

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

**Prepared for the  
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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 7<sup>th</sup> and February 11<sup>th</sup>. 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 dryers 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<sup>1</sup>
  - a. Memory Limitations and Recall Decay Rates
  - b. Facilitating Encoding of Messages

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<sup>1</sup> 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 Krennek, 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.<sup>2</sup>

*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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<sup>2</sup> 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.<sup>3</sup>

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

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<sup>3</sup> 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".<sup>4</sup> 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

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<sup>4</sup> Among the studies cited by Hammond that were obtained and reviewed for this project are Eichelberger 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 Wooller, 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.