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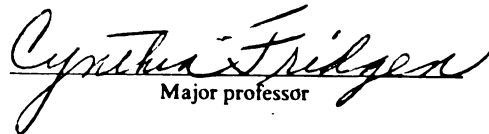
A CAUSAL MODEL FOR ENVIRONMENTAL ACTION: TESTING
THE THEORY OF REASONED ACTION THROUGH THE EMPIRICAL STUDY
OF HOUSEHOLD HAZARDOUS WASTE MANAGEMENT

presented by

WeiJun Zhao

has been accepted towards fulfillment
of the requirements for

Ph.D degree in Resource Development


Major professor

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**A CAUSAL MODEL FOR ENVIRONMENTAL ACTION:
TESTING THE THEORY OF REASONED ACTION THROUGH THE EMPIRICAL
STUDY OF HOUSEHOLD HAZARDOUS WASTE MANAGEMENT**

**by
Weijun Zhao**

A DISSERTATION

**Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of**

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ABSTRACT

A CAUSAL MODEL FOR ENVIRONMENTAL ACTION: TESTING THE THEORY OF REASONED ACTION THROUGH THE EMPIRICAL STUDY OF HOUSEHOLD HAZARDOUS WASTE MANAGEMENT

BY

Weijun Zhao

This research was designed to explore the relationship between environmental attitude and behavior within the context of household hazardous waste management. The objectives of this research were twofold: (1) to develop a specific instrument to assess people's appraisal of specific environmental hazards; and (2) to test the applicability of the theory of reasoned action to a special problem area, i.e. the management of household hazardous waste.

The data for this research were originally collected in the study of Human Disposition toward Hazards: Testing the Environmental Appraisal Inventory. Three new attitudinal measurements, i.e. Natural Hazards subscale, Technological Hazards subscale, and Behavioral Intention scale were constructed and their validity and reliability were assessed. A causal model was proposed to test the relationships between the major attitudinal variables and reported behaviors.

Four major conclusions were drawn from the results of the statistical analyses: (1) Technological Hazards subscale is a useful instrument capable of more precisely assessing people's attitudes toward the specific human-generated hazards;

WeiJun Zhao

(2) behavioral Intention mediates the relationship between attitude and behavior and is the best predictor of reported behaviors; (3) past experience with environmental pollution has a strong influence on people's actions to protect the environment; and (4) there is evidence to support the applicability of the theory of reasoned action to environmental attitude and behavior research.

The findings of this research will have a significant impact on the design and implementation of education programs, technical assistance programs and community programs to conserve and preserve the environment.

ACKNOWLEDGMENTS

I would like to acknowledge the many people that helped, encouraged, and supported me in my doctoral degree program. First, I want to thank my major professor and dissertation director, Dr. Cynthia Fridgen, for her generosity in allowing me to use her research data, and for her untiring work in reviewing, commenting, and editing the drafts of this dissertation. I owe a great debt of gratitude to her.

Special thanks and appreciation are extended to Dr. James Anderson, the former Vice Provost and Dean of the College of Agriculture and Natural Resources. Without his generous support and funding, this dissertation would not have been possible.

I want to express my thanks to Dr. Frank Fear, my former major professor and ongoing member of my guidance committee, for his persistent encouragement and support. The prompt feedback and comments regarding this dissertation from the dissertation committee members Dr. Joseph Fridgen and Dr. Christopher Vanderpool are deeply appreciated.

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TABLE OF CONTENTS

	Page
LIST OF TABLES	vi
LIST OF FIGURES	viii
 Chapter	
I. INTRODUCTION	1
Household Hazardous Waste	1
Programs for Control of Household Hazardous Waste	3
Environmental Attitude and Behavior Study....	5
Environmental Appraisal Inventory	6
The Expanded EAI	7
The Theory of Reasoned Action	8
Problem Statement	10
Research Objectives	16
II. LITERATURE REVIEW	18
Attitude and Behavior	18
A Definition of Attitude	18
Nature of Attitudes and Behaviors	20
A Definition of Behavior	21
Attitude and Behavior Inconsistency	24
The Theory of Reasoned Actions	28
The Principle of Compatibility	28
Behavior under Volitional Control	29
Predicting Behavior from Intention	31
Understanding Human Behavior:	
The Theory of Reasoned Action	33
Attitudes and Subjective Norms	34
Appraisal of Environmental Hazards	38
Environmental Appraisal Inventory	42
The Expanded EAI	45
III. RESEARCH METHODS	49
Source of Data	49
Sample Characteristics	51
Research Hypotheses	56
Practical and Theoretical Background for the Research Hypotheses	56
The Survey Questionnaire	64
The Research Variables	65

Dependent Variable	65
Independent Variables	66
The Research Model	70
Analysis Techniques and Procedure	75
Validity and Reliability Assessment	75
Correction for Attenuation	79
Path Analysis	80
Tests of Hypotheses	82
IV. FINDINGS AND DISCUSSIONS	88
Validity and Reliability Test	88
Comparison of the Two Specific Hazards	
Subscales	98
Correlation Analysis	102
Selecting Variables for Prediction ...	106
Path Analysis	110
V. SUMMARY, CONCLUSIONS AND IMPLICATIONS	117
Summary of the Study	117
Results of the Hypotheses Testing	122
Findings and Conclusions	124
Implications	130
Limitations of the Study	135
Recommendations for Future Research	137
BIBLIOGRAPHY	138
APPENDIX	146
Appendix A. The Original Survey Questionnaire	146

LIST OF TABLES

Tables	Page
2.1 The 24 Hazards used in the Environmental Appraisal Inventory	44
2.2 Comparison of Alpha Value of the Original EAI and the Expanded EAI	47
3.1 Comparison of Gender between the Sample and Michigan Population	52
3.2 Comparison of Age Characteristics between the Sample and Michigan Population	53
3.3 Comparison of Education between the Sample and Michigan Population	54
3.4 Comparison of Income between the Sample and Michigan Population	54
3.5 Correlation Matrix of the Four Attitude Scales	84
4.1 Factor Loadings of the Five Items in the Natural Hazards Subscale	91
4.2 Communalities of the Five Items in the Natural Hazards Subscale	91
4.3 The Results of Factor Analysis of the Natural Hazards Subscale	92
4.4 Factor Loadings of the Eight Items in the Technological Hazards Subscale	93
4.5 Communalities of the Eight Items in the Technological Hazards Subscale	93
4.6 The Results of Factor Analysis of the Technological Hazards Subscale	94
4.7 Comparison the Results of Factor Analysis of Three Attitudinal Scales	95
4.8 Comparison of Reliability of the Three Attitudinal Scales	96

4.9	The Results of Factor Analysis of Intention Scale and Its Alpha Value	97
4.10	The Results of Second Run of the Factor Analysis of Intentions Scale and Its Alpha Value	97
4.11	Comparison of Means and Standard Deviation of the Three Attitudinal Scales	100
4.12	Results of Paired t-tests	102
4.13	Observed Correlation Matrix of the Major Variables in the Study	105
4.14	Stepwise Regression Analysis for Selecting Variables Predicting the Behavioral Intention	108
4.15	Stepwise Regression Analysis for Selecting Variables Predicting Behavior	110
4.16	The Observed Correlation Matrix for the Research Variables in the Finalized Research Model	112
4.17	Path Coefficients for the Research Variables in the Research Model	113
4.18	Comparison of the Observed Correlations and the Reproduced Correlations of the Variables in the Research Model	115

LIST OF FIGURES

Figures	Page
2.1 The Theory of Reasoned Action	37
3.1 The Research Model	71
3.2 The Restructured Research Model	74
4.1 Path Coefficients of the Research Model	111

CHAPTER I

INTRODUCTION

Proper management and disposal of household hazardous waste (HHW) has been a growing concern in protecting the environment in recent years. This study uses the theory of reasoned action to analyze the relationship between environmental attitude and behavior in the context of household hazardous waste management. It also attempts to identify strategies for designing and implementing programs for managing HHW.

Household Hazardous Waste

Household Hazardous Waste is defined by the U.S. Environmental Protection Agency as a waste discarded from homes or similar sources that has any one of four characteristics: ignitability, corrosivity, reactivity, and toxicity (EPA, 1986). Commonly used substances such as paint thinners, household pesticides, cleaners and solvents, and some aerosols are potentially hazardous to human health and the environment. There are two major problems regarding the management of HHW: first, the general population is unaware of proper disposal methods and lacks knowledge about the long-

term consequences of improper disposal of these wastes; second, HHW is the single largest source of unregulated hazardous material entering the environment.

When hazardous household products are misused or improperly stored or disposed, residents are the ones most likely to be exposed to the dangers, and will be subject to the longest term exposure. The nature of some HHW also increases their potential damage to home environments over a period of time. Materials that are used infrequently are often stored in closets, basements, or garages for long periods of time. Materials such as paint thinners, solvents, and fertilizers may react within containers over the years, causing the containers to deteriorate. This further increases the potential danger to homeowners.

Some hazardous constituents will persist in the environment for long periods of time and are candidates for migration into the air, ground and surface water. Constituents from hazardous wastes can be leached as water percolates through the refuse in landfills. Some HHW are volatile. The constituents may become a part of the landfill gas generated through decomposition of organic materials. The gas may migrate and pose a health threat if found in high enough concentrations.

Possibly the greatest impact is on those who come in contact with these wastes. This could be the homeowner or disposal site personnel. By definition, these materials are

wastes, and therefore may not be handled with caution since people just want to get rid of them. Likewise their nature and the ways in which they are used and stored lead to exposure and potential injury. Thus, any program designed to reduce the amount of HHW from generator to disposal and to reduce the amount being stored by homeowners should be beneficial to all concerned.

Current Federal regulations exempt HHW from the regulations applicable to other types of hazardous waste. Refuse from homes, apartments, farms, and hotels may contain wastes that would otherwise be considered hazardous; however, current regulations do not prohibit them from being disposed with mixed municipal (nonhazardous) waste. The U.S. Environmental Protection Agency has stated that it would be virtually impossible to regulate all the small quantity generators in the country (Fridgen, 1992).

Programs for Control of Household Hazardous Waste

Concern and interest in HHW began in the early 1980s. Many activities on this topic have been initiated at local and state level. These activities include collection programs, education programs, and technical assistance programs. According to a survey conducted by the U.S. Environmental Protection Agency in 1986, the common goals of these programs can be summarized as follows: "1) Increasing awareness among

general public about the impact of HHW on human health and the environment; 2) Educating residents with best HHW disposal methods; 3) Removing HHW from homes, thus reducing exposure and potential injury; 4) Reducing danger to refuse collectors and other sanitation workers; and 5) Providing proper disposal for HHW" (EPA, 1986, p.6-1).

Public education is an important component of all these programs. According to the same survey, public education focuses on: "1) Making the public aware of the presence of hazardous materials in the home and the consequences of improper use and disposal; 2) Helping residents to select and use substitutes that are less hazardous; 3) Encouraging better home management practices such as buying only the amount of hazardous material that is needed at any one time; 4) Helping residents with proper storage and disposal methods; and 5) Promoting participation in HHW collection and recycling programs" (EPA, 1986 p.6-1).

The impacts of the educational aspects of HHW management programs are difficult to assess. Only the participation in the collection program gives a quantitative indication of the effectiveness of public education efforts. According to the EPA survey (EPA, 1986), participation rates in HHW collection programs have been low. In Vermont, Connecticut, Florida, Rhode Island, Washington, and Minnesota there are statewide active collection programs. But few programs can attract participation of even 1 percent of households in the

community, and several programs report participation of less than 0.2 percent (EPA, 1986).

The major purpose of most environmental education programs is to influence people's attitudes and, consequently, change their environmental behavior. Therefore, the success of public educational programs and other efforts dependent upon specific individual action may well depend upon people's understanding of the relationships among socio-economic characteristics, attitudes, and environmental values, knowledge, and behavior (Arbuthnot, 1973; Murch, 1974; Van Liere and Dunlap, 1980). Maloney and Ward (1973) said that "we must determine what the population 'knows' regarding ecology, the environment, and pollution; how they feel about it; what commitments they are willing to make; and what commitments they do make" (p.583). Studying and understanding the relationship between environmental attitude and behavior can help us develop more effective environmental education programs.

Environmental Attitudes and Behavior Studies

Studies for better understanding of environmental attitudes and behavior have multiplied rapidly in recent years. According to Padmanabhan (1981), the objectives of these studies have been: "1) Evaluating people's environmental attitudes by individuals and groups; 2) Identifying variables

that could explain observed differences in attitudes;

3) Investigating the impact of environmental attitudes on environmental behavior" (p.16).

Environmental Appraisal Inventory (EAI)

There have been several notable attempts to assess the relationship between the person and the environment. The best-known works were McKechnie's Environmental Response Inventory (McKechnie, 1974) and Rotter's Internal-External Locus of Control (Rotter, 1966). More recently, Schmidt and Gifford (1989) developed the Environmental Appraisal Inventory (EAI), a 72-item inventory based on a set of 24 hazards. The purpose of developing EAI was to provide a standard instrument to assess people's appraisal of different environmental hazards (Schmidt and Gifford, 1989). According to Schmidt and Gifford, these 24 hazards were selected to represent a range of types including (a) natural and technological hazards (e.g., earthquakes and chemical dumps); (b) hazards that have global- and local- scale impacts (e.g., changes to the ozone layer caused by pollution and smoking in public buildings); and (c) hazards that have long- and short-term impacts (e.g., hazards that accumulate over time, such as acid rain, and those that usually leave little trace once the source is terminated, such as fluorescent lighting); (d) indoor and outdoor hazards (e.g., office fumes and floods).

The EAI was designed to assess the appraisal of hazards

along three dimensions: First, the appraisal of threat to self, which measures the degree to which hazards are perceived to be threatening to the individual; second, the appraisal of threat to the environment, which measures the degree to which hazards are perceived to be threatening to the environment; and third, the appraisal of control, which measures the degree to which personal control is perceived in the face of hazards.

Schmidt and Gifford found through their preliminary test that the EAI is "an internally consistent and valid instrument for assessing how environmental hazards are appraised both as threats and in terms of the individual's control over those threats" (Schmidt and Gifford, 1989, p.64).

The Expanded EAI

In 1991, Fridgen (1992) studied the effects of a state-wide household hazardous waste management assistance and education program on people's attitudes and behavior in Michigan. The general objective of the Fridgen study was to explore the relationship between environmental disposition and people's commitment and action taken to protect the environment (Fridgen, 1992). Fridgen used the EAI as an instrument to test the perception of a different population. In the study, the EAI was expanded from the original 24 hazards to 28 hazards for application to a practical environmental problem, i.e., small quantities of nonregulated hazardous materials. A new scale, the responsibility scale,

was developed and added to the EAI to assess individuals' perceptions of their personal responsibility for environmental hazards.

The results of the Fridgen study showed that the expanded EAI can be used as a new independent instrument in studying the appraisal of environmental hazards (Fridgen, 1992). Adding the four items to each scale has increased the explanatory power of these scales. For instance, the mean score of the threat to self scale has increased from 3.41 in the original EAI to 3.7 in the expanded EAI (Fridgen, 1992). This means that after adding the four hazards, the respondents perceived more threat to themselves from these environmental hazards. The study also showed a positive relationship between people's appraisal of environmental hazards and their commitment to take action to control HHW. However, the study did not find a significant positive relationship between people's appraisal of environmental threats and their reported action to protect the environment (Fridgen, 1992). The relationship between commitment and behavior was not tested.

