. Falls were the most common reason for the ER visit among the 200 participants (44 percent of the sample).

> Most of the respondents (85 percent) were unaware of a specific action that led to the accident, but the same percentage reported being aware of the general risks associated with the activity that led to their injury. Moreover, 19 percent indicated that they had had a similar type of accident before. Just under half reported that they engaged in each of two potentially risky activities—climbing stairs/ladders while alone (44 percent) and using knives to cut packaging (43 percent). The authors conclude that awareness of household risks is not sufficient to prevent people from taking actions that can lead to accidents associated with these risks.

Chaudhuri, Arjun, *A Study of Emotion and Reason in Products and Services*, Journal of Consumer Behavior, February 2002, 1 (3): 267-279.

This article focuses on the role of emotional aspects of experience with a product in shaping the consumer's perception of the risk associated with its use. The literature has already shown that prior knowledge of, and familiarity with, a product influences the risk perception. Chaudhuri argues that subjective emotional attributes ("hedonic" factors), as well as objective ("utilitarian" ones), contribute to perceived risk.

Users were interviewed about various aspects of a product or service consumed. The sample consists of 30 users for each of nearly 150 products and services chosen at random on the basis of four-digit SIC codes. The questionnaire attempted to elicit responses on three positive and three negative emotional attributes using the form, "Does your use of (product/service) increase your feelings of (attribute)?" The dimensions tested are as follows:

Positive:	Joy, pleasure, delight
Negative:	Worry, disappointment, irritation

Users were also asked to evaluate utilitarian aspects such as quality, value and convenience. They were also asked about the level of perceived risk, *but risk was defined to include all five components of risk (financial, performance, physical, psychological, social)*, rather than focusing

on the risks to safety and health. Moreover, the three positive and three negative emotional attributes were each compressed to single summary indicators for the preferred versions of the model.

Chaudhuri finds that negative emotional ratings have a "strong influence" on perceived risk, while positive emotional attributes have a "moderately strong influence" on risk perceptions. However, the paper does not discuss the likely direction of causality, and is thus silent on the issue of whether the level of perceived risk is a factor that shapes users' emotional responses to product consumption.

Edworthy, Judy, *Warnings and Hazards: An Integrative Approach to Warnings Research*, International Journal of Cognitive Ergonomics, 1998, 2 (1-2): 3-18.

Edworthy presents a framework for understanding the warning-compliance process based on the Subjective Expected Utility model. Compliance judgments are developed by comparing the expected reduction in risk from compliance (taking into account the severity and the likelihood of the hazard in the compliance and no-compliance states) with the costs of achieving that risk reduction. Edworthy notes that researchers have found that risk judgments are shaped by a number of factors, including the characteristics of the individual (e.g., familiarity with the product or task), the hazard (e.g., severity or perceived obviousness), and context (e.g., observations of others' behavior when using the product). These factors mean that "when people confront a potentially hazardous situation, it is not necessarily the warning that tempers their behavior".

Warnings provide information that can influence this judgment, but also have "iconic"—alerting or attention-getting—features. Color choice, use of capital and/or block lettering, and signal words (such as "Danger") are elements of warnings that provide cues to the user about the level of risk associated with the product or task. These attributes minimize (but do not always eliminate) the role of language skills and vision in processing the information provided by warnings.

Frantz, J. Paul and Rhoades, Timothy P., *A Task-Analytic Approach to the Temporal and Spatial Placement of Product Warnings*, Human Factors, 1993, 35 (4): 719-730.

Warnings that temporarily interfere with task performance were significantly more effective in securing compliance in this study by Frantz and Rhoades. The authors argue that "even with a novel product, a cognitive analysis often indicates…the user will be continuously guided by a combination of prior knowledge and non-verbal contextual clues". The study was designed to test whether users have "scripts"—series of actions or events in temporal order—available for product use and the extent to which different temporal and spatial placement of warnings can influence the execution of these scripts.

Frantz and Rhoades tested four alternative warnings that communicated information on how to avoid a relatively minor hazard—file cabinet tipping—using a sample of 60 college

students and custodians. The study participants were asked to set up an office; one task was to fill a two-drawer file cabinet. After completing the set-up, participants were asked if they noticed and read any information on file cabinet safety while completing the tasks. Recall of two specific warnings (do not open more than one drawer at a time; fill the bottom drawer first) was examined.

Four alternative warning positions were tested:

1. On the outside of the shipping carton;
2. On the bottom of the top drawer of the file cabinet;
3. On the front of the file cabinet and on the bottom of the top drawer; and
4. Across the bridge of the top drawer of the file cabinet.

The proportions noticing, reading, recalling, and complying with each of the four warnings varied significantly. Warning #1 was not noticed by any of the participants. Most filled the top drawer of the file cabinet first, which Frantz and Rhoades attribute to an embedded product use script. Most of the participants (93 percent each) who were presented with warning #3 or warning #4 noticed it, and two-thirds of each group reported that they read the warning. However, both recall and compliance were higher for warning #4.

Only eight participants indicated that they read all of the warning information; all eight then complied with the warning instructions to some extent. Among the 17 who claimed to have read at least some information on the warning, 11 exhibited some degree of compliance. From the results reported, it appears that among the 35 participants who did not read any of the warning information, only eight did not fill the top drawer first (Heiden Associates calculation).