The Theory of Reasoned Action

As happened in the Fridgen study, many social scientists find inconsistent results in their studies on the relationship between attitude and behavior (Ajzen and Fishbein, 1977; Fishbein and Ajzen, 1975; Wicker, 1971). Repeated failures to obtain a strong consistency between attitude and behavior

forced many scientists to investigate the attitude-behavior relationship from different perspectives (Calder and Ross, 1973; Campbell, 1963; Defleur and Westie, 1963; Deutscher, 1973).

Fishbein and Ajzen (1975) developed the theory of reasoned action in which they proposed an intermediate variable -- behavioral intention variable -- to link attitudes and behavior. According to their theory, if one wants to know whether or not an individual will perform a given behavior, the simplest and probably most revealing thing that one can do is to ask the individual whether he or she intends to perform that behavior. What Fishbein and Ajzen developed is a causal model in which actions with respect to an object follow directly from behavioral intentions, and the behavioral intentions are consistent with the attitude toward the object.

Another important component of the theory of reasoned action is that the strength of an attitude-behavior relationship largely depends on the degree of correspondence between attitudinal and behavioral measurement (Fishbein and Ajzen, 1975). In other words, attitude and behavior would show a strong relationship when both are measured at an equivalent level of generality or specificity. Crespi (1971) and Weigel et al. (1974) concluded from their research that when both attitude and behavior are measured at a very specific level, a strong consistency between attitude and behavior can be demonstrated.

Ever since the theory of reasoned action was developed, it has received considerable attention and has been applied and tested in a wide range of areas and situations (Sheppard et al. 1988; Ryan and Bonfield, 1980). The theory has been supported and justified in a large number of studies (Ajzen and Fishbein, 1980; Manstead et al. 1983; Sheppard et al. 1988). However, the theory has not been studied and tested extensively in the area of environmental studies, especially in the area of hazardous waste management.

Problem Statement

The current study is an extension of the research work begun by Fridgen. The general purpose of this study is to apply the theory of reasoned action to the original data collected in the Fridgen study and analyze the relationship between environmental attitudes and behavior in the context of household hazardous waste management.

There are several research questions that are directly derived from the results of Fridgen's study. The first question is: **Is there a difference between people's appraisal of natural hazards and technological hazards?** As we mentioned before, the expanded EAI used in the Fridgen study was a 28-item inventory that covered a wide range of environmental hazards. What the expanded EAI measured was people's general attitudes toward general environmental hazards. The behavioral

criterion used in the same study was a very specific question that asked respondents whether they had acted on the information they had received from the Hazardous Materials Information Line(HMIL). Past researchers have shown that when attitudes are measured in general terms and behavior is measured in specific terms, the correlation between the attitudes and the behavior is low (Ajzen and Fishbein, 1977; Jaccards et al. 1977). This may be one of the reasons why high correlations between attitude and behavior could not be obtained in the Fridgen study. To realize a high correlation between attitude and behavior, we need to measure respondents' appraisal of environmental hazards and behavior at the same level of specificity. The behavioral criterion in the Fridgen study was a single yes or no response to action about the management of HHW and the attitudinal scales measured respondents' perceptions of different environmental hazards; therefore, the contents of both attitudinal and behavioral measurements were not correspondent to each other and also were not at the same level of specificity. The corresponding attitudes to be measured should be the attitudes toward the specific hazards caused by improper handling and disposal of HHW or related hazards.

Studies have shown that people perceive natural hazards and technological hazards differently (Churchill and Hutchinson, 1984; Dynes and Yulzy, 1965; Quarantelli and Dynes, 1976). The most commonly accepted classifications

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define those disasters or hazards -- such as floods, hurricanes, and earthquakes -- that result from uncontrollable forces of nature as natural disasters or hazards; and those disasters or hazards -- such as chemical dumps, acid rain, and radioactive fallout -- that derive from a loss of control over otherwise controllable systems as technological disasters or hazards (Baum, Fleming, and Davidson, 1983; Couch and Kroll-Smith, 1985). Natural hazards are usually perceived by victims as misfortunes, while technological hazards are often perceived by victims to be the result of human mistakes. According to these findings, in order to answer the first question, we need to construct two subscales: a natural hazards subscale and a technological hazards subscale from the expanded EAI and compare the respondents's appraisal cross the four scales: Self scale, Environment scale, Control scale, and Personal Responsibility scale.

After we identify the differences between people's appraisal of natural hazards and technological hazards, the second question is: **Is there a positive relationship between people's appraisal of specific types of hazards, such as technological hazards, and behavioral intention?** In the Fridgen study, there was a series of questions asking if respondents would be willing to take certain actions for disposal of hazardous waste, such as drive a certain distance or wait a certain amount of time or make certain number of phone calls in order to dispose of household hazardous waste

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(Fridgen, 1992). These variables were treated as the respondent's commitment to take action to control household hazardous waste. A positive relationship between people's appraisal of general environmental hazards and the commitment to take actions to control household hazardous waste was found in the Fridgen study.

The commitment variable in Fridgen's study can be considered a measure of respondents's behavioral intention toward the specific actions related to control of disposal of hazardous waste. However, according to Fishbein and Ajzen's theory of reasoned action, this behavioral intention is determined by the attitudes toward these hazardous wastes. We do not know whether this behavioral intention also has a positive relationship with respondents' appraisal of specific hazards, such as technological hazards. To answer this question we need to form a new behavioral intention scale and test the relationship between these two variables.

The third question is: **Is there a positive relationship between the behavioral intention and the behavior?** The relationship between the commitment and behavior was not tested in the Fridgen study. According to Fishbein and Ajzen's theory of reasoned action, behavioral intention plays an intermediate function between attitudes and behavior. Ajzen (1988) found out that intention has greater predictive validity than attitudes toward the behavior. Johnson (1985) also noted that behavioral intention is the best indicator of

actual behavior. Therefore, we need to test the relationship between the behavioral intention and the behavior using Fridgen's research data.

According to Fishbein (1973), attitude toward general objects is often a poor predictor when behavior is measured by a specific single act but a good predictor when multiple acts are used as the criterion of behavior (Tittle and Hill, 1967). Weigel and Newman (1967) learned from their research that attitude-behavior correspondence could be greatly increased by broadening the scope of the behavioral measurement. As we mentioned before, the behavior criterion used in Fridgen's study was either to act or not to act according to the call to the HMIL. This might be one of the reasons why a significant positive relationship between attitudes and behavior could not be found. We want to test whether, if we combine two or more single act criteria into a more comprehensive behavioral index, we find a closer relationship between the behavioral intention and the behavioral index.

The fourth question is: **What role does past experiences with environmental pollution play in people's behavioral intention and behavior?** The relationships between socio-economic background and environmental attitudes and behavior have always been an important area of study among social scientists (Arbuthnot, 1973; Murch, 1974; Van Liere and Dunlap, 1980). A frequently asked question is how do social and economic factors influence people's environmental

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responses? Fridgen (1992) studied the relationship between demographic and socio-economic variables and environmental attitudes and found that past experiences with environmental pollution had a positive relationship to people's attitudes toward environmental hazards. She also found that age was always negatively related to people's attitudes toward environmental hazards, i.e., young people tend to be more sensitive to environmental pollution. Because the relationships between socio-economic factors and people's environmental attitudes in Fridgen's study have already been tested and reported, the current study will not repeat these analyses. However, we do not know what role past experiences with environmental pollution play in influencing people's behavioral intention and behavior. The relationship between past experiences with environmental pollution and behavioral intention and behavior were not tested in the Fridgen study; therefore, this study will investigate the relationships between these important variables.

One of the major objectives of this study is to test the theory of reasoned action in the context of HHW management; therefore, our last research question is: **Is there evidence of a causal relationship between the research variables in the research model?** As Fishbein and Ajzen pointed out in the theory of reasoned action, there is a causal relationship between variables in their model: attitudes toward an object are the direct cause of behavioral intention, and behavioral

intention, in turn, is the direct cause of behavior in the question. The theory has been supported by a large number of studies (Ajzen and Fishbein, 1980; Manstead et al., 1983; Sheppard et al., 1988). We have discussed four major variables in the current study: (1) past experience with environmental pollution, (2) people's appraisal of different environmental hazards, (3) behavioral intention, and (4) behavior. It is important to apply Fishbein and Ajzen's model to Fridgen's data and to explore whether a causal relationship exists between these four variables. The results of this analysis can help us identify the important determinants in predicting environmental behavior.

In general, the reasoned answers to these research questions will have important impacts on designing and implementing education programs to conserve and protect our environment.

Research Objectives

The general objective of this study is to explore the relationship between environmental attitudes and behavior in the context of household hazardous waste management. Secondary data, originally collected in the Fridgen study, will be used in the current data analysis. The goals of this study are twofold: (1) to segment the expanded EAI scales and develop a specific instrument to assess people's appraisal of specific

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environmental hazards; (2) to apply Fishbein and Ajzen's theory of reasoned action to Fridgen's data and identify the major determinants predicting actions taken to protect the environment.

The specific objectives of the study are:

(1) To construct a Natural Hazards subscale and a Technological Hazards subscale from the expanded EAI and examine the differences in people's appraisal of these two types of hazards;

(2) To construct a Behavioral Intentions scale and test its relationship to people's appraisal of different environmental hazards;

(3) To construct an Action Index and test its relationship to behavioral intention;

(4) To determine the relationships between past experience with environmental pollution and people's environmental attitudes, behavioral intention, and behavior;

(5) To lay out a hypothesized causal model between the variables predicting behavior and test if a causal relationship exists between the variables in the model.

CHAPTER II

LITERATURE REVIEW

In this chapter, the literature from four study areas are reviewed: (1) attitude and behavior, (2) the theory of reasoned action, (3) appraisal of environmental hazards, and (4) the Environmental Appraisal Inventory. In the first part of the review, the definitions of attitude and behavior and the nature of attitude and behavior relationships are discussed. Special attention is given to a discussion of attitude and behavior inconsistency and concepts of general attitudes, specific attitudes and their relationship to behavior. The second part of the review describes the theory of reasoned action developed by Fishbein and Ajzen (1975). This model provides a theoretical basis for the current study. The third part of the review explains the differences between natural hazards and technological hazards. The last part of the review covers the Environmental Appraisal Inventory and how it was expanded by Fridgen (1992).

Attitude and Behavior

A Definition of Attitude

From the traditional point of view, attitude consists of three basic components -- cognitive, affective, and conative -

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- that exist in balance (Engel et al., 1968; Katz 1968; Lauer, 1971). A more contemporary view, proposed by Fishbein and Ajzen (1975), defines attitude as

...a person's location on a bipolar evaluative or affective dimension with respect to some object, action, or event. An attitude represents a person's general feeling of favorableness or unfavorableness toward some stimulus object (p.14).

Fishbein and Ajzen also treat the three basic components of attitude as independent constructs termed, respectively, belief, attitude, and intention (Ajzen, 1988). They outline a three-level causal sequence to explain the relationships between beliefs, attitudes, behavioral intentions, and behavior. First, an attitude toward some object is a function of the person's beliefs and is formed as a result of his or her affective or evaluative reactions associated with beliefs. Therefore, in many instances, attitudes are assessed by computing an index over responses to a set of belief items. Second, behavioral intentions are directly influenced by attitudes. And finally, the person's behavior is mainly determined by behavioral intentions (Fishbein and Ajzen, 1975).

A person's belief represents the information he or she has about the object, which can be any entity or action. The information can be any characteristic or dimension associated with the object. Therefore, a belief serves as a linkage between the information and some object (Fishbein and Ajzen,

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1975). For example, the belief that "dumping motor oil on the ground can contaminate surface water" links the object "dumping motor oil on the ground" to the information "contaminate surface water." Beliefs may be formed on the basis of direct observation, from information received through outside sources, or by way of various inference processes (Fishbein and Ajzen, 1975). When individuals make evaluative judgments about the information associated with the object, a belief "becomes" an attitude, or an attitude is formed.

In summation, the term attitude used in this study describes the affective or evaluative aspect associated with a belief and this belief serves "as the information base that ultimately determines attitudes, intentions, and behaviors" (Fishbein and Ajzen, 1975, p.14).

Nature of Attitude and Behavior Relationship

There are many factors that influence human behavior; these factors range from inner, organismic reactions to external, socio-cultural attributes (Moore, 1986). Moore and his colleagues (1985) defined human behavior as a person's physiological and psychological responses to the environment. Studies on physiological responses to the environment have been done on noise, indoor air quality, pollution, and building materials (Cohn et al., 1973; Farr, 1972; Levin and Duhl, 1984). Psychological studies of human behavior have focused on issues of human perception, cognition, meaning,

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symbolism, and affect (Moore, 1986).

An individual decodes or interprets incoming information through perception (Newcomb et al., 1965). Attitudes are part of the selective mechanism that controls perception, making incoming information compatible with existing attitudes and values (Lauer, 1971). When information is perceived as supportive of a prior attitude, the experience is more likely to have some reinforcing affect on the attitude and the information is more likely to be learned or retained (Lauer, 1971; Newcomb et al., 1965). If the incoming information is inconsistent with existing attitudes, however, the individual may tend to avoid exposure or misinterpret the incoming information. Therefore, information that is contradictory or otherwise inconsistent with a person's attitudes is likely to cause a reaction of selective perception, and the contradictory information is either avoided or rejected. A person may also misinterpret incoming information if it is inconsistent with his or her attitude. People may perceive and interpret the information in a manner that contrary to its original intent, but consistent with their attitudes (Engel et al., 1968).

A Definition of Behavior

Behavior is often defined either as overt action or verbal statements concerning behavior (Fishbein and Ajzen, 1980). However, some people assume a verbal response reflects

a person's attitude or personality trait, whereas nonverbal ("overt") actions represent behavior. Actually, this is a misleading concept. According to Ajzen(1988), both verbal and nonverbal responses are observable behaviors. Both responses reflect the same underlying disposition (Roth and Upmeyer, 1985; Upmeyer, 1981). How can we know if a person is honest or dishonest, dominant, or submissive? How can we know if a person agrees or disagrees on abortion, likes or dislikes a new environmental law? We can not directly observe or record these personal characteristics or attitudes since we have no access to the person's thoughts and feelings. These personal characteristics and attitudes are latent. They can be judged and inferred only from external, observable behaviors, either verbal or nonverbal (Jones and Davis, 1965; Kelley, 1971). Both types of behavior can be observed or recorded through standard scaling procedures. Only some responses are valid and adequate for the assessment of a given attitude (Ajzen and Fishbein, 1980; Jackson and Paunonen, 1985). Ajzen (1988) has quoted Merton's (1940) statement to support his argument:

The metaphysical assumption is tacitly introduced that in one sense or another overt behavior is 'more real' than verbal behavior. This assumption is both unwarranted and scientifically meaningless ... It should not be forgotten that overt actions may deceive; that they, just as 'derivations' or 'speech reactions', may be deliberately designed to disguise or to conceal private attitudes (p. 20).

McGrath (1964) also pointed out that behavioral

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observations are nothing more or less than one kind of data utilized by a behavioral scientist. He said:

Data are records of behavior gathered in a systematic manner. They are usually quantified or categorized in some manner. Some specific aspects are recorded and not others. Thus, data are coded records of selected aspects of behavior (p.30).

It should be clear that behavioral observations to validate attitude measurement instruments or to test the attitude-behavior relationship are only measures, and therefore are susceptible to the same errors of other variables. Further, as Ehrlich (1969) has pointed out:

While the operations for attitude scale construction are relatively well standardized, the operations for observing and recording behavior, particularly in natural settings, are generally unstandardized and problem-specific (p.29).

On studies of internal psychological responses to the environment, Moore (1986) also noted that:

These responses have no directly observable, objective measures. The measures of internal psychological processes are less quantifiable because they deal with more subjective aspects of human experience(p.1389).

Most tests of the "attitude-behavior" relationship are better conceptualized as tests of the relation between verbal and nonverbal indicators of the same underlying disposition. This increases the difficulty and complexity of the attitude-behavior study. However, in the current study, in line with

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common practice, we will continue to use the term of attitude-behavior relations.

Attitude and Behavior Inconsistency

In the past 50 years, the relationship between attitudes and behavior has received increasing attention (Fishbein, 1973). Two frequently asked questions are (1) whether attitudes predict behavior and (2) whether changing attitudes lead to changes in behavior. However, accurate tests of this relationship are difficult and have produced different and somewhat controversial results (Ajzen and Fishbein, 1977; Kiesler et al., 1969; Lemon, 1973; Olson, 1980). For example, Wicker (1971) reviewed 46 studies in which verbal and overt behavioral responses were obtained. He concluded that "Measured attitudes were often unrelated or only slightly related to overt behaviors, and rarely were attitude-behavior correlation coefficients above .30" (p.18). Similarly, in his review of attitudes and attitude change, McGuire (1969) stated that "attitude research has long indicated that the person's verbal report of his attitude has a rather low correlation with his actual behavior toward the object of the attitude" (p.156).

Generally there are two explanations for lack of a simple one-to-one relationship between attitudes and behavior. First, many studies utilize a general attitude measure to predict or explain a specific behavior (Ajzen and Fishbein, 1977;

Fishbein and Ajzen, 1975; Kiesler et al., 1969; Jaccard et al., 1977; Wells, 1980). Second, overt behavior is generally recognized as a function of both attitudes and other variables (Ajzen and Fishbein, 1977; Fishbein and Ajzen, 1975; Newcomb et al., 1966; Lauer, 1971; Wicker, 1971; Lemon, 1973; Olson, 1980).

One commonly accepted theory about attitude-behavior relationship is that a high correlation between attitude and behavior can be achieved when both attitude and behavior are measured at the same level of generality or specificity. In other words, attitude and behavior should be in close correspondence if attitude is to be used to predict behavior (Ajzen and Fishbein, 1977; Fishbein and Ajzen, 1975; Kiesler, et al., 1969; Wells, 1980). When attitudes are measured in general terms and behaviors in specific terms, the correlation between the attitudes and the behavior is low (Ajzen and Fishbein, 1977; Jaccard et al., 1977). Therefore, when we use general attitudes to predict or explain specific behaviors, attitude measures are less useful (Wells, 1980). Logically then, the way to improve the relationship between the attitude and the behavior is to bring the attitude and the behavior into closer correspondence.

To gain closer correspondence, a distinction should be made between an attitude toward an object and an attitude toward a behavior (Cohen, 1981). Where an attitude toward a behavior has been used, rather than an attitude toward an

object, significant correlation has been obtained (Ajzen and Fishbein, 1977; Fishbein and Ajzen 1975). For example, if the behavior under investigation is "disposal of household hazardous waste," then the relevant attitude used to predict or explain this behavior should be the individual's "attitude toward disposal of household hazardous waste" and not their "attitude toward households hazardous products in general".

Another example to illustrate the problems in attitude and behavior measurement is Heberlein and Black's (1976) study of the relationship between people's perception of environmental pollution and the purchase of lead-free gasoline. In their study, various predictors were used, ranging from a general attitude toward the environment, through attitudes toward air pollution and toward lead-free gasoline, to a general commitment to use lead-free gasoline. Finally, a single item was used to measure the respondent's behavior: whether s/he did or did not purchase lead-free gasoline.

It can be seen that the attitudes toward the environment and toward air pollution lacked any correspondence with the behavioral criterion. The attitudes toward lead-free gasoline just measured the attitudes toward the product in general, not toward the use of the product, so there was only a partial correspondence. And the remaining predictor, the general commitment to use lead-free gasoline, corresponded highly with the criterion. As might be expected, the prediction of

behavior became more accurate as the degree of correspondence increased. The correlations ranged from .12 to .21 under lack of correspondence, from .36 to .39 under partial correspondence, and from .50 to .59 for high correspondence.

While most researchers would agree that attitude is only one factor determining behavior, there is no agreement as to exactly which "other variables" are most important. Even for those who agree that attitudes also interact with other variables, there are two different points of view. One is that other variables interact with attitudes to determine behavior. The second suggests that other variables act separately, and when added to attitudes determine behavior (Fishbein and Ajzen 1975). Examples of other variables suggested by various authors include: personal and situational variables including other attitudes held by the individual; the presence of other people; the range of available alternative behaviors; the occurrence of unforeseen events (Wicker 1971); the necessary knowledge individuals have to connect attitudes to the relevant behaviors; the opportunities the actual situation could provide for individuals to perform attitudinal compatible behaviors (if no suitable alternatives are present, the individual may choose to perform some activity he or she dislikes); and the anticipated future consequences of behavior (Lemon 1973).

The Theory of Reasoned Actions

The Principle of Compatibility

In their discussion of research on attitude and behavior, Ajzen and Fishbein (1977) stated that the strength of an attitude-behavior relationship depends in large part on the degree of correspondence between attitudinal and behavioral entities. These entities consist of the following four elements: "the target at which the action is directed, the particular action or actions involved, the context in which the action occurs, and the time of its occurrence" (p.889). Accordingly, they formulated a "principle of compatibility." It can be stated as follows: "two indicators of a given disposition are said to be compatible with each other to the extent that their target, action, context, and time elements are assessed at identical levels of generality or specificity" (Ajzen, 1988, p.96).

When a behavioral criterion is based on a single observation, there always four specific elements involved. That is, a given action is always performed with respect to a given target, in a given context, and at a given time. For instance, a behavioral criterion can be "the person's participation or nonparticipation in next Sunday's hazardous waste collection day's activity in his or her community from 10 am to 4 pm." Here, the action element is participation or

nonparticipation, the target element is the hazardous waste collection day's activity, the context element is the community, and the time element is next Sunday from 10 am to 4 pm. In this case, the corresponding attitudinal predictor would be a measure of the person's evaluation of "participation in next Sunday's hazardous waste collection day's activity in your community from 10 am to 4 pm." In this case, the four elements in both attitudinal and behavioral criteria are specified and correspond highly with each other. However, when the criterion is based on multiple observations of behavior, one or more of the four elements may be generalized. For instance, in the above-mentioned example, if the hazardous waste collection day occurs every Sunday from 10 am to 4 pm, then the time element in both the behavioral and attitudinal criteria is generalized. Similarly, if the collection activity does not specifically occur in the person's community, then the context element may be generalized. In conclusion, the measurement procedure determines both the behavioral and the attitudinal entities. When both the behavioral and attitudinal entities are measured at the same level of generality or specificity, a strong relationship can be found.

Behaviors under Volitional Control

Many behaviors in everyday life can be thought of as being largely under volitional control (Ryan, 1970). That is,

people can easily perform these behaviors if they want to, or avoid performing them if they decide not to.

The important point about willful behaviors of this kind is that their occurrence is a direct result of deliberate attempts made by an individual. These deliberate attempts are defined by Ajzen (1988) as a person's intentions to engage in a certain behavior. Intentions are assumed to capture the motivational factors that have an impact on a behavior; they are indicators of how hard people are willing to try, of how much of an effort they plan to make, in order to perform the behavior. These intentions remain behavioral dispositions until, at the appropriate time and opportunity, an attempt is made to translate the intention into action. Assuming that the behavior is in fact under volitional control, the attempt will produce the desired act. This implies that the disposition most closely linked to a specific action tendency is the intention to perform the action under consideration. In other words, when dealing with volitional behavior, people can be expected to do what they intend to do. Therefore, if the prediction of a person's behavior is the primary objective of the study, the most efficient way to accomplish this is to obtain an appropriate measure of the person's intention. For instance, if we want to know whether or not an individual will donate money to a church, the simplest and probably most efficient thing that we can do is to ask the individual whether he or she intends to donate money to the church.

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Predicting Behavior from Intention

There are many examples in previous reports of intentions that are highly correlated with volitional behavior (Fishbein and Ajzen, 1975). McArdle (1972) obtained a high correlation between intentions and behavior in a group of patients with a drinking problem who were asked whether they intended to participate in an alcoholic treatment program in the hospital. This question was part of a long questionnaire. Immediately following the survey, the patients were given a sign-up sheet for admission to the treatment program. The correlation between intentions to participate and actual signing behavior was .76.

Another example was the high correlation between people's intentions to vote for a given candidate and their self-reported voting behaviors. Fishbein and Coombs (1974) found that correlations between intentions to vote and actual voting in the 1964 presidential election were .888 for Goldwater and .785 for Johnson. When intention is measured at the same level of specificity as behavior and has not changed between the time of measurement and the observation of behavior, intention is highly predictive of behavior.

Another argument of Fishbein and Ajzen is that intentions are close antecedents of overt actions (Ajzen, 1988). According to their theory, intentions are the immediate determinants of volitional behavior. They correlate more strongly with the behavior than other kinds of antecedents.

Consistent with this argument, Ajzen (1988) stated that "the predictive validity of intentions is typically found to be significantly greater than that of attitudes toward the behavior" (p.114). For example, in the study by Manstead et al. (1983) on the prediction of breast-feeding versus bottle-feeding of newborn infants, mothers' attitudes about alternative feeding practices had a correlation of 0.67 with the feeding method they actually employed. The intention-behavior correlation in this study was 0.82.

Very similar results were obtained with respect to cooperation in Prisoner's Dilemma games (Ajzen, 1971; Ajzen and Fishbein, 1970). In these games, two players can each choose between two possible moves, and their joint choices determine how much each player wins or loses (their pay-offs). One option in the game represents a cooperative move, the other a competitive move. The participants in the studies were pairs of same-sex college students who played three Prisoner's Dilemma games that varied in their pay-off matrices. Following a few practice trials, the players were asked to complete a questionnaire that include two semantic differential measures of attitude, each comprised of four or five bipolar evaluative scales. These scales were used to obtain measures of attitude toward choosing the cooperative strategy and attitude toward the other player. The proportion of cooperative strategy choices following completion of the questionnaire served as the behavioral criterion. Looking at

the three games played in the two experiments, the actual choice of cooperative moves correlated 0.63, 0.70, and 0.65 with attitude toward choosing the cooperative strategy. When predicted from intentions, correlations with game behavior were found to be in the 0.82-0.85 range.

Understanding Human Behavior: The Theory of Reasoned Actions

As we mentioned before, if the primary objective of a study is to predict a person's behavior, then the most efficient way to achieve this goal is to measure the person's intention. Knowing the person's intention, however, does not provide much information about the reasons for behavior. As is common in social science, one of the important goals of our study was to understand human behavior, not merely predict it. We need, therefore, to identify the factors that determine the person's intention and actual behavior.

Developed by Fishbein and Ajzen (1975), the theory of reasoned action was designed to accomplish this goal. This theory is based on the assumption that human beings usually behave in a sensible manner, that they take account of available information and implicitly or explicitly consider the implications of their actions. Consistent with its focus on volitional behavior, the theory assumes that a person's intention to perform (or not to perform) a behavior is the immediate determinant of that action. People are expected to act in accordance with their intention aside from unforeseen

events.

Johnson (1985) also proposed a similar theory in which he considered behavioral intention as the best indicator of actual behavior. He also noted that time and opportunity played a vital role in turning the intention into actual behavior. This is consistent with Fishbein and Ajzen's (1975) theory that a person's intention may change over time, and this change may occur before the individual has the opportunity to perform that behavior. This is the key to understanding the relationship between behavioral intention and actual action.

Attitudes and Subjective Norms

According to the theory of reasoned action, intentions are a function of two basic determinants: attitudes toward the behavior and subjective norms. Attitude toward the behavior is the individual's positive or negative evaluation of performing a given behavior. Traditional measures of attitude toward an object can influence a given behavior only indirectly, while attitude toward the behavior has direct linkage with the behavior. Subjective norm is defined as the person's perception of social pressure to perform or not to perform a particular behavior under consideration. According to the theory of reasoned action, people tend to perform a behavior when they evaluate it positively and when they believe that important others think they should perform it.

Attitude toward the behavior is the expression of personal beliefs, while subjective norm is the reflection of other people's beliefs or social influence on the person to perform or not perform the action (Ajzen, 1988). For instance, Manstead et al. (1983) studied women's preferences of infant feeding methods. The measurements of attitude toward the behavior were obtained by asking respondents to evaluate each statements as "breast-feeding protects a baby against infection," or "bottle-feeding provides incomplete nourishment for a baby." Meanwhile, subjective norms were measured by asking respondents what others, such as the baby's father, the mother's own mother, or her closest female friend thought about the mother's using a particular feeding method. The statement used was "In general, how much do you care what the baby's father thinks you should do?" In most of the situations, subjective norms are assessed by asking respondents to judge how likely it is that most people who are important to them would approve or not approve of their performing a given behavior.

The theory of reasoned action assumes that the relative importance of attitude toward the behavior and subjective norm depends in part on the intention under investigation. For some intentions attitudinal consideration are more important than normative considerations, while for other intentions normative considerations predominate. In most of the cases, both factors are important determinants of the intention (Fishbein and

Ajzen, 1975). Figure 2.1 is a graphic representation of the theory of reasoned action.

According to Ajzen (1988), the relative weights of the attitudinal and normative factors may vary from one person to another, and their relative importance in predicting behavioral intentions may vary from one case to another. For instance, on the matter of abortion, for some people their attitude toward abortion may be a more decisive factor than the normative information, such as other people's beliefs or the social opinions on abortion, in determining their abortion intention; for other people, the situation may be reversed. It is same in the use of marijuana; some people may take the social pressures for not using marijuana more seriously than others. In this case, the subjective norm is more important in determining the individual's intention to not use marijuana.