The authors conclude that "users' world knowledge, along with knowledge of the product itself, are critical to predicting usage behaviors". They view their results as showing that warnings can change behavior, and that the amount of information read in a warning is related to the likelihood of obtaining compliance.

Friedmann, Keyla, *The Effect of Adding Symbols to Written Warning Labels on User Behavior and Recall*, Human Factors, 1988, 30 (4): 507-515.

Friedmann tested four issues related to the impact on user behavior and recall of adding symbols to written warning labels:

1. Whether adding symbols increased label effectiveness;
2. Whether the type of image provided had a differential impact on behavior;
3. Whether the user's level of familiarity with both the product and with the perceived hazard affected behavior; and
4. Whether the types of precautions recommended to avoid the hazard influenced the rate of compliance.

These issues were investigated using a study of three types of labels on a relatively familiar product (drain opener) and a less familiar one (wood cleaner). Two types of hazards—inhalation and eye contact—were addressed by alternative versions of the labels. Overall, Friedmann found that while 88 percent of the 144 participants (undergraduate students) noticed the warning label, only 46 percent read it and only 27 percent followed the directions.

When asked specifically about the symbol on the label, 30 percent reported noticing it and 23 percent correctly described it. Both percentages were higher for the label concerning the inhalation hazard than for the one relating to eye contact.

The most significant determinant of whether the user read the label was the perceived hazardousness of the product. Compliance was a problem even among readers of the label—only 60 percent of those who read the label followed its directions. Among those who read the label but did not comply, most understood that the product could be hazardous, but thought they could use it in a safe manner without following the label recommendations.

Proactive labels (which describe the precautions to be taken) were found to be more effective than the other types tested. Proactive symbols were more likely to be noticed and to be recalled than reactive ones (which describe the hazards to be avoided). Overall rates of compliance for the various scenarios ranged from eight percent to 42 percent.

Garling, Anita and Garling, Tommy, *Mothers' Supervision and Perception of Young Children's Risk of Unintentional Injury in the Home*, Journal of Pediatric Psychology, 1993, 18 (1): 105-114.

Garling and Garling report the results of a study that investigated the perceived impact of various parental supervision scenarios on the expected risk level associated with children playing. A questionnaire (in the form of face-to-face interviews) was administered to a sample of 150 mothers. Respondents were asked to rate the level of risk (on a nine-point scale) faced by their children in each of four rooms in the house under four different supervision scenarios. The results showed that closer supervision is expected to reduce risk in all four locations. Interestingly, participants felt that risk levels for children were lowest in their bedrooms (compared with living rooms, kitchens, and bathrooms), whether supervised or unsupervised.

The authors interpret the results as confirming the Slovic (1987) hypothesis that perceived control reduces perceived risk levels.

Gerritsen, Marinel; Van-Meurs, Frank; and Diepstraten, Wendy, *Consumers' Views on Text Characteristics of Product Recall Notices*, Document Design, 2000/2001, 2 (3): 258-271.

The authors investigated consumer reactions to alternative versions of warnings on the dimensions of clarity and impact on company image. Five strategies were evaluated:

1. Adding a picture to the written warning;
2. Providing the steps to be taken in a list format;
3. Using "reader-oriented" language (i.e., active voice, direct address);
4. Minimizing the level of risk posed by the hazard; and
5. "Bolstering" the company's image by describing positive attributes of the company.

A supermarket-intercept study was used to obtain the views of 128 female shoppers with a diversity of ages and education levels on alternative versions of labels. The inclusion of a picture and provision of instructions in a list format were found to increase both clarity and the image of the company providing the warning. Casting the warning in reader-oriented language was preferred on clarity grounds by a modest majority of those who had a preference. A larger proportion of the respondents felt that the reader-oriented version helped the company's image.

> A majority of those with a preference (34 of 57) felt that minimizing the risk made the label less clear, while 38 of 52 participants with an opinion felt that it improved the company's image. However, no such tradeoff was observed for the bolstering strategy—significant majorities felt that it both made the label less clear and had an adverse impact on the company's image.

Gibson, Dirk C., *Public Relations Considerations of Consumer Product Recall*, Public Relations Review, Fall 1995, 21 (3): 225-240.

Gibson reviews effectiveness data from recall programs conducted under CPSC and NHTSA jurisdiction, noting that response rates vary widely. He then examines possible factors from public relations theory that may help to explain why programs often do not achieve higher participation rates, including:

1. Editorial requirements and judgment cause recall stories to be cut or eliminated;
2. Lack of public knowledge about the recall (for unspecified reasons);
3. Consumer saturation with recall messages;
4. Problems with the type and quality of publicity (Gibson stresses need to use television and provide visuals);
5. Under-funded, under-supported regulatory agencies; and
6. Poor planning prior to initiation of a recall (lack of parts needed for repairs, etc.).

Gibson then prescribes twelve rules for recall publicity campaigns:

1. Be candid;
2. Be consumer-centered;
3. Be consistent;
4. Be contrite;
5. Be compassionate;

6. Be careful;
7. Be cooperative;
8. Be correct;
9. Be concise;
10. Have CEO involved;
11. Be credible; and
12. Be quick.