In summary, a person's action with respect to an object follows directly from the individual's behavioral intention. The behavioral intention is determined by the attitudes toward the action and the subjective norm. The behavioral intention functions as a mediating factor between the attitudes toward the action and performing the action. The theory of reasoned action provides an useful tool for explaining human behavior and it will be used as a theoretical guideline in constructing the research model in the current study. We can see from the literature review that the theory of reasoned action has been applied and tested in a wide range of areas, such as political

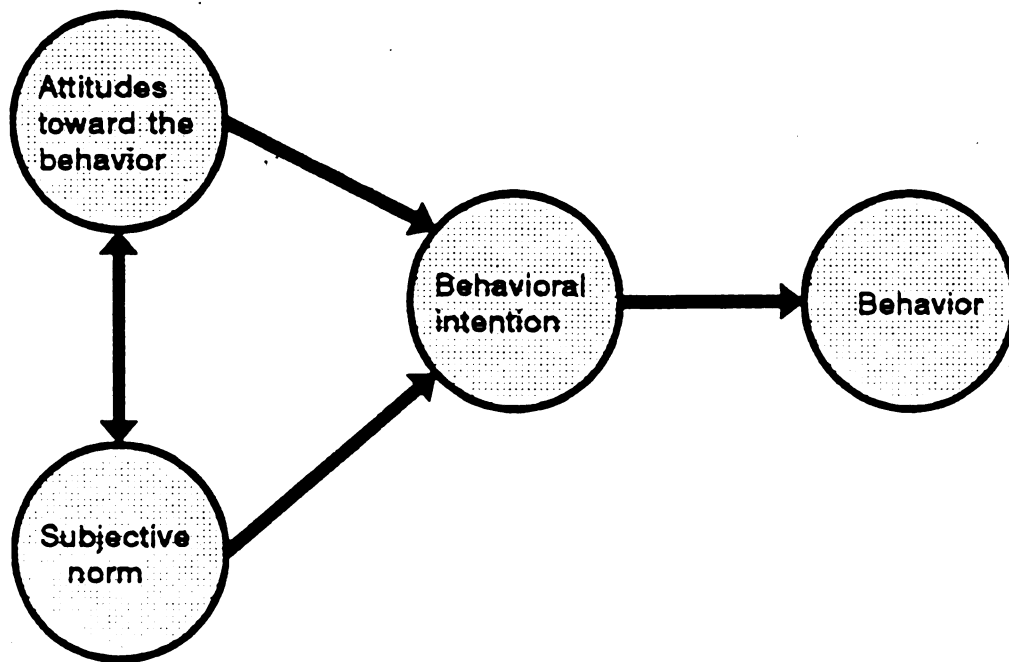


Figure 2.1 The Theory of Reasoned Action

voting, abortion, breast feeding of infants, patients with drinking problems, consumer behavior, and many other areas. However, the theory has not been studied and tested in the area of environmental studies, especially in the area of hazardous waste management. The current study is an attempt to test the theory in the area of hazardous waste management. Since normative information on disposal of household hazardous waste, such as how other people's opinions or social influences impacted the individual to form the behavioral intentions, was not recorded in the Fridgen study, subjective norms are omitted in this study. We add past experience with environmental pollution into the model as a predicting factor to behavioral intentions. These modifications will be discussed in detail in the next chapter.

Appraisal of Environmental Hazards

The ways people respond to or assess an environmental event are often called environmental appraisal. This appraisal is defined as the individual's psychological response to the stimulus and the situation (Lazarus, 1966). Different people may appraise the same environmental events differently because of the characteristics of the event, the individual, and the interactions between the individual and the event (Paterson and Neufeld, 1987, Schmidt and Gifford, 1989). Understanding how people appraise an environmental event is important since

it is directly related to how people will cope and react to the situation. The essence of the study of environmental appraisal is to understand the relationship between environment and the human being. Eventually, it is to comprehend the relationship between environmental attitudes and behaviors. As Schmidt and Gifford (1988) noted, "appraisal has been considered as a mediator that may have strong impact on environment-behavior relations in many areas" (p.58).

There has been a growing interest in studying environmental appraisal in recent years (Baum, Fleming, and Davidson, 1983; Couch and Kroll-Smith, 1985; Fridgen, 1992; Paterson and Neufeld, 1987; Lazarus and Folkman, 1984; Schmidt and Gifford, 1989). The focus of these studies was on people's appraisal of environmental stressors or hazards. Several appraisal instruments have been developed and tested (Cohen, Kamarck, and Mermelstein, 1983; Fridgen, 1992; Schmidt and Gifford, 1989). Researchers have shown that the degree to which people experience an environmental event as a threat and stressful is strongly influenced by appraisal (Fisher, Bell, and Baum, 1984). Appraisal is a process of accumulating and critically evaluating information on causes, danger, and future threat of an event (Bachrach and Zautra, 1985; Baum, Fleming and Singer, 1983). It is the most critical factor in predicting how people cope and otherwise respond to stressful life events (Lazarus, 1966, 1981; Lazarus and Launier, 1979; Rochford and Blocker, 1989). Baum, Fleming, and Singer (1983)

further suggested that "the ways in which people interpret and define stress are more important than are the stressors' objective characteristics" (p.130).

Traditionally, people have defined natural hazards and technological hazards differently (Churchill and Hutchinson, 1984; Dynes and Yutzy, 1965; Quarantelli and Dynes, 1976). The most commonly accepted classification for floods, hurricanes, and earthquakes -- disasters that result from uncontrollable forces of nature -- is natural disasters or hazards. Those resulting from chemical dumps, acid rain, and radioactive fallout, which derive from a loss of control over otherwise controllable systems, are technological disasters or hazards (Baum, Fleming, and Davidson, 1983; Couch and Kroll-Smith, 1985). Natural hazards are usually perceived by victims as misfortunes while technological hazards are perceived by victims to be the results of human mistake.

Technological and natural hazards have been conceptually distinguished along these very lines: Technological hazards pose a continuing threat while natural hazards do not (Baum, Fleming, and Davidson, 1983; Baum, Fleming, and Singer, 1983). Hazards such as toxic contamination (Edelstein, 1988; Levine, 1982) or radiation releases such as occurred at Three Mile Island (Walsh, 1981) are generally perceived by victims as threats that are long-lasting and indefinite. Conversely, natural hazards are "chance-events" whose effects are short-lived (Baum, Fleming, and Davidson, 1983). The probability of

repeated natural catastrophes is, therefore, viewed as minimal.

Differences in appraisal often lead to different coping strategies (Rochford and Blocker, 1989). For natural hazards, which are usually appraised as uncontrollable, people often cope with emotional responses, such as simply accepting the situation since nothing could be done; while for technological hazards, people normally cope with action-focused responses that involve individual attempts to alter the stress-provoking situation (Lazarus, 1966, 1981).

However, Rochford and Blocker (1989) challenged the traditional dichotomy between natural and technological hazards. They studied people's appraisal of future threat of flooding and individual coping strategies after a flooding disaster. They found that some people viewed flooding as controllable so that these people actively participated in social protest to prevent future flooding. Those who interpreted flooding as an uncontrollable act of nature remained uninvolved in the social protest. This is quite different from the traditional point of view that flooding is always uncontrollable. Rochford and Blocker (1989) believe that this differences in perception arises "because humans in the modern context perceive the natural world as increasingly within the realm of their control. Some disaster events previously understood as natural and uncontrollable are now often interpreted as within the bounds of scientific

prediction, if not control" (p.187).

In conclusion, people's appraisal of environmental hazards determines their psychological response to an event. This response is a cumulative function of the nature of the event, the individual, and the interaction between the individual and the situation in which the event occurred. Appraisal is the most important factor in predicting an individual's coping strategies to an environmental event. People usually appraise natural hazards and technological hazards differently. The differences in appraisal can help us understand why people vary in actions in responding to an environmental event. These findings will provide a good foundation to formalize the research model herein and reconstruct the attitude scales.

Environmental Appraisal Inventory

The Environmental Appraisal Inventory (EAI) developed by Schmidt and Gifford (1989) is a 72-item inventory that is based on a set of 24 hazards. The purpose for developing the EAI was to provide a standardized instrument to "assess appraisal as an individual difference variable" (Schmidt and Gifford, 1989, p. 58) in studying relationships between environment and behavior. According to Schmidt and Gifford, these 24 hazards were selected to represent a range of types including: (a) natural and technological hazards (e.g.,

earthquakes versus chemical dumps); (b) hazards that have global- and local-scale impacts (e.g., changes to the ozone layer caused by pollution versus smoking in public buildings); and (c) hazards that have long- and short-term impacts (e.g., hazards that accumulate over time, such as acid rain, versus those that usually leave little trace once the source is terminated, such as fluorescent lighting); and (d) indoor and outdoor hazards (e.g., office fumes versus floods). The 24 hazards used in the Environmental Appraisal Inventory are shown in Table 2.1.

According to Schmidt and Gifford, the EAI is designed to assess the appraisal of hazards along three dimensions. These dimensions are measured on three scales. First, the appraisal of threat to self scale (Self) measures the degree to which hazards are perceived to be threatening to the individual. Second, the appraisal of threat to the environment scale (Environment) measures the degree to which hazards are perceived to be threatening to the environment. Third, the appraisal of control scale (Control) measures the degree to which personal control is perceived in the face of hazards (i.e., how much control the individual could exercise against a hazard if it became a threat).

The EAI is a repeated measures design. The 24 items are to be evaluated three times by each respondent, once in each of the above three dimensions. The three scales all use a seven-point Likert response scale,; but the content of the

Table 2.1 The 24 Hazards Used in the Environmental Appraisal Inventory

1. Water pollution
2. Storms-lightning, hurricanes, tornados, snow, etc.
3. Pollution from cars, factories, and burning trash
4. Smoking in public buildings
5. Acid rain
6. Pollution from office equipment, e.g., ozone from photocopiers
7. Number of people-crowding, increasing population
8. Fluorescent lighting
9. Water shortage, e.g., drought, water depletion
10. Noise pollution
11. Visual pollution-billboards, litter, etc.
12. Radioactivity in building materials, e.g., radon gas
13. Change to the ozone caused by pollution
14. Earthquakes
15. Soil Erosion
16. Impure drinking water
17. Forest fires
18. Floods or tidal waves
19. Germs or micro-organisms
20. Radioactive fallout
21. Fumes or fibers from synthetic materials-asbestos, carpets, plastics, etc.
22. Chemical dumps
23. Video screen emissions
24. Pesticides and herbicides

responses are different. For the Self and Environment scales, the response alternatives are 'no threat', 'minimal', 'mild', 'strong', 'very strong', and 'extreme'; while for the Control scale, the response alternatives are 'none', 'minimal', 'little', 'moderate', 'much', 'very much', and 'complete'.

The preliminary results from the test of the EAI scales have shown the value of the EAI for assessing environmental hazard appraisal. Schmidt and Gifford (1989) reported that:

First, the pattern of intercorrelations among the three EAI scales suggests that the perception of threat from hazards and perceived control over them are separate constructs. Second, the appraisal of threat to oneself and to the environment are related. This is not surprising because threats to the environment often do also pose a risk to persons in that environment. Third, a significant difference was found between the Self and Environment means with hazards in general appraised as more threatening to the environment than to the self (p.65).

The Expanded EAI

In the Fridgen (1992) study an additional scale, the Responsibility scale, was developed and included in the EAI. The purpose of including the Responsibility scale was "to explore the idea of conscience as a motivator of positive environmental action and high commitment to environmental quality" (Fridgen, 1992, p. 29). According to Fridgen, appraisal of people's perceived moral responsibility over hazardous environmental events has not been fully studied and understood. In recent years the discussion of inter-generational justice is an example of the growing interest in the personal responsibility trait in regulating positive environmental action. It is commonly recognized that protecting our present environment and sustaining the use of natural resources are the moral responsibility of this generation to the next generation. This moral responsibility is a function of personal belief and may become a predictor of human behavior regarding environmental protection. Therefore, adding the Responsibility scale increased the scope of the EAI

to study the relationship between environment and humans. The appraisal of the personal responsibility scale measures the degree to which an individual may assume personal responsibility for the existence of a hazard (Fridgen, 1992).

In addition, four items were added by Fridgen to the original EAI scales to emphasize the context of the study -- hazardous waste management -- and to increase the weight of respondent's appraisal of waste hazards and environmental pollution caused by improper waste management. These four items were:

- 25. Groundwater pollution from landfill seepage
- 26. Air pollution from waste to energy incinerators
- 27. Surface water contamination from discarded motor oil
- 28. Ocean pollution from dumping municipal solid waste

Because one more scale was added to the original EAI and four additional items were added to each scale, the expanded EAI was then treated as a new instrument and the validity and reliability of this new instrument were tested (Fridgen, 1992).

The results from factor analysis showed that the 28 items held together as a single construct and "the addition of the four new items did not reduce the internal validity of the scale" (Fridgen, 1992, p.38). For each new scale, "the first factor had an Eigenvalue that explained 43 percent or more of the variance within the scale" (Fridgen, 1992, p.38).

The reliability of the expanded EAI was assessed through

an examination of the internal consistency of each scale. Comparison of the Alpha values of the original EAI scales and the expanded EAI scales showed that the later have higher reliability than that of the original ones (Table 2.2).

Table 2.2. Comparison of Alpha Value of the Original EAI and the Expanded EAI

Scale	Alpha Value	
	Original EAI	Expanded EAI
You	.93	.95
Environment	.92	.95
Control	.95	.96
Responsibility	N/A	.96

Source: Fridgen, 1992, p.40.

The preliminary results from administering the expanded EAI to a new sample population, demonstrated that the expanded EAI can be used as an improved instrument in studying the appraisal of environmental hazards (Fridgen, 1992). The expanded EAI expanded the conceptual framework of the Schmidt and Gifford study (1989) by creating a new Responsibility scale. Adding the four items to each scale increased the explanatory power of these scales as an appraisal measurement. For instance, the mean score of the Self scale has increased from 3.41 in the original EAI to 3.7 in the expanded EAI (Fridgen, 1992, p.39). This means that after adding these four hazards, the respondents perceived more threat to

themselves from these environmental hazards.

As Schmidt and Gifford point out, there is a significant need to develop and use standardized tools that can assess the person-environment interface. Fridgen successfully expanded the original EAI as a research instrument. The expansion of the instrument "to the realm of threats from pollution increases the utility of the instrument in a broader arena of environmental studies" (Fridgen, 1992, p.61).

CHAPTER III

RESEARCH METHODS

This chapter covers two broad areas: (1) the research data and (2) the methodology employed in completing the study. In the first part, the sources of data, sample characteristics, research hypotheses, and the practical and theoretical bases for the research hypotheses are discussed and presented.

In the second part, the research variables and measurement, the construction of new attitudinal and behavioral scales, and the methods used in analyzing data and testing the hypothesized model are outlined and explained.

Sources of Data

The data for this research were originally gathered in the study of Human Disposition toward Hazards: Testing the Environmental Appraisal Inventory (Fridgen, 1992). Since small quantities of HHW are not monitored and their disposal is not regulated, there is a need to help Michigan citizens better manage their small quantities of hazardous materials. To protect people's health and environment, the W.K. Kellogg Foundation funded a statewide assistance and education program

in March of 1989. The purpose of the program was to provide a convenient, low-cost channel for Michigan citizens to gain information about hazardous materials and gain assistance in the proper disposal of these materials. The basic hypothesis of the Fridgen study was that "with appropriate education and assistance, citizens would have the confidence to take control of their decisions regarding hazardous materials and exhibit responsible behavior" (Fridgen, 1992. p.2).

To implement the Kellogg Foundation-funded program, four full-time agents were hired as District Hazardous Materials Management Agents. These agents were equipped with an 800 toll-free information line and a computerized information database. This database was developed with current information and best practices recommendations regarding hazardous waste management. In this way the agents could respond quickly to requests for information from callers. In addition, the agents also provided callers with educational materials and information about upcoming workshops and related activities on hazardous waste control.

In the first year of the project (1989-1990) over 3,000 of Michigan's citizens accessed the Hazardous Materials Information Line (HMIL). To evaluate the relative success of this program and to determine the change in attitudes and beliefs as a result of agent efforts, a questionnaire was sent to 482 individuals who called the HMIL over a nine-month period between November 1, 1989, and July 31, 1990. Of those

mailed-out questionnaires, 11 could not be delivered. A total of 471 surveys were received by potential respondents. After a follow-up letter to nonrespondents, a total of 289 questionnaires were returned, a response rate of 61.2 percent.

Sample Characteristics

The sample population was compared to Michigan's population. The purpose of comparing demographic characteristics between sample and ambient population was to document the representativeness of the sample and thereby determine the generalizability of the study. The sample population of the original study was not randomly selected. The original questionnaire was mailed to those who called the Hazardous Material Information Line between November 1, 1989, and July 31, 1990. These people were defined as environmentally "concerned citizens." Therefore, the sample probably represent only those who were concerned about hazardous waste management.

With respect to gender distribution (Table 3.1), male and female distribution were similar to statewide distribution. With only a 2 percent difference between the sample and the Michigan population, it can be said that gender distributions were appropriately represented.

Table 3.1 Comparison of Gender between the Sample and Michigan Population

Gender	Sample		Michigan	
	N	%	N (in thousand)	%
Male	145	50.5	4,513	48.5
Female	142	49.5	4,783	51.5

Source: U.S. Department of Commerce. (1990). 1990 Census of Population and Housing: Summary Population and Housing Characteristics Michigan (CPH-1-24)

Note: Valid cases are 287 for research sample.

For age distribution (Table 3.2), the sample generally overrepresented all age group categories with the exception of the group 18 to 25 years old, which was underrepresented. About 97 percent of the respondents ranged in age from 25 to 65 or more. Approximately, 53 percent of the sample was 25 to 55. Comparing the age distribution of the sample with the 1990 census data, it is clear that the respondents of the study were older than the average for Michigan residents.

Education levels of respondents were quite high (Table 3.3). More than 96 percent of the respondents had completed high school; about 50 percent reported that they had a college degree. For Michigan residents, about 93 percent have completed high school and only about 18 percent have a college degree. Therefore, the sample underrepresented those with a high school or less than high high school education, and

overrepresented those with college or higher degrees.

Income data presented in Table 3.4. For the 277 respondents who answered this question, incomes ranged from low (less than \$10,000 category) to high (over \$70,000 category). From a comparative perspective, respondent incomes were quite high. Thirty-three percent of the study sample reported incomes over \$50,000; in contrast, only 25.3 percent of Michigan respondents report having incomes in that category.

Table 3.2 Comparison of Age Characteristics between the Sample and Michigan Population

Age	Sample		Michigan	
	N	%	N (in thousand)	%
18 to 25	9	3.2	1,005	10.8
25 to 45	135	38.4	2,981	32.1
45 to 55	43	15.4	948	10.2
55 to 65	44	15.8	795	8.5
65 and over	48	17.2	1,108	11.9

Source: U.S. Department of Commerce. (1990). 1990 Census of Population and Housing: Summary Population and Housing Characteristics. Michigan. (CPH -1-24).

Note: Valid cases are 279 for research sample.

Table 3.3 Comparison of Education between the Sample and Michigan Population

Education	Sample		Michigan	
	N	%	N (in thousand)	%
Less than HS	10	3.6	453	7.7
High School	42	15.0	2,791	47.4
Some College	60	21.4	1,191	20.2
Assoc. or Tech	24	8.6	393	6.6
College	78	27.9	678	11.5
Graduate or Prof.	66	23.6	376	6.3

Source: U.S. Department of Commerce. (1990). 1990 Census of Selected Social Characteristics: Educational Attainment Michigan. (CPH -L -80).

Note: Valid cases are 280 for research sample.

Table 3.4 Comparison of Income between the Sample and Michigan Population

Income	Sample			Michigan	
	N	%		N (in thousand)	%
Less than \$10,000	18	6.5	Less than 10.000	534	15.5
\$10,000 - \$19,999	29	10.5	\$10,000 - \$14,000	294	8.5
\$20,000 - \$29,999	68	24.5	\$15,000 - \$24,999	562	16.4
\$30,000 - \$39,999	38	13.7	\$25,000 - \$34,999	526	15.3
\$40,000 - \$49,999	31	10.7	\$35,000 - \$49,999	639	18.6
\$50,000 - \$59,999	45	15.6	\$50,000 - \$74,000	557	16.2
\$60,000 - \$69,999	21	7.6	\$75,000 and more	313	9.1
\$70,000 or more	27	9.3			

Source: U.S. Department of Commerce. (1990). 1990 Census of Economic Characteristics: 1989 Households Income and Poverty Status Michigan. (CPH -L -80).

Note: Valid cases are 277 for research sample.

In summary, the sample in this study are individuals with higher education and higher income levels than the ambient population. The gender of the sample is almost equally distributed, and about 53 percent of the sample ranged in age from 25 to 55.

The differences in the demographic profile between the study sample and Michigan residents could be explained in two ways. First, as mentioned before, the research sample was not randomly selected from the Michigan population. The sample consisted of those who had called the Hazardous Materials Information Line during a nine month period. According to past research, environmental concern is positively associated with social class as indicated by education, income, and occupational prestige (Van Liere and Dunlap, 1980; Murch, 1974); therefore, these individuals could be considered as "environmentally concerned people." The distribution of the sample might be reflected by the characteristics of those who were concerned about environmental quality.

Second, according to Rogers' (1983) adoption and diffusion theory, those who called the Hazardous Materials Information Line could be considered early adopters. The socio-economic profile of early adopters is usually higher income and education than the population as a whole (Fridgen, 1992).

Research Hypotheses

Based on the problem statement, the following research hypotheses will be tested in the study:

1. The survey respondents will appraise natural hazards differently than they will appraise technological hazards;
2. Attitudes toward technological hazards will be positively related to respondents' intentions to properly manage hazardous materials;
3. Respondents' intentions for proper management of hazardous materials will have a positive relationship to the reported actions for that purpose;
4. Past experience with environmental pollution will be positively related to respondents' intentions to properly manage hazardous materials; and
5. Past experience with environmental pollution will be positively related to respondents' behavior to properly manage hazardous materials.

Practical and Theoretical Basis for the Research Hypotheses

The research hypotheses for this study were built on the following practical and theoretical considerations:

- (1) People will appraise natural hazards and the hazards caused by improper disposal or management of hazardous waste

differently.

In Fridgen's study (1992), the expanded EAI consisted of 28 items which covered a wide range of environmental hazards. These hazards included (a) natural and technological hazards; (b) hazards with global- and local-scale impacts; (c) hazards with long- and short-term impacts; and (d) indoor and outdoor hazards (Schmidt and Gifford, 1989; Fridgen, 1992). Therefore, the Inventory was actually measuring people's general attitudes toward general environmental hazards, and not specific attitudes towards specific hazards. According to Ajzen and Fishbein's (1975) "principle of compatibility," this general attitude would not be compatible with any specific behavioral indicator. Schmidt and Gifford (1989) have suggested that EAI subscales could be developed as a "Large Natural Hazard Subscale" and an "Indoor Workplace Hazard Subscale" (p.66). As we have discussed in the previous chapter, past researchers have demonstrated differences in people's appraisal of natural hazards and technological hazards, and these differences often lead to different coping strategies. In the current study, we hypothesize that the respondent will appraise natural hazards differently from technological hazards. The term "technological hazards" as used here specifically means hazards that are caused by improper disposal of household hazardous materials. The term technological hazard is still broadly defined, but it is difficult to find an alternative term to classify the kind of

hazards we want to describe; therefore, we will still use the term technological hazard.

(2) Attitudes toward technological hazards will be positively related to behavioral intentions to properly manage hazardous materials.

According to the theory of reasoned action, attitudes are formed reasonably from the beliefs people hold about the object of the attitude, just as intentions and actions follow reasonably from attitudes (Ajzen, 1988). Generally speaking, people form beliefs about an object by associating it with certain attributes, i.e., with other objects, characteristics, or events. Since the attributes that come to be linked to the object are already valued positively or negatively, people automatically and simultaneously form an attitude toward the object. In this manner, an individual learns to like objects that he or she believes have largely desirable characteristics, and an individual forms unfavorable attitudes toward objects that he or she associates with mostly undesirable characteristics. For instance, people usually link tobacco with lung cancer, and attitudes toward smoking are negative. Here, lung cancer is an attribute associated with tobacco, and tobacco is valued negatively. Therefore, following the beliefs that tobacco can cause lung cancer, unfavorable attitudes are formed toward smoking tobacco. However, if one doesn't believe that smoking causes lung cancer, he or she might form either neutral or even positive

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attitudes toward smoking tobacco.

It has usually been assumed that a person's attitude toward an object can be used to predict his or her behavior with respect to the object. However, according to the research work of Fishbein and Ajzen (1975), the performance or nonperformance of a specific behavior usually cannot be predicted from the person's attitude toward that object. Instead, a specific behavior is more likely to be predicted by the person's intention to perform that behavior. Therefore, we assume that when people feel a strong threat to themselves and to the environment from technological hazards, they will intend to take some action to control technological hazards and to reduce the threat. Since people's appraisal of technological hazards is negative (feel threat), then their attitudes toward the behavior (control of technological hazards) will be positive. This is because "threat to humans is the primary motivator of changed behavior" (Van Liere and Dunlap, 1978, p. 12). And since people's behavior, in most cases, is under volitional control, then we assume that positive attitude toward the behavior will lead to positive behavioral intentions.

(3) Behavioral intentions will have a positive relationship with the improved action index.

In Fridgen's (1992) study, the action variable was a dichotomous variable with a yes or no answer to measure the respondents' behavioral response to information received from

the Hazardous Materials Information Line (HMIL). Although all the participants in the survey were those who called the HMIL and can be considered "concerned citizens," the purposes for calling were different. According to the data from Fridgen's study (1992), 6 percent asked questions about the need to purchase the least toxic product to clean or care for something, 9 percent asked for interpretation of directions on a label, 78 percent needed information discarding or disposing of a product no longer needed, and 7 percent wanted information on setting up a community collection day or holding an educational workshop. Although all these calls were related to the information about the purchase, use, or disposal of hazardous materials, some questions may not need action (for instance, questions asked about interpreting directions on a label). For this group of people, answers to the action question may be NO, but it does not mean that they did not take any action. Their action was the phone call and the adherence to label direction.

One possible alternative for the problem is to broaden the scope of the behavioral measure. As Weigel and Newman (1976) concluded from their study: when a single behavioral criteria was used, "the attitude measure exhibited only modest capacity to predict performance or nonperformance of the action. However, when these single criteria were combined into a more comprehensive behavioral index, the correlation between scores on this index and scores on the attitude measure was

much more pronounced" (p.793). Therefore, in order to get higher correlation between attitudes and behavior, it is useful to use two or more action items to form "a more comprehensive behavioral index."

On the other hand, the magnitude of the intention-behavior relationship is largely dependent on the correspondence in levels of specificity that the two variables are measured at. The greater the correspondence in levels of specificity, the higher should be the correlation between intention and behavior. In the current study, the behavioral criteria are a set of actions related to the disposal and management of hazardous waste, and the behavioral intentions are measured by asking what the individual is willing to pay for disposal of hazardous waste in terms of time, money, or some other valued resource. In this way, we assume that the correspondence between intentions and behavior in the study will be relatively high and consequently, the relationship between intention and behavior will be positively correlated.

(4) Past experience with environmental pollution will have a significant impact on behavioral intentions and behavior.

From Fridgen's study we have learned that past experience with environmental pollution contributed significantly to the appraisal of environmental hazards (Fridgen, 1992). For example, past experience with environmental pollution affected the respondents' appraisal of threat of environmental hazards

to themselves and to the environment. This may imply that past experience with environmental pollution provided a cognitive and affective foundation for the respondents' attitudes toward these environmental hazards.

Since past experience with environmental pollution made significant contributions in forming respondents' attitudes toward environmental hazards, we assume that this variable will also have a strong influence on their behavioral intentions and behavior. For instance, if someone suffered or is suffering from an illness caused by drinking polluted water nearby, he or she probably intends to take some measures to control the pollution. Because of past experiences with pollution, these people have gained a different degree of knowledge about the causes and consequences of pollution; therefore, in order to avoid further suffering or damage, we assume that they will tend to take action to eliminate the causes of pollution. When people appraise various environmental hazards, past experiences with these or other hazards will be an additive attribute in forming a negative attitude toward these hazards, and these feelings and concerns will lead to favorable intentions and behavior to control these hazards.

In addition to test the five hypotheses, it is needed to find evidence to support the applicability of the theory of reasoned action to present research data. The theory of reasoned action has been applied to and supported by many

empirical studies ever since it was first developed (Ajzen, 1988; Manstead et al., 1983; Sheppard et al., 1988). The findings of these studies provided evidence of the utility of the theory of reasoned action in its application to the prediction and understanding people's intentions and behavior. However, most of these studies were focused in areas such as political voting, abortion, infant feeding methods, consumer behavior, et al. Based on a review of the literature, it appears that there is no other published research demonstrating the applicability of the Fishbein-Ajzen theory to household hazardous waste management. The current study is an attempt to extend the theory's range of applicability to a new behavioral domain: control of small quantities of nonregulated hazardous waste. In Fishbein and Ajzen's model, there are four major variables: attitudes toward behavior, subjective norm, behavioral intention, and behavior. As we mentioned before, secondary data are to be used in the current study, and information about a subjective norm was not collected in the original study; therefore, subjective norms can not be included in the current research model. However, we do include another important variable in the research model: past experience with environmental pollution. The purpose of including the past experience variable is to explore the relationship between life experience and people's environmental attitudes and behavior. In this sense, the research for this study is a modification of Fishbein and

Ajzen's original model.

The Survey Questionnaire

The survey questionnaire used in Fridgen's (1992) study consisted of eight pages and contained five main parts. The first four pages of the questionnaire consisted of the primary instrument used to assess a cognitive response to environmental hazards and was an expanded version of the Environmental Appraisal Inventory (EAI). The expanded EAI contained 28 items. It was used four times. Each time it was used with a different lead-in question to assess the appraisal of hazards in one dimension. There were four dimensions: threat to self, threat to environment, perceived control, and personal responsibility.

The second part consisted of questions mainly for assessing the behavioral intentions of the respondents. Four questions used in the study asked the individuals what they were willing to pay in terms of "money, time, phone calls, and miles traveled" for disposal or management of hazardous material.

The third part asked questions about the background of the respondents. These questions included the following items: gender, age, income, education, marital status, family status, youth environment, and number of brothers/sisters.

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experience with environment related activities. It contained three questions asking whether family members had ever been affected by environmental pollution, whether parents or grandparents had been involved in pro-environmental causes, and whether the individual contributed money to environmental causes.

The last part consisted of nine questions about the respondents' behavior after they called the Hazardous Materials Information Line (HMIL). Based on the design of the current study, answers from two of the nine questions (i.e. questions 1 and 6 of the action part) were used in the analysis. The original questionnaire is provided in Appendix A.

The Research Variables

Dependent Variable

The dependent variable in this research is an action index which consists of two questions:

(1) "Have you acted on the information you received from the Hazardous Materials Information line?"

(2) "Do you contribute money to environmental causes?"

Each of these activities was scored 0 for "no" or 1 for "yes."

Item 1 is the original question that was used in Fridgen's study to measure respondents' action and is directly

related to the objective of the study, hazardous waste management. Item 2 is a more commonly accepted action that many people take to express their concern for environmental quality. The purpose of using these two items to form an action index is to broaden the scope of behavioral measurement and, consequently, to increase the attitude-behavior correspondence.