Gibson provides several hypotheses about why recalls do not achieve higher response rates. These hypotheses are based on his review of news accounts of recalls. He does not provide any evidence or analysis to support whether his hypotheses are borne out in actual experience. Recall effectiveness is not addressed in this article. The rules for PR campaigns are useful guidelines for assessing specific programs, but do not appear to provide the basis for any general conclusions about improving recall effectiveness.

Goldhaber, Gerald M. and deTurck, Mark A., *Effectiveness of Warning Signs: Gender and Familiarity Effects*, Journal of Products Liability, 1988, 11: 271-284.

Goldhaber and deTurck investigated the impact of gender and previous experience on warning compliance. The authors collected and analyzed observations of behavior at two pools—one with a warning about diving in the shallow end of the pool and a control pool with no such warning—and the results of a questionnaire administered at the end of the four-week test period. The warning used followed the recommendations of the ANSI 1987 standard:

1. A signal word ("danger") was included;
2. The hazard was stated;
3. The effects of the hazard were stated; and
4. Instructions on how to avoid the hazard were given.

The study subjects were 180 male and 148 female high school students. Males were more likely than females to have noticed the signs (both unprompted and prompted recall) and to recall that a pictograph was part of the sign. However, males were more likely to dive into the shallow end than were females. In fact, a higher percentage of males did so at the pool with the danger sign than at the control pool.

Previous experience was also found to influence the likelihood of warning compliance. A prior history of diving into the shallow end and/or swim team membership made it more likely that the subject would disregard the warning.

Hadden, Susan G., *Regulating Product Risks Through Consumer Information*, Journal of Social Issues, 1991, 47 (1): 93-105.

This article focuses on potentially unconsidered side effects of warning label provision. Hadden is concerned with the extent to which people may not read, understand or act on warning

labels. She also notes that poorer consumers often have fewer resources to understand and use label information.

Her review of the literature indicates that people can process information with an intent to learn as much as possible, or alternatively, only to determine if there is something new or surprising. However, she notes that people are likely to pay less attention to information, perceive less risk, and are more likely to take risks as they become familiar with the product.

Hadden reviews some strategies for improving the effectiveness of labels. Among these are:

1. Changing the content of labels over time;
2. Using appropriate language and graphical presentations; and
3. Providing a hierarchical presentation that provides summary information up front.

However, even if these strategies are deployed, the literature suggests that the level of risk must be perceived as high for consumers, relative to the costs of acting, before consumers are willing to respond to, and comply with, warnings. She offers some proposed remedies; these do not appear to vary from those generally offered by other sources reviewed.

Hammond, Amy J., *Adult Notions of Adults' and Children's Perceptions of Consumer Product Risk*, Proceedings of the Human Factors and Ergonomics Society 39th Annual Meeting, 1995, pp. 321-325.

This study explores adults' perceptions of the risks faced by themselves, other adults, and children. Particular attention is directed to testing whether or not adults exhibit "superiority bias"—i.e., the belief that they can better judge risks than other adults or children. Hammond examined this issue using a test of 85 college students. About two-thirds of the participants were parents or had substantial experience as a child caregiver.

Subjects were asked to evaluate the severity and likelihood of the hazards associated with a randomly chosen sample of 40 products and activities identified from CPSC's NEISS database. Participants were also asked to estimate the likelihood that they would take precautions when using the product or performing the task.

Study participants perceived the level of product hazards faced by children as being greater than the levels *they believed that children would perceive*. They perceived the risks to be the same for themselves and other adults, but reported that they thought they exercised more caution when using these products and performing these tasks than other adults.

Hancock, Holly E.; Rogers, Wendy A.; and Fisk, Arthur D., *An Evaluation of Warning Habits and Beliefs Across the Adult Life Span*, Human Factors, Fall 2001, 43 (3): 343-354.

This article reports on the results of testing to determine if age-related factors exert a significant effect on the processing of warnings. The authors examine age-related differences in four areas:

1. The frequency of attending to warning information;
2. The perceived level of risk for different types of products;
3. Beliefs about how important or necessary warnings are; and
4. Comprehension and usefulness of safety symbols.

These issues were tested using a mail survey of 4,250 Georgia residents around the Atlanta metropolitan area. Half of the sample was selected among residents who were 55 or older. Participants were asked about product usage patterns and the four categories of questions outlined above. They were able to achieve a 20 percent response rate.

Highlights of their findings are as follows:

1. Older people read warnings for three product groups (personal care products, cleaners, and small appliances) more often than those in the younger age brackets. However, the middle-age group showed a higher propensity to read warnings for power tools.

2. Older people generally felt warnings were less important in general and for the polishes/paints/stains and cleaners/detergents categories.

3. There were no significant differences among age groups in the perceived risk of consumer products generally, although older people were likely to see prescription medicines as *less* risky and personal care products as *more* risky than the younger age groups; and

4. Older participants considered hazard symbols to be more useful than did the other age cohorts in the study, but on average they showed poorer comprehension and less familiarity with the symbols included in the survey.

The authors also conducted a regression analysis. Age accounts for a relatively small portion (three percent) of the overall variance among respondents. The interpretation is that chronological age is not a very good measure of the potential processing problems associated with memory loss and limitations.

Heisler, J.T. and Bernstein, A. (Market Facts), *Study To Determine Why Vehicle Owners Respond to or Ignore Recall Notifications*, July 1980, DOT HS-805-591.

This report summarizes the results from a market panel study of participants and non-participants in 25 late 1970s automobile recall campaigns. Two-thirds of the sample of approximately 3,600 vehicle owners completed a written questionnaire, with the remainder interviewed by telephone.

Those who responded to a recall notice were asked to identify the main reason for participating: concern for safety was cited by 33 percent of those interviewed, while 31 percent indicated they did so to comply with a request for action. These proportions varied significantly with the severity of the recall.

The study also identified reasons for non-participation among those who did not respond to the recall notice:

- 25% indicated never receiving the recall notice;
- 21% reported that they did have the problem fixed;
- 15% had sold the car covered by the recall;
- 7% had some problem getting the repair; and
- 23% cited reasons that Market Facts classified as "owner apathy".

The authors raise the prospect that some survey participants may have felt the need to offer "socially desirable responses" for non-complying behavior, noting that a larger percentage of non-respondents indicated never receiving a notice for recalls involving defects thought to be very serious.

Survey participants were also asked to report the source from which they learned of the recall. The majority (72 percent) reported receiving a letter about the recall; 22 percent recalled receiving a second notice. Newspapers, dealer/mechanic advice, television and other sources each accounted for between four and eight percent of those notified, while 17 percent indicated that they had never heard of the recall involving their vehicle.

Interestingly, there were no differences between recall participants and those who did not respond in their reported perceptions of the severity of the hazard involved.

Finally, when asked how to improve program response rates, recall participants stressed adequate communication of safety issues in the recall notice, but non-participants were more likely to suggest taking steps to improve the quality or speed of repairs, as well as unspecified ways to increase the convenience of participating in recalls.

Hoffer, George E.; Pruitt, Stephen W.; and Reilly, Robert J., *When Recalls Matter: Factors Affecting Owner Response to Automotive Recalls*, Journal of Consumer Affairs, Summer 1994, 28 (1): 96-106.

The authors review a large set of auto recalls conducted from 1984 to 1986 for which data on both the number of registered owners contacted and the number having covered repairs done were available. They report differences in program response rates relating to several factors, including:

1. Country of manufacture: Recalls of US-manufacturer vehicles achieved an average correction rate of 52 percent, compared with 45 percent for European manufacturers and 24 percent for Japanese manufacturers;

2. Correction rates for older vehicles (those in service for two years or more) average 41 percent, somewhat lower than the 54 percent average for one-year old vehicles; and

3. Correction rates for recalls involving serious defects averaged 54 percent, compared with 44 percent for those involving defects that were not serious.

Hoffer et. al. offer one explanation for the first of these observations. At the time of the study, Japanese cars required substantially fewer repairs than vehicles made by American or European companies, and thus offered fewer opportunities to "bundle" recall repairs with other needed work to reduce transactions costs.

Lehto, Mark R. and Miller, James M., *The Effectiveness of Warning Labels*, Journal of Products Liability, 1988, 11: 225-270.

This extensive survey article summarizes research on the numerous steps required for warnings to be effective. Highlights of this research are presented for each step.

First, the warning must receive attention from the user—it must first reach him/her, and then survive the information filtering process. Information on the extent of filtering process is provided by Wright (1982) for user attention to warnings on 60 products. One-third of the time respondents indicated that they would not read the instructions, while participants reported that they would read *all* of the instructions just over half (53 percent) of the time. This varied by the extent of perceived product risk: 76.6 percent would read all of the instructions for complex electrical products, while only 41.8 percent would do so for non-electrical tools. This underscores the need for an alignment of perceived and actual risk for warnings to be effective—although other research has shown the existence of large discrepancies between these two factors.

Other factors contributing to filtering include information overload effects, noise effects, "conspicuity" effects and warning tone effects.

Next, the authors review available research on the comprehension of warning labels. One 1976 study of aspirin labels found that the labels required an 11^{th} or 12^{th} grade-level reading ability to understand. Factors viewed as increasing warning comprehension include:

1. Use of concrete warnings with simple sentence structure;
2. Use of signal words, such as "danger" (comprehension of "warning" and "caution" is not similarly high, however);
3. Emphasis of hazard description, rather than prescription; and
4. Placing recommended actions before describing the condition to be avoided.

This section also includes an extensive discussion of the comprehension and effectiveness of various safety symbols. Like other aspects of warnings, symbols are seen to be effective only when placed in the context of the task being performed; they are not universally understood.

The third area reviewed includes the research on memory, decision and response. Retention of warnings erodes fairly rapidly, according to a 1979 study by Wright. Wright found that less than ten percent of those who purchased a product placed next to an in-store warning recalled the warning during an interview administered at the exit of the store.

Lehto and Miller also review a body of literature that focuses on the ability of warnings to modify decisions and risk behavior. While not much is available on labels specifically, they find that more general safety education campaigns face considerable obstacles to success. Some factors that influence effectiveness are:

1. The user's regard for the value of safety knowledge (which is higher among people who have previously experienced an accident or problem);
2. Conflicting objectives associated with use of the product, such as comfort and performance;
3. The presence or absence of an actual belief in danger;
4. The nature of risk-coping strategies employed; and
5. The level of risk acceptability associated with the product (see Rethans and Albaum in the previous set of reviews).

Lehto and Miller note that the most effective programs have involved direct feedback—warnings when inappropriate responses occur, as well as external rewards for sustaining recommended behavior.

Leonard, S. David and Wogalter, Michael S., *What You Don't Know Can Hurt You: Household Products and Events*, Accident Analysis and Prevention, 2000, 32: 383-388.

This article reports the results of the author's research about the level of public knowledge of hazards associated with common household goods. Leonard and Wogalter developed and administered two questionnaires—one multiple choice, the other open-ended—to samples of college students and community members. Recognition of the best known hazards was very high. Most respondents could identify (multiple-choice) or report (open-ended) the risks associated with hair spray, lead paint, and child ingestion of iron tablets.

However, they were less able to connect this knowledge to actions that could cause exposure to these hazards. For example, while between 70 (open-ended) and 92 (multiple-choice) percent of the participants could identify lead paint as hazardous to children, 45 percent indicated that the preferred method of removing old paint would be to scrape it off.

One limitation of the study is that it does not look at differences in knowledge by age and gender of the respondent. More importantly, the sample is drawn from a pool of participants whose life experiences are, in the words of the authors, "less extensive".

Lepkowska-White, Elzbieta and Parsons, Amy L., *Comprehension of Warnings and Resulting Attitudes*, The Journal of Consumer Affairs, Winter 2001, 35 (2): 278-294.

This article investigates the relationship between education and the vocabulary deployed in warnings. Differences in both the message (the complexity of the warning language) and the receiver (e.g., the level of user education) were examined using a test scenario involving the hypothetical purchase of drain cleaner.

This study had two groups of participants—those with less than a high school education (n=44) and those with more than an undergraduate degree (n=61). The authors attempted to create a high level of interest in the warnings being evaluated by asking the participants to assume that they had never used drain cleaner before, but had previously sustained a chemical burn from the use of another product. Recognition, not subsequent recollection, of warnings was selected as the measure of comprehension.

Two alternative warnings were provided—one with 5th grade-level vocabulary and one requiring a 10th grade-level vocabulary. Unsurprisingly, Lepkowska-White and Parsons found that the difficult warning was less well understood by the lower-education group. However, some other findings were less obvious. The high-education groups were more skeptical on average about the need to heed *either* warning label. When presented with the more difficult label, both groups were more skeptical about the dangers being warned against and perceived the risk to be greater.

Mazis, Michael B. and Staelin, Richard, *Using Information-Processing Principles in Public Policymaking*, Journal of Marketing & Public Policy, 1982, pp. 3-13.

The authors investigate several steps in the acquisition, processing and use of warnings. First, they identify several factors that cause bottlenecks to develop in warning exposure and attention:

1. Accidental destruction/removal of warning information (due to weather, etc.);
2. Lack of warning availability (i.e., if presented in separate materials);
3. Inappropriate timing (i.e., at a time other than when the task is being performed);
4. Targeting problems (the intended recipients are not reached);
5. Filtering because of the nature of the message or the receiver;
6. *Internal factors* that lead to selectivity in the processing of data; and
7. *External factors*, such as the distinctiveness of the message and the intensity of the stimulus provided.

Among the factors reviewed that affect warning comprehension are the "understandability" of the message (fuel economy ratings get high marks, while life insurance cost measures fail) and the ease of "encoding" (minimizing the processing required to store the

message in memory). The latter is particularly relevant in the development of new metrics, such as those summarizing appliance energy consumption, unit pricing, and interest rates.

Mazis and Staelin provide some observations on information retention/retrieval and user decision-making that are relevant for safety messages. One important consideration is that consumers will only use information that is explicitly provided and will only use it in the form in which it is displayed. They underscore the need for simplified, standardized formats to facilitate information retention and comparison among products.

Meingast, Melissa, *Increasing Attention and Retention of Warnings: Effects of Container Hazardousness, Warning Quality, and Severity of Injury*, Proceedings of the Human Factors and Ergonomics Society 45th Annual Meeting, 2001, pp. 1482-1486.

Meingast examines the impact of packaging, as well as warning quality and hazard severity, on risk perceptions. A sample of 64 undergraduate students were asked to evaluate the product packaging (but not the riskiness) of one of a 2 x 2 x 2 set of alternative containers, warning labels, and warned-against hazards. After being shown the containers, the participants were asked whether they read the labels, noticed the warnings, recalled the content of the warnings and the severity of the injuries warned about, and if they would obey the warning label.

The author found that the higher quality warning (based on ANSI 235, compared with a plain text warning as a control) evoked higher rates of notice and recall. The severity of the injury warned against was not related to the proportion of respondents recalling the warning, however. Meingast suggests that this may have been due to the experimental nature of the study design, which did not involve actual use of the product.

The type of container did exert some influence on recall and risk perception. For the group with the low-severity injury warning, the "high hazard" container increased the likelihood that the warning would be read. This group was also more likely to regard use of the product with the low-severity injury hazard as being potentially hazardous. However, these effects were not observed for the group given the high-severity hazard warning.

Mitchell, V-W., *Understanding Consumers' Behavior: Can Perceived Risk Theory Help?*, Management Decision, 1992, 30 (3): 26.

Mitchell reviews the impact of perceived risks (primarily from product performance and satisfaction, rather than safety) on consumer decision-making processes both prior to and after product purchase. The case of interest is what he calls "dissonance-reducing buying behavior", in which the consumer is confronted with a mismatch between actual and expected product performance. In this instance, the literature indicates that consumers will employ risk-reducing strategies to minimize the consequences of the unsatisfactory purchase.

This article's applicability to product risks is not demonstrated. However, it is possible that consumers may respond to post-purchase information about the safety of products in an analogous fashion.

Oglethorpe, Janet E. and Monroe, Kent B., *Determinants of Perceived Health and Safety Risks of Selected Hazardous Products and Activities*, Journal of Consumer Affairs, Winter 1994, 28 (2): 326-346.

This paper presents an extensive model of consumer risk perceptions and reports the statistical results of a test conducted to identify the significance of various factors in forming these risk perceptions. According to the authors, risk perceptions are determined not only by the probability and severity of the actual hazard involved, but also by several other factors:

1. Availability, which denotes the extent to which the hazard is understood and the vividness of these understandings;
2. Controllability;
3. "Dreadedness";
4. Irreversibility;
5. Catastrophic potential; and
6. Immediacy of effect.

These dimensions were translated into seven-point scales and incorporated into a questionnaire administered to study participants, who were asked to evaluate each aspect of risk for a set of eight hazards ranging from aerosols' impact on the ozone layer to cancer from cigarettes. Two of the hazards—head injuries from bicycling and electric shocks from hair dryers—are of particular interest in the context of recalls. Test participants rated these two hazards high on the dimensions of controllability and immediacy of effect, but low on catastrophic potential and probability of occurrence.

> Oglethorpe and Monroe found that risk perceptions among test participants depended on factors in addition to the probability and severity of the hazard being evaluated. The explanatory power of specific factors (other than probability and severity) varied across the eight hazards evaluated, however. Their overall contributions to explaining risk perceptions are ranked in the order listed above (note that immediacy of effect was not included in the revised model because of data limitations).

Rethans, Arno J. and Albaum, Gerald S., *Towards Determinants of Acceptable Risk: The Case of Product Risks*, Advances in Consumer Research, 1980, 8: 506-510.

Rethans and Albaum highlight the distinction between risk *estimation* and risk *evaluation*. The latter involves subjective assessments of the acceptable level of risk. Insights into determination of acceptable levels of risk are available from the marketing, product liability, and risk assessment literature.

The authors develop a model of risk acceptance that includes several factors:

Factors Increasing Acceptable Risk Level	Factors Reducing Acceptable Level
Voluntariness	Exposure
Risk knowledge	Ease of risk reduction
Risk control	(Possibility of) user error
Product necessity	Risk to children
Foreseeability	

Study participants were asked to rate a set of 30 consumer products on each of these dimensions using 7-point scales, as well as to rate the perceived level of risk associated with the product. Rethans and Albaum found that for all but two products (fireworks and skateboards), the level of risk was judged to be acceptable by the study group. They note that risk acceptance levels were high for some products with high degrees of perceived risk, such as skiing, knives, and swimming pools.

Most of the factors had the hypothesized relationships with risk acceptance, with the exception of foreseeability, which was negatively associated with the level of acceptable risk. A stepwise regression approach indicated that the most important explanatory factors (in order of decreasing importance) were product necessity, user error, voluntariness, risk knowledge and foreseeability.

Rogers, Wendy A; Lamson, Nins; and Rousseau, Gabriel K., *Warning Research: An Integrative Perspective*, Human Factors, Spring 2000, 42 (1): 102-139.

The authors develop and present a framework to classify and categorize previous studies of various aspects of warnings. They distinguish between *person* variables—including demographics, cognitive factors, and influences of personality—and *warning* variables, which deal with the context, physical features, and other characteristics of the message itself. Previous studies are reviewed to determine whether the results relate to one of four stages of the warning process: notice, encoding, comprehension, and compliance.

Among the issues included in the review are the impact of familiarity, hazard perception, and receptivity/interest in information on the likelihood that a user will notice and pay attention to a warning. Familiarity and hazard perception also influence the encoding and recall of safety messages. Other factors relevant to this component include warning placement and interactivity. Placement and the explicitness of the warning language are two variables shown to influence the comprehension of warnings. Finally, the authors review a large number of studies relating to compliance—which in their framework includes both the evaluation of the message and the resulting action (if any) to implement it. In addition to the factors usually cited (e.g., risk perception and compliance costs), Rogers et. al. also focus attention on the role of the individual's perception of control, the impact of social influence, and risk-taking styles.

Stoltman, Jeffrey J. and Morgan, Fred W., *Product Safety, Information, and Behavior*, American Behavioral Scientist, February 1995, 38 (4): 633-645.

This paper focuses on the behavioral factors that influence the efficacy of safety warnings and product labels. The authors review the available literature on the psychological dimensions of the comprehension and use of risk information. One key result is that consumers are not likely to read information that is spatially and temporally separated from the actual risk.

Stoltman and Morgan argue that it is necessary to examine both product usage and the underlying motivation of the user during three phases of product use: initiation, implementation, and termination. Cognitive monitoring is relevant, but so is the motivational control of the users. Unconditional threats (e.g., ladders and power tools) require vigilance even by experienced users, while the need to monitor and control a conditional threat will depend on the quantity of product used and the characteristics of the user.

Tse, Alan Ching Biu, *Factors Affecting Consumer Perceptions on Product Safety*, European Journal of Marketing, 1999, 33 (9/10): 911-925.

The author developed a set of hypothesis from the literature on the determinants of perceived product risk and conducted a test using a group of students. Tse identified eight factors that may be correlated with a higher perceived level of product safety:

1. Higher product price
2. National brand
3. Sale through specialty store
4. Manufactured in more developed country
5. Product promoted through specialized magazines
6. Product promoted by expert
7. Product underwent government-specified testing procedures
8. Longer length of warranty period

Tse tested these hypotheses using a sample of undergraduate students, who were asked to rate identical computer monitors with varied sets of these attributes on the dimension of perceived risk from radiation. Each of these factors was associated with an increase in perceived product safety.

Viscusi, W. Kip and Magat, Wesley A., *Learning About Risk*, 1987, Cambridge, MA: Harvard University Press.

Chapters 3 through 5 of this collection of studies present the design, administration, results and analysis of a consumer labeling experiment conducted by the authors at area shopping malls. The research was performed to measure consumer responses to various types of warning labels on household cleaner (bleach) and drain opener, including variations in the reported

willingness to take precautions when using these products. The authors also examined the impact of household demographic factors on the willingness to take precautions. Among the demographic factors, having children under five present in the home had the strongest positive influence on safe behaviors.

Four alternative bleach labels were tested. The label designed by the research team elicited the highest response, while those on two commercial bleaches outperformed a plain text label used as a control. For the three drain-opener labels, however, the commercial product label was more successful in eliciting a willingness to take precautions than the design label. Interestingly, while the labels for both products had a significant impact on the willingness to take precautions, these effects were *not* greater for the drain opener, which has more serious risks associated with its use.

The authors also tested the significance of several specific warning-content variables. The size of the label area devoted to warnings was significant in most cases, as was the inclusion of specific descriptions of the hazards.

Magat and Viscusi also examined consumer risk perceptions and found ample evidence of "superiority bias" among the respondents. When asked to compare their own personal risks of product use with those of the average consumer, 32 to 57 percent felt that they faced average levels of risk, while 40 to 65 percent believed that their own personal risk exposure was below average.

Warner, Harland W., *Recall Effectiveness and the Communications Clutter*, Public Relations Quarterly, Fall 1980, pp. 21-24.

This paper examines the 1976 Corning recall of electric percolators in detail. While this recall would have been projected to achieve a 7.2 percent participation rate (using the Murphy-Rubin model), the Corning program actually secured returns of 13 percent of the units in the hands of consumers.

However, this result was achieved with an extensive, and expensive advertising campaign that included ads in 400 major newspapers and Women's Day magazine. Warner reports that while these ads reached 78 percent of U.S. households, a survey indicated that only 44 percent of product owners were aware of the recall. Moreover, only 15 percent indicated that they had acted on the notice.

Of those who did not return the percolator, nearly half indicated that lack of an alternative unit was the reason. Four percent cited inconvenience, and nine percent reported that they no longer used the product.

Warner argues that more creativity is required in developing stories and getting exposure. Increasing the chance that a recall message will be distributed, received, and retained cannot be accomplished simply by more information or use of fear as a motivator (it "gets attention, but not

necessarily action"). Among his suggestions are alternative sources of dissemination to the print media (e.g., finished stories for suburban papers and advice/help columns).

Wogalter, Michael S., *Factors Influencing the Effectiveness of Warnings*, in Visual Information for Everyday Use (ed. Zwaga, Harm J.G.; Boersema, Theo; and Hoonhout, Henriette C.M.), 1999, Philadelphia, PA: Taylor & Francis Inc., pp. 93-110.

In this chapter, Wogalter provides an overview and summary of research on what he identifies as the four steps between the provision of safety-related information and the behavioral outcome:

1. Attention—which in his paradigm includes filtering and processing;
2. Comprehension;
3. Beliefs and attitudes—which examines the impact of familiarity and risk perceptions; and
4. Motivation—which involves the weighing of compliance and non-compliance costs, and is subject to persuasion and social influence.

> Wogalter underscores the importance of locating warnings in close proximity to the hazard, both physically and temporally. Attention is also given to the problem of habituation, which degrades a warning's impact over time on users who are familiar with its presence and contents.

To maximize the target audience that can be reached, warnings should be written to require the lowest level possible of verbal skills and knowledge of the language. Wogalter cites the work of Trommelen and Akerboom to argue for using explicit language to describe the nature of the hazard, the consequences, and the instructions on how to avoid the hazard. This approach has been shown not only to improve comprehension and recall, but also to increase the perceived risk associated with the hazard and the perceived severity of the injuries associated with the risk.

In contrast to other research findings, Wogalter's studies (and those of his associates) show that perceived risk is shaped almost exclusively by the seriousness of the injuries associated with a hazard, rather than their probability. Warning information that is inconsistent with prior beliefs and attitudes about risk have a higher likelihood of being filtered out and face a higher burden of persuasion to motivate a response. Wogalter concludes by noting that while substantial research effort has been directed at the design and comprehension of warnings, relatively less in known about the issues of persuasion and motivation.

Wogalter, Michael S.; Allison, Scott T.; and McKenna, Nancy A., *Effects of Cost and Social Influence on Warning Compliance*, Human Factors, 1989, 31 (2): 133-140.

This article reports on a series of experiments that dramatize the importance of social influence on subjects' compliance with safety warnings. This factor's strength is attributable to the use of heuristics (i.e., rules of thumb), rather than systematic processing, to respond to

persuasive messages. The authors cite Cialdini's 1984 estimate that people are exposed to more than 3,000 social influence attempts daily.

The setting for the first study was a chemistry lab where compliance was observed under varying combinations of costs (in the form of the distance required to obtain protective equipment) and the compliance of a partner ("confederate") in the same experiment. Most participants complied when the effort required was low, but only a few did so when the recommend equipment was located in an adjacent room. This experiment showed discernible, though modest, effects of confederate compliance.

However, a field study testing the impact of a warning sign about the reliability of an elevator in a woman's dormitory showed far more pronounced results. The majority of the subjects ignored the warning when no one else was present or when the confederate chose to use the elevator. When the confederate was observed using the stairs instead, 16 of the 18 subjects followed suit.

Wogalter et. al. note that there is not much research available on situations in which confederate compliance is mixed.

Wogalter, Michael S. and Usher, Mary O., *Effects of Concurrent Cognitive Task Loading on Warning Compliance Behavior*, Human Factors Perspectives on Warnings, 1999, 2: 251-255.

This study involves an experiment that tested the impact of task loading on the extent of compliance with instructions. Wogalter and Usher designed a test with a primary task (installing an external disk drive on a computer) and secondary tasks requiring different levels of attention (oral computation of the results for two-digit and one-digit addition problems) that were performed simultaneously. The disk drive installation involved three instructions that were required to avoid damaging the computer: turning it off before installing the drive, ejecting the packing disk, and discharging the static electricity before connecting the drive to the computer.

The authors conducted the test with 48 undergraduate students, who were told to focus on the primary task even if a secondary task was required. The results show that the extent of task loading exerted a significant influence on compliance—both overall and in particular for the discharging of static electricity. One factor that influenced performance was the level of prior experience with installing electronics—subjects with this experience did better than average at performing both the primary and the secondary tasks. The authors interpret this as demonstrating that familiarity with a task frees up resources that can be deployed to perform other tasks at the same time.

Wright, P.; Creighton, P.; Threlfall, S.M., *Some Factors Determining when Instructions Will be Read*, Ergonomics, 1982, 25 (3): 225-237.

This study investigates the influence of product and user characteristics on the likelihood that safety instructions will be read. Factors investigated included the familiarity, perceived safety, price, and simplicity of the products, as well as user age and the frequency of product use.

A group of 60 products, half of which were electrical devices, were selected for testing. Products in the electrical group were drawn from three categories: those with complex operating procedures, those with simple operating procedures, and those that were operated by battery power. The non-electrical products studied included "potions" (which included both cleaning agents and medicines), foods, and non-electric tools. Participants were provided with six-page booklets that included a set of six possible answers (for each product) about the likelihood and extent that they would read the instructions, as well as a general statement of the reason for their response.

A total of 44 subjects provided usable responses. Overall, participants indicated that they would not read the product instructions at all about one-third of the time, but would read *all* of the instructions in just over half (53 percent) of the cases they were presented with. Product complexity affected the willingness to read at least some of the instructions. Almost 83 percent of the participants indicated that they would read at least some of the instructions for complex electrical products, while almost half would not read any of the instructions that accompanied hand-powered tools.

The propensity for reading instructions also varied by age of the participants. Those who were over 50 were more likely on average to report that they would not read any instructions (38 percent, compared with 30 and 31 percent for those under 20 and those 31-50, respectively). However, this result held only for electrical products. Increased frequency of product use was also associated with reduced willingness to read all of the accompanying instructions.

Zeitlin, Lawrence R., *Failure to Follow Safety Instructions: Faulty Communication or Risky Decisions?*, Human Factors, 1994, 36 (1): 172-181.

Zeitlin used an experiment involving the use of an electric chain saw to test whether the failure to follow safety instructions was attributable to problems in communicating warnings or to the decisions of users to assume risks. Undergraduate students were first provided with a two-lecture sequence on human factors; the second lecture was different for the two groups of participants. Participants were also rated on the basis of their degree of familiarity with electric power tools (electric drills and chain saws).

The overall compliance rate with the safety instructions was 55 percent, but only 41 percent for those who had previous experience with chain saws. Most participants (87 percent) in both the experienced and inexperienced groups were able to recall the safety instructions after the experiment. On the basis of post-testing interviews, Zeitlin concluded that differences in warning compliance were best explained by subjects' prior experience and attitudes toward risk.