Independent Variables

For the purpose of analysis and test of research hypotheses, three groups of independent variables are used in this study.

1. Past Experience. Incidences of self or family members impacted by environmental pollution are investigated by a continuous variable through the question, "Have you or your family been affected by environmental pollution?" The responses were recorded on a Likert-type scale with a range of 1-7. For each case score 1 was "Not affected," score 7 was "Seriously affected."

2. Specific Hazards Subscale. For the purpose of this study, items were selected from the expanded EAI to form two subscales, namely, Natural Hazards subscale and Technological Hazards subscale. First, five items were selected to represent a Natural Hazards subscale:

- (1) Storms-lightning, hurricanes, tornados, snow, etc.
- (2) Water shortage, e.g., drought, water depletion
- (3) Earthquakes

- (4) Forest fires
- (5) Floods or tidal waves

The selection was based on the definition and theories about the characteristics of natural hazards discussed in the literature review chapter. These are all naturally occurring hazards and their occurrences and impacts are beyond human control.

The second subscale is the Technological Hazards subscale. Seven items were selected to form this subscale. The criterion for the selection was to choose those items which most closely relate to the context of this study, household hazardous waste and its impact on environment. There are about 23 items in the expanded EAI that are classified in a broad sense as technological hazards; however, some of the items, such as smoking in public buildings or fluorescent lighting, have little relation to the subject of the study. According to the principle of compatibility (Ajzen and Fishbein, 1977), attitude variable, intention variable, and behavior variable should be highly compatible with each other if we want to obtain a stronger statistical relationship between them. In addition, a higher compatibility can be achieved when these variables are measured at similar levels of generality or specificity. In the current study, intention variable and behavior variable are all assessed through a specific group of hazards -- household hazardous waste; therefore, the attitude variable should also be measured within this specific group of

hazards. According to this principle, we chose the following eight items to form the Technological Hazards subscale. As we discussed in the previous chapter, the term "technological hazards" used here is not an ideal term to describe the specific kind of hazards we are interested in; however, since it is difficult to find a more suitable and commonly accepted term for these hazards, we use the term "technological hazards," although it represents the group of items that either themselves are hazardous waste or pollution caused by hazardous waste. Among these eight items, three were created and used by Fridgen (1992) in her study to form the expanded scale.

- (1) Acid rain
- (2) Water pollution
- (3) Chemical dumps
- (4) Pesticides and herbicides
- (5) Groundwater pollution from landfill seepage
- (6) Air pollution from waste-to-energy incinerators
- (7) Surface water contamination from discarded motor oil
- (8) Change to the ozone caused by pollution

The respondents were asked to answer four different questions regarding these two subscales and their responses were recorded on a Likert-type scale with a range of 1-7. These four questions are:

(1) Please rate how threatening the following problems are TO YOU by marking the response that best describes your position.

(2) Please rate how threatening the following problems

are TO THE PHYSICAL ENVIRONMENT by marking the response that best describes your position.

(3) Please rate how much CONTROL you could personally exercise against each problem if it become a serious threat to you.

(4) Please rate how much PERSONAL RESPONSIBILITY you feel for the existence of this hazard.

In each case the low score was "no threat" or "no control" or "no responsibility." The high score was "extreme threat" or "extreme control" or "extreme responsibility."

3. Behavioral Intention Scale. The Behavioral Intention scale used in the study attempted to measure respondents' specific intentions about engaging in particular behaviors (i.e., intentions toward engaging in certain activities for control of household hazardous waste). It consisted of the following questions:

(1) Would you be willing to drive to dispose of a hazardous material? (1=1 mile to 7=30 or more miles)

(2) Would you be willing to wait to dispose of a hazardous material? (1=10 minutes to 7=70 or more)

(3) Would you be willing to spend to dispose of one gallon of toxic material? (1=1 dollar to 7=30 or more)

(4) Would you be willing to make to find out the best possible option for disposing of an unwanted hazardous material? (1=1 phone call to 7=7 or more)

(5) Will you make different consumer decisions as a

result of the information you received from the Hazardous Materials Information Line? (1=no, 7=yes)

These questions are different from the questions asked in the action index scale. In the action index the heading of the questions are always "have you (done certain things)?" For the Behavioral Intention scale, the headings are always "would you be willing to (do something)?" Therefore, these questions are asking people's intentions but not what actions they took.

For the newly constructed Natural Hazards subscale, Technological Hazards subscale, and Behavioral Intention scale, both validity and reliability were examined.

The Research Model

Model building is an important procedure in scientific research and has been used successfully in predicting systems (Bross, 1953). It is in the statement of the model that the researcher's view of the real world is developed and all of the simplifying assumptions are explicitly organized. Figure 3.1 is the hypothesized causal model for the current study. This model is based on Ajzen and Fishbein's (1988) theory of reasoned actions as well as the assumptions and hypotheses made for the study. The model consists of four components: attitudes toward the specific hazards, past experience with environmental pollution, behavioral intentions, and behavior.

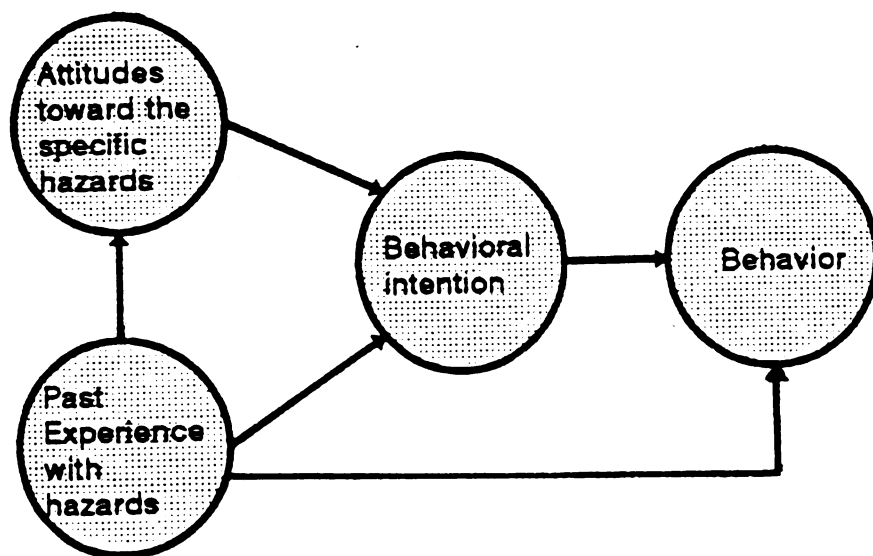


Figure 3.1 The Research Model

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Correlation between attitudes toward general environmental hazards (the expanded EAI) and past experience with environmental pollution has been identified in Fridgen's (1992) study. However, with the newly constructed Natural Hazards and Technological Hazards subscales, the attitude measurements become more specific, and it is assumed that the respondents will appraise the natural hazards and technological hazards differently. The items selected to construct the Technological Hazards subscale are mainly human-imposed or self-generated hazards that are the major causes of environmental pollution. Those who have been affected in the past by environmental pollution may express strong concerns about these hazards; therefore, correlations between attitudes toward the technological hazards and past experience with environmental pollution is expected to be stronger. With the theory of reasoned action, respondents with strong feelings of threat to themselves and to the environment will reasonably tend to take some actions to control these hazards. Past experience with environmental pollution not only will influence the respondents' appraisal of environmental hazards, but will also play an additive function in forming the respondent's behavioral intentions. In the research model, it is also assumed that the behavioral intention variable has two functions: one is to predict behavior, the other is to mediate relations between the attitude variable, the past experience variable, and the action variable.

Since the attitudes toward the hazards subscales are actually measured in four different dimensions, i.e., Threat to Self, Threat to Environment, Perceived Control, and Personal Responsibility, the research model can be restructured to include these four variables¹ (Figure 3.2). In the final model, we expect the number of attitude scales will be reduced through a step-wise regression analysis using the four attitude scales as the independent variables and the behavioral intention as the dependent variable. Those variables that do not enter the equation will be removed from the model.

¹ It should be noted that among the four attitudinal variables, three of them, i.e., threat to self, threat to environment, personal responsibility, used in the research model represent negative perceptions. It is hypothesized that if these four variables contained positive perception, the research results would be different.

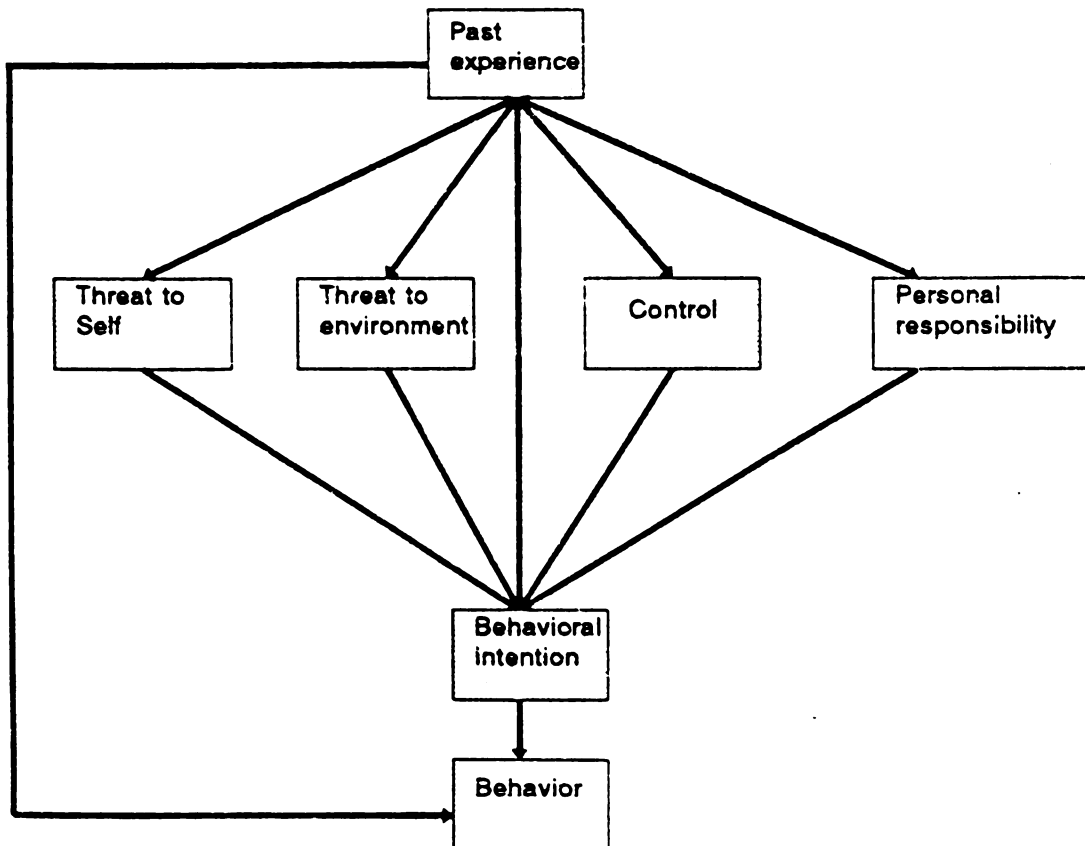


Figure 3.2 The Restructured Research Model

Analysis Techniques and Procedures

The data analyses are organized into three parts:
(1) validity and reliability assessment, (2) tests of hypotheses, and (3) path analysis.

Validity and Reliability Assessment

In the current study, the Natural Hazards subscale, the Technological Hazards subscale, and the Behavioral Intention scale are newly constructed scales; validity and reliability of these new measurements need to be evaluated. "Measurement" is usually defined as "the assignment of numbers to objects or events according to roles" (Stevens, 1951, p.22). But as we have seen, for any measuring procedure to be scientifically useful, it must lead to results that are relatively reliable and valid. In other words, viewed from a scientific perspective, it is crucial that the process of assigning numbers to objects or events leads to results that are generally consistent and fulfill its explicit purpose. "Fundamentally, reliability concerns the extent to which an experiment, test, or any measuring procedure yields the same results on repeated trials" (Carmines and Zeller, 1979, p.11).

The measurement of any phenomenon always contains a certain amount of chance error. The goal of error-free measurement is never attained in any area of scientific investigation. Instead, as Stanley (1971) has observed, "The

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amount of chance error may be large or small, but is universally present to some extent. Two sets of measurements of the same features of the same individuals will never exactly duplicate each other" (p.356). It is necessary to realize that fact because repeated measurements never exactly equal one another, unreliability is always present to at least a limited extent. But while repeated measurements of the same phenomenon never precisely duplicate each other, they do tend to be consistent from measurement to measurement. The person with the highest blood pressure on a first reading, for example, will tend to be among those with the highest reading on a second examination given the next day. And the same will be true among the entire group of patients whose blood pressure is being recorded: Their readings will not be exactly the same from one measurement to another but they will tend to be consistent. This tendency toward consistency found in repeated measurements of the same phenomenon is referred to as reliability. The more consistent the results given by repeated measurement, the higher the reliability of the measuring procedure. Conversely, the less consistent the results, the lower the reliability.

But an indicator must be more than reliable if it is to provide an accurate representation of some abstract concept. It must also be valid. In a very general sense, any measuring device is valid if it does what it is intended to do. An indicator of some abstract concept is valid to the extent that

it measures what it purports to measure. Thus while reliability focuses on a particular property of empirical indicators, i.e., the extent to which they provide consistent results across repeated measurements, validity concerns the crucial relationship between concept and indicator.

There are several methods for assessing the reliability of empirical measurements. The most popular one is the Internal Consistency method which developed by Cronbach (1951). It is also called coefficient alpha which can be expressed as follows:

$$\alpha = N/(N - 1) [1 - \sum \sigma^2(Y_i) \sigma_x^2] \quad [1]$$

Where N is equal to the number of items ; $\sum \sigma^2(Y_i)$ is equal to the sum of item variance; and σ_x^2 is equal to the variance of the total composite. If one is working with the correlation matrix rather than the variance-covariance matrix, then alpha reduces to the following expression:

$$\alpha = N\bar{P}/[1 + \bar{P}(N - 1)] \quad [2]$$

Where N is again equal to the number of items and $\bar{P}$ is equal to the mean interitem correlation. To take a hypothetical example applying Equation 2, if the average intercorrelation of a six-item scales is .5, then the alpha for the scale would be:

$$\begin{aligned}\alpha &= 6(.5) / [1 + .5(6 - 1)] \\ &= 3 / 3.5 \\ &= .857\end{aligned}$$

Equation 2 also makes clear that the value of alpha depends on the average interitem correlation and the number of items in the scale. Specifically, as the average correlation among items increases and as the number of items increases, the value of alpha increases. For example, a 2-item scale with an average interitem correlation of .2 has an alpha of .333. However, a 10-item scale with the same average interitem correlation has an alpha of .714.

Factor analysis is usually used to test construct validity. Factor analysis is a common statistical tool used to uncover underlying latent variables by studying the covariance structure among a set of observed variables (Long, 1983). Generally, there are two types of factor analysis: exploratory factor analysis and confirmative factor analysis.

Exploratory factor analysis has been used as an expedient way of ascertaining the minimum number of hypothetical factors that can account for the observed covariation, and as a means of exploring the data for possible data reduction. Confirmative factor analysis has been used as a means of testing specific hypotheses. Generally speaking, the majority of the applications in the social sciences use exploratory factor analysis (Kim and Mueller, 1978).

In Fridgen's original study, both validity and reliability of the extended EAI were evaluated. Because the new subscales are derived from the extended EAI, factor analysis is necessary to determine whether or not the items held together as a single construct.

The Statistical Package for the Social Sciences (SPSS) program were used to conduct factor analysis and reliability test.

Correction for Attenuation

Whatever particular method is used to obtain an estimate of reliability, one of its important uses is to "correct" correlations for unreliability due to random measurement error. That is, if we can estimate the reliability of each variable, then we can use these estimates to determine what the correlation between the two variables would be if they were made perfectly reliable. According to Carmines and Zeller (1979) the appropriate formula is as follows:

$$P_{x_t y_t} = \sigma_{x_i y_j} / \sqrt{P_{xx}' P_{yy}'} \quad [3]$$

where $P_{x_t y_t}$ is the correlation corrected for attenuation; $\sigma_{x_i y_j}$ is the observed correlation; P_{xx}' is the reliability of X; and P_{yy}' is the reliability of Y. For example, if the observed correlation between two variables was .2 and the reliability of each variable was .5, then the correlation corrected for

attenuation would be:

$$P_{x_t y_t} = .2 / \sqrt{(.5)(.5)} = .4$$

This means that the correlation between these two variables would be .4 if both were perfectly reliable (measured without random error).

Path Analysis

Path analysis is a useful tool for testing the research model formulated by the researcher on the basis of knowledge and theoretical considerations. As Bachrach and Zautra (1985) note, there are several reasons why this analytic tool is particularly well-suited for testing a pattern of reasoning and its alternatives. First, with the development of a structural model, the path analytic technique makes explicit the relationships among the variables. Second, researchers may test and evaluate their hypotheses and assumptions by how well they fit with the generated data. Finally, such an analyses allows for revision of the model and the reasoning on which it is based. Path analysis is important in attitudinal and behavioral research, for instance, when a social scientist wants to bring about desired changes in human behavior. The scientist must be able to identify the factors affecting the behavior before change can be fostered.

Building a path diagram is the first step of path

analysis. A path diagram is a useful device for displaying graphically the pattern of causal relations among a set of variables. In a path diagram, the variables on the right are influenced by the temporally prior variables on the left, and this relationship is not reciprocal, which means that the causal flow in the model is unidirectional. In other words, at a given point in time a variable cannot be both a cause and an effect of another variable.

The path coefficient is a statistical indicator that provides evidence of a cause-effect relationship between the two variables in consideration. Path coefficients are usually derived by ordinary least square estimation (Helse, 1975) using simple or multiple regression of each variable onto its causal antecedents. If a variable has only one antecedent, then the path coefficient is the correlation between the dependent variable and its antecedent. Where a variable has a number of antecedents, the path coefficients are the beta weights obtained from the multiple regression of the dependent variable onto the variables upon which it is assumed to depend.

Using path coefficients one can reproduce the correlation matrix for the variables in the model. This reproduced correlation matrix is then compared with the observed correlation matrix. If the discrepancies between the observed and the reproduced correlation are small, it is possible to conclude that the data are consistent with the proposed model.

If the discrepancies are large, the data may not fit the proposed model, and the model needs to be reconsidered or revised.

Tests of Hypotheses

After assessing the validity and reliability of the newly constructed scales, five hypotheses were tested by employing correlation coefficient analysis, regression coefficient analysis, and path analysis:

(1) Testing the first hypothesis: In the first hypothesis, we assume that respondents will appraise technological hazards and natural hazards differently. The differences in appraisal are evaluated by comparing the mean score of the two subscales; the higher the mean score, the stronger the appraisal will be. On the seven-point Likert-type scales used in this study, lower mean scores in Self and Environment scales, for instance, indicate a "minimal" or "mild" level of perceived threat to self and to the environment, while higher mean scores indicate a "strong" or "very strong" level of perceived threat to self and to the environment. Since we assume that people will perceive more threat from technological hazards than natural hazards, we expect the mean score of the technological hazards subscale to be higher than the mean score of the natural hazards subscale.

(2) Constructing the research model: After the comparison

is made between the technological hazards subscale and natural hazards subscale, and if the first hypothesis is supported, then only the technological hazards subscale will be included in the research model. Since each subscale is actually evaluated four times along the four dimensions (i.e., threat to self, threat to environment, perceived control, and personal responsibility), the technological hazards subscale consists of four attitude variables: threat to self, threat to environment, perceived control, and personal responsibility. It is not certain whether all four of these variables fit in the model. In order to identify the key attitude variables that best predict the behavioral intention, a stepwise multiple regression analysis will be conducted using the four attitude scales as independent variables and behavioral intention as the dependent variable. In the stepwise solution the criterion is optimal prediction with a minimum number of variables. Those variables that cannot enter the equation are removed from the model.

From Fridgen's study, it was learned that there is a set of modest correlations between the four attitudes scales; therefore, it was concluded that it was not appropriate to include the four variables into the same regression equation because it might result in a multicollinearity problem. However, it is useful to reconsider the problem of multicollinearity. According to Lewis-Beck (1980), "For diagnosis (of the problem of multicollinearity) we must look

directly at the intercorrelation of the independent variables. A frequent practice is to examine the bivariate correlations among the independent variables, looking for coefficients of about .8 or larger" (p.60). In order to test the problem of multicollinearity of the four attitude scales, we have obtained a correlation matrix among the four attitudes scales from Fridgen's study (1991, Table 3.5).

Table 3.5. Correlation Matrix of the Four Attitude Scales

	You	Environ.	Control	Respon.
You				
Environ.	.67**			
Control	.35**	.29**		
Respon.	.24**	.19**	.31**	--

Source: Fridgen, 1991, p. 3-36.

Note: ** $p < .001$. Number of Valid Cases: 269

Because none of the bivariate correlations are .8 or larger, we might conclude that multicollinearity is not a problem. However, simply looking at the bivariate correlation for a multicollinearity problem may not be the most satisfactory approach, "for it fails to take into account the relationship of an independent variable with all the other independent variables" (Lewis-Beck, 1980. p.60). Therefore, we must use another method to assess the multicollinearity problem. As Lewis-Beck (1980) has suggested, the preferred

method of assessing multicollinearity is to regress each independent variable on all the other independent variables, and "when any of the R^2 from these equations is near 1.0, there is high multicollinearity" (p.61). In fact, the largest of these R^2 serves as an indicator of the amount of multicollinearity that exists.

The results of the regression among the four independent variables are as follows:

$$\begin{array}{ll}
 X_1 = .36 + .90X_4 + .63X_2 + .14X_3 & R^2=.49 \\
 X_2 = 1.79 + .02X_4 + .64X_1 + .06X_3 & R^2=.46 \\
 X_3 = 1.02 + .28X_4 + .09X_2 + .23X_1 & R^2=.18 \\
 X_4 = .94 + .22X_3 + .02X_2 + .12X_1 & R^2=.12
 \end{array}$$

(X_1 =You, X_2 =Environ., X_3 =Control, X_4 =Responsibility.)

From the above results we can see that the largest coefficient of multiple determination is $R^2 = .49$ which lies a good distance from 1.0. Thus, the conclusion is that multicollinearity is not a problem for the partial slope estimates in the multiple regression model, and we can use these four attitude scales together as independent variables in data analysis.

(3) Testing hypotheses 2 to 5: Hypotheses 2 to 5 will be tested through calculation of the coefficients among the variables in each hypothesis. The correlations will be

corrected using the formula discussed earlier to correct for attenuation and this will form an observed correlation matrix. From this observed correlation matrix, we can evaluate the relationship between each set of paired variables, (i.e., the relationship between the attitudes scales and the behavioral intentions, the relationship between the past experience and the behavioral intentions, and the relationship between the behavioral intentions and the actions). If each of the correlations between these paired variables are significantly different from 0, then the hypotheses 2, 3, 4, and 5 are supported; otherwise, the hypotheses may be rejected.

(4) After the research model is constructed, a path analysis will be used to test the relationships among the variables in the model. This procedure involves two steps.

First, we will use both simple and multiple regression analysis to assemble a path coefficient. Simple regression analysis will be conducted between past experience and the attitude scale using the latter as the dependent variable. Two multiple regression analyses will be conducted, first between past experience, the attitude scales, and the behavioral intentions with the latter as the dependent variable; and second between past experience, the behavioral intentions, and the actions with the latter as the dependent variables. As discussed earlier, in the simple regression analysis, the path coefficient is the correlation between the dependent variable and its antecedent. In the multiple regression analysis, the

beta weights are the path coefficients. The reason for using beta weights, not the b weights, for path coefficients is that the beta weights are conceived as the regression coefficients to be used with standard scores, while the b weights, although they are partial regression coefficients, are not in the standard form.

Second, the path coefficients calculated in the research model will be used to reproduce the original correlation matrix, and this reproduced correlation matrix will be used to compare with the observed correlation matrix. The comparison can be accomplished by subtracting the reproduced correlation coefficients from the observed correlation coefficients. From the residual matrix we can judge the goodness of fit of the proposed model. If the differences between these two matrices are small, then we can say that a causal relationship exists among the variables in the model; otherwise, the model needs to be modified and both matrices need to be recalculated.

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CHAPTER IV

FINDINGS AND DISCUSSION

In this chapter, major results relevant to the research questions are addressed. First, the validity and reliability tests of the newly constructed attitudinal subscales and intention scale are provided. Then, the comparison of major statistical characters between attitudes to technological hazards and natural hazards is presented and discussed. Third, the results of testing of relationships proposed in the study hypotheses are described. In the final section of this chapter, the results of path analysis are reported.

Validity and Reliability Test

A principal-component factor analysis was used to evaluate the validity and reliability of the newly constructed attitudinal scales. According to Carmines and Zeller (1979), in a principal-component factor analysis, if a set of items is measuring a single phenomenon, it should meet the following conditions: "1) the first extracted component should explain a large proportion of the variance in the items; 2) subsequent components should explain fairly equal proportions of the remaining variance except for a gradual decrease; 3) all or

most of the items should have substantial loadings on the first component; and 4) all or most of the items should have higher loadings on the first component than on subsequent components" (Carmines and Zeller, 1979, p.60). With these conditions as criteria, factor loadings, communalities, and percent of variance explained by the first extracted component were used as the indicators for the level of validity; the higher factor loadings, communalities, percent of variance explained by the first extracted component, the better the level of validity of a construct.

The reliability of a scale is judged by the alpha level (it is also called reliability coefficient). 'Alpha' is the label given by Cronbach (1951) to a particular type of coefficient that measures the reliability of a test in the special sense of its internal consistency. The higher the alpha level, the better internal consistency among the items of a construct.

The Natural Hazards subscale consisted of five items. Because the expanded EAI was assessed four times for four dimensions, i.e., threat to self, threat to environment, perceived control, and personal responsibility, factor analysis was also applied four times to evaluate the validity of these four dimensions. Results of factor analysis for the Natural Hazards subscale are shown in Tables 4.1 to 4.3. From these tables it can be seen that the factor loadings of the five natural hazard items in the Self dimension ranged from

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0.525 to 0.811, communality ranged from 0.276 to 0.657, and the variance explained by the first extracted component was 51.0 percent. The alpha value for the construct was 0.73. According to Carmines and Zeller (1979), when all or most of the items have a factor loading larger than 0.3 on the first component, and the percent of variance explained by the first extracted component is larger than 40 percent, then a better validity can be expected. The factor loadings, communality (in a one-common-factor model communalities are no more than the squares of the respective factor loadings), percent of variance explained by the first extracted component, and alpha value for the Self dimension were all high enough to conclude that the Self dimension of the Natural Hazards subscale was a valid and reliable construct.

Similar conclusions can be made regarding the remaining three dimensions (i.e., threat to environment, perceived control, and responsibility) in the Natural Hazards subscale. The factor loadings in these three dimensions ranged from 0.564 to 0.909, communality ranged from 0.318 to 0.816, the variance explained by the first extracted component ranged from 57.2 percent to 62.7 percent. The alpha values for these three dimensions were 0.82, 0.77, and 0.75 respectively. Therefore, in the Natural Hazards subscale the five items in each of the four dimensions hold together as a single construct.

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Table 4.1 Factor Loadings of the Five Items in the Natural Hazards Subscale

Items	Self	Environment	Control	Responsibility
1. Storms	.525	.724	.775	.909
2. Water shortage	.702	.566	.626	.564
3. Earthquakes	.811	.866	.834	.869
4. Forest fires	.684	.796	.657	.665
5. Floods or tidal waves	.808	.880	.858	.888

Note: Number of valid cases: Self scale, 282; Environmental scale, 266; Control scale, 268; Responsibility scale, 282.

Table 4.2 Communalities of the Five Items in the Natural Hazards Subscale

Items	Self	Environment	Control	Responsibility
1. Storms	.276	.524	.601	.826
2. Water shortage	.493	.321	.392	.318
3. Earthquakes	.657	.750	.695	.755
4. Forest fires	.468	.633	.432	.443
5. Floods or tidal waves	.654	.774	.736	.789

Note: Number of valid cases: Self scale, 282; Environmental scale, 266; Control scale, 268; Responsibility scale, 282.

The results of factor analysis of the Technological Hazards subscale are shown in Tables 4.4 to 4.6. The Technological Hazards subscale consisted of eight items. Just like the Natural Hazards subscale, these eight items in each of the four dimensions had only one common factor. The factor

Table 4.3 The Results of Factor Analysis of the Natural Hazards Subscale

Dimensions	Eigenvalue	# of Factor	% of Variance	Alpha
Self	2.54	1	51.0	.73
Environment	3.00	1	60.1	.82
Control	2.85	1	57.2	.77
Responsibility	3.13	1	62.7	.75

Note: Number of valid cases: Self scale, 282; Environmental scale, 266; Control scale, 268; Responsibility scale, 282.

loadings of these items in the four dimensions ranged from 0.716 to 0.897; the communalities ranged from 0.513 to 0.805; and the variance explained by the first extracted component ranged from 63.8 percent to 67.9 percent. The alpha values for the four dimensions were 0.93, 0.93, 0.93, and 0.92 respectively. It can be seen from Tables 4.4 to 4.6 that all the conditions for a principal-component factor analysis were satisfactorily met and the four dimensions of the Technological Hazards subscale were valid and reliable constructs.

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Table 4.4 Factor Loadings of the Eight Items in the Technological Hazards Subscale

Items	Self	Environ	Control	Respon.
1. Water pollution	.797	.770	.781	.752
2. Acid rain	.726	.752	.798	.780
3. Change to the ozone	.760	.810	.846	.786
4. Chemical dumps	.879	.897	.870	.859
5. Pesticides and herb.	.781	.770	.716	.777
6. Groundwater pollut.	.896	.874	.894	.854
7. Air pollution...	.833	.838	.869	.811
8. Surfacewater pollut.	.859	.821	.800	.762

Note: Number of valid cases: Self scale, 280; Environmental scale, 262; Control scale, 260; Responsibility scale, 274.

Table 4.5 Communalities of the Eight Items in the Technological Hazards Subscale

Items	Self	Environ.	Control	Respon.
1. Water pollution	.635	.562	.611	.565
2. Acid rain	.527	.565	.637	.608
3. Change to the ozone	.579	.657	.716	.618
4. Chemical dumps	.773	.805	.759	.739
5. Pesticides and herb.	.610	.594	.513	.604
6. Groundwater pollut.	.803	.765	.799	.729
7. Air pollution...	.695	.702	.755	.657
8. Surfacewater pollut.	.738	.675	.641	.580

Note: Number of valid cases: Self scale, 280; Environmental scale, 262; Control scale, 260; Responsibility scale, 274.

Table 4.6 The Results of Factor Analysis of the Technological Hazards Subscale

Dimensions	Eigenvalue	# of Factor	% of Variance	Alpha
Self	5.36	1	67.0	.93
Environment	5.35	1	67.0	.93
Control	5.43	1	67.9	.93
Responsibility	5.10	1	63.8	.92

Note: Number of valid cases: Self scale, 280; Environmental scale, 262; Control scale, 260; Responsibility scale, 274.

Table 4.7 is the comparison of the results of factor analysis of three environmental attitude scales: the expanded EAI, the Natural Hazards subscale, and the Technological Hazards subscale. In Table 4.7 it can be seen that in the Self dimension, the number of common factors reduced from 3 in the expanded EAI to 1 in both the Natural Hazards subscale and the Technological Hazards subscale. Similarly, in the Environment dimension, the number of common factors reduced from 5 to 1; in both the Control and Responsibility dimensions, the number of common factors reduced from 4 to 1. The percent of variance explained by the first extracted component for each dimension was also improved greatly. It indicated that compare with the expanded EAI, both the Natural Hazards subscale and the Technological Hazards subscale exhibited high construct validation. Unlike the expanded EAI which measured more general environmental attitudes, these two new subscales, with

Table 4.7 Comparison the Results of Factor Analysis of Three Attitudinal Scales

Scale	The Expanded EAI*		Natural Hazards Subscale		Technological Hazards Subscale	
	# of Factor	% of Variance	# of Factor	% of Variance	# of Factor	% of Variance
Self	3	44.7	1	51.0	1	67.0
Environment	5	43.4	1	60.1	1	67.0
Control	4	48.2	1	57.2	1	67.9
Responsib.	4	51.9	1	62.7	1	63.8

Source: * Fridgen (1992).

carefully selected and fewer items, measured more precisely the specific attitudes as described.

Table 4.8 is the comparison of alpha values of the three attitudinal scales. Alpha value is often closely related to the number of items in a construct. We can always increase the alpha value by increasing the number of items entering a construct. In other words, reducing the number of items in a construct often results in a decrease of the alpha value. The Natural Hazards subscale had only five items; the alpha values in the four dimensions ranged from .73 to .82, which represented a high reliability. Compared with the expanded EAI, the number of items in the Technological Hazards subscale were reduced from 28 items to eight items, but the alpha value in each dimension was still above 0.92, only reduced by .02 to .04, indicating a very high level of internal consistency among these eight items.

Table 4.8 Comparison of Reliability of the Three Attitudinal Scales

The Expanded EAI*			The Natural Hazards Subscales		The Technological Hazards Subscales	
Scale	# of items	Alpha	# of items	Alpha	# of items	Alpha
Self	28	.95	5	.73	8	.93
Environment	28	.95	5	.82	8	.93
Control	28	.96	5	.77	8	.93
Responsib.	28	.96	5	.75	8	.92

Source: * Fridgen (1992)

The results of factor analysis for the Intention scale is shown in Table 4.9. For the first four items, both factor loadings and communality were quite high. However, the fifth item had a very small factor loading of -0.195 and communality of 0.038. It indicates that this item does not contribute much to the construct. In the original questionnaire (Fridgen, 1992), the first four items were questions about whether the respondents willing to do something (i.e., drive certain distance, spend some money, etc.) to dispose of hazardous materials. The fifth item questioned whether the respondents were going to make different consumer decisions as a result of the information they received from the HMIL. It seems these two groups of questions having different meanings. Therefore, the fifth item should be removed from the construct.

Table 4.9 The Results of Factor Analysis of Intention Scale and Its Alpha Value

Items	Factor loadings	Communality	# of factors	% of variance	Alpha
			1	44.2	.67
1. Phone	.677	.458			
2. Spend	.758	.574			
3. Drive	.736	.542			
4. Wait	.773	.597			
5. Action6	-.195	.038			

Note: Valid cases: 235

Table 4.10 shows the results of the second run of factor analysis of the Intention scale after the fifth item was removed. There was a very little reduction in the factor loadings and communality (about 0.01), but the percent of variance explained by the first extracted component has increased from 44.2 percent to 53.9 percent and the reliability coefficient has increased from .67 to .71. It demonstrated that after removing the fifth item from the construct, both the validity and reliability of the scale were improved.

Table 4.10 The Results of Second Run of the Factor Analysis of Intentions Scale and Its Alpha Value

Items	Factor loadings	Communality	# of factors	% of variance	Alpha
			1	53.9	.71
1. Phone	.667	.445			
2. Spend	.733	.537			
3. Drive	.769	.591			
4. Wait	.762	.580			

Note: Valid cases: 264

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In summary, the validity and reliability of the three newly constructed attitudinal scales were tested and the unidimensionality of these scales was confirmed. For both the Natural Hazards subscale and Technological Hazards subscale, factor loadings, communality, and percent of variance explained by the first extracted component were all satisfactorily high. For the Intention scale, after removing the fifth item from the construct, construct validity was improved. Compared with the expanded EAI, reliability coefficients of the two newly constructed subscales were all very high, which indicated a high level of internal consistency among the items of each construct.

Comparison of the Two Specific Hazards Subscales

One of the major objectives in the current study was to construct the Natural Hazards subscale and the Technological Hazards subscale and compare the respondents' appraisal of these two different types of environmental hazards. After we confirmed the validity and reliability of these two subscales, the next step was to compare the differences between the respondents' appraisal of these two types of hazards. Table 4.11 shows the means and standard deviations of the three attitudinal scales. It can be seen in Table 4.11 that the means of the Technological Hazards subscale in all four dimensions were not only much higher than the means of the

Natural Hazards subscale, but were also higher than the means of the expanded EAI.

In the Self dimension, the mean score of the expanded EAI was 3.73, which suggested that the respondents appraised the general environmental hazards as a 'mild' to 'moderate' threat to themselves; the mean score of the Natural Hazards subscale was 2.69, representing that the respondents felt the natural hazards a 'minimal' to 'mild' threat to themselves. The mean score of the Technological Hazards subscale was 4.46, indicating that the respondents appraised the technological hazards as a 'moderate' to 'strong' threat to themselves.

In the Environment dimension, the mean score of the expanded EAI was 4.40, which reflected to the respondents' appraisal of general environmental hazards as a 'moderate' to 'strong' threat to the environment; the mean score of the Natural Hazards subscale was 3.65, which represented a 'mild' to 'moderate' threat to the environment. The mean score of the Technological Hazards subscale was 5.29, which indicated a 'strong' to 'very strong' threat to the environment.

In general, the descriptive statistics of the two newly constructed environmental hazards subscales are in a consistent pattern with those of Schmidt and Gifford (1989) and Fridgen (1992), i.e., the mean scores of Self and Environment dimensions were higher than the mean scores of Control and Responsibility dimensions, and the respondents felt more threat to the environment than to themselves.

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In the Control dimension, the mean score for the expanded EAI was 2.9, indicating that the respondents felt 'minimal' or 'little' control over the general environmental hazards; the mean score of the Natural Hazards subscale was 1.99, indicating that respondents perceived only a 'minimal' control; the mean score of the Technological Hazards subscale was 3.17, which suggested that respondents felt they perceived had 'little' control over the technological hazards.

For the Responsibility dimension, the mean score of the Technological Hazards subscale was 2.52, which is much higher than the mean score of 1.46 for the Natural Hazards subscale. A mean score of 1.46 indicated that the respondents felt they had 'no' responsibility for the existence of the natural hazards, while a mean score of 2.52 suggested that the respondents felt they had a 'little' responsibility for the presence of the technological hazards.

Table 4.11 Comparison of Means and Standard Deviation of the Three Attitudinal Scales

Scale	The Expanded EAI*		The Natural Hazards Subscales		The Technological Hazards Subscales	
	Mean	SD	Mean	SD	Mean	SD
Self	3.73	1.14	2.69	1.05	4.46	1.49
Environ.	4.40	1.12	3.65	1.36	5.29	1.34
Control	2.90	1.16	1.99	1.02	3.17	1.46
Responsi.	2.10	0.99	1.46	0.75	2.52	1.26

Source: * Fridgen (1992)

Eight paired t-tests were conducted to assess the differences between the means of three different scales and subscales in four dimensions and the results are reported in Table 4.12. Since our focus is mainly on the assessment of the differences between the Technological Hazards subscale and the Natural Hazards subscale, here we only discuss the test results of these two subscales. In the Self dimension, the mean difference between the Technological Hazards subscale and the Natural Hazards subscale was 1.76 and the t value was 24.03; in the other three dimensions, the mean difference between the two subscales was 1.63, 1.17 and 1.05; and the t value was 20.16, 18.13, and 19.39, respectively. For all these four dimensions the two-tailed probability were less than 0.0001. Thus we can conclude that all the mean differences were significant.

Significant differences between the means of the Technological Hazards subscale and the Natural Hazards subscale in all the four dimensions supports the first hypothesis and suggests that respondents appraised the technological hazards and the natural hazards differently. The respondents felt the technological hazards caused more threat to themselves and to the environment than the natural hazards did. Although the score is moderate, the respondents had much stronger feelings of perceived control and personal responsibility over the technological hazards than they felt over the natural hazards.

Table 4.12 Results of Paired t-tests among attitude scales

	Mean Difference	t Value	DF	2-tail Prob.	# of cases
TSelf with Self	0.73	21.78	288	p<.0001	289
TSelf with NSelf	1.76	24.03	288	p<.0001	289
TEnvirn. with Envrn.	0.89	24.98	270	p<.0001	271
TEnvirn. with NEnvirn.	1.63	20.16	271	p<.0001	272
TControl with Control	0.26	8.08	270	p<.0001	271
TControl with NControl	1.17	18.13	271	p<.0001	272
TPersp with Persp	0.39	15.96	284	p<.0001	285
TPersp with NPersp	1.05	19.39	284	p<.0001	285

Note: DF represents Degree of Freedom. T represents the Technological Hazards subscale. N represents the Natural hazards subscale.
 TSelf = the Self dimension of the Technological Hazards subscale.
 Self = the Self dimension of the Expanded EAI.
 NSelf = the Self dimension of the Natural Hazards subscale.
 TEnvirn = the Environment dimension of the Technological Hazards.
 Envrn = the Environment dimension of the Expanded EAI.
 NEnvirn = the Environment dimension of the Natural Hazards subscale.
 TControl = the Control dimension of the Technological Hazards sub.
 Control = the Control dimension of the Expanded EAI.
 NControl = the Control dimension of the Natural Hazards subscale.
 TPersp = the Responsibility dimension of the Technological Hazards.
 Persp = the Responsibility dimension of the Expanded EAI.
 NPersp = the Responsibility dimension of the Natural Hazards subs.

Correlation Analysis

Since we found significant differences between the respondents' appraisal of the technological hazards and the natural hazards, the Technological Hazards subscale was selected as the appraisal instrument for purpose of this study. In Fridgen's study, the expanded EAI was assessed four times along the four dimensions (i.e. threat to self, threat

responsibility), and each dimension actually represented an attitudinal variable. In the current study, the Technological Hazards subscale was also evaluated four times along the same four dimensions; thus we treated each of these four dimensions as a separate variable.

In present study, the second hypothesis is concerned with the relationship between the attitudes toward the technological hazards and the behavioral intention. The third hypothesis focuses upon the relationship between the behavioral intention and actual reported behavior. The fourth hypothesis explores the relationship between past experience with environmental pollution and the behavioral intention. The fifth hypothesis examines the relationship between past experience with environmental pollution and the reported behavior. These relationships were tested through calculation of the correlation coefficients among these variables. Table 4.13 is the observed correlation matrix for the following major variables: Threat to Self, Threat to Environment, Perceived Control, Personal Responsibility, Past Experience, Behavioral Intention, and Behavior. Due to the error of measurement, the correlation matrix shown on Table 4.13 was corrected for attenuation using the formula described in previous chapter.

The correlation coefficient ranges from -1 through 0 to +1. The more the correlation between two measures departs from zero and approaches the value of either -1 or +1, the stronger

zero and approaches the value of either -1 or +1, the stronger the relationship will be between the two measures in question. Correlations greater than zero indicate that as the value of one variable increases, the value of the other variable increases too. In addition to reporting the strength of a correlation, it is often necessary to check whether or not this correlation is statistically significant. Traditionally, statistical significance is represented by the level of probability (p). A correlation is significant when the observed relation between two variables is unlikely to be due to chance alone. A symbol of $p < .05$ means the probability of occurrence of observed relation between two variables by chance alone is less than 5 in 100. A symbol of $p < .01$ means this kind of chance reduced to 1 in 100.

The correlation coefficients between the four attitudinal variables and the intention variable are shown on the second column of Table 4.13. Correlation between Self and Intention was .209; correlation between Environment and Intention was .193; correlation between Perceived Control and Intention was .237; and correlation between Personal Responsibility and Intention was .193. All the correlations were significant at 0.01 level. Correlation results indicated a weak, yet positive and significant linear relationship between respondents' appraisal of the technological hazards and the behavioral intention. Thus the second hypothesis is supported.

Table 4.13 Observed Correlation Matrix of the Major Variables in the Study

Scales	(1)	(2)	(3)	(4)	(5)	(6)	r_{xx}
(1) Action							.24
(2) Intention	.537**						.71
(3) TSelf	.319*	.209*					.93
(4) TEnviron.	.279	.193*	.736**				.93
(5) TControl	.086	.237*	.422**	.338**			.93
(6) TRespon.	.204	.193*	.319**	.258**	.344**		.92
(7) Experien.	.410**	.209*	.252**	.269**	.167*	.240**	1.0

Note: All correlations are corrected for attenuation due to error of measurement. Valid cases are 252. Significance level of one tailed significance test: * = $p < 0.01$; ** = $p < 0.001$. r_{xx} represents reliability coefficient.

As can be seen in Table 4.13, Behavioral Intention exhibited the strongest relationship with Behavior. The correlation coefficient was .537 and significant at 0.001 level. This suggests that Behavioral Intention was the most important determinant of Behavior. Compared to other variables, Behavioral Intention was the best predictor of Behavior. Thus the third hypothesis is supported.

The relationships between Past Experience with environmental pollution, and Behavioral Intentions, and actual reported Behavior were positive and significant. The correlation between Past Experience and Behavioral Intention was .209 with a significant level of 0.01. The relationship between Past Experience and reported Behavior was moderately strong and positive ($r = .41$) and significant ($p < 0.001$). It was obvious that Past Experience with environmental pollution

had more effect on the respondents' behavior than on the behavioral intention. The fourth and fifth hypotheses are supported.

Selecting Variables for Prediction

As shown in Figure 3.2, the proposed research model consisted of seven variables: Past Experience, Threat to Self, Threat to Environment, Perceived Control, Personal Responsibility, Behavioral Intention, and Behavior. Attitudes toward the technological hazards were assessed through four different dimensions (four variables). In Table 4.13 it can be seen that all these four variables were positively correlated with the behavior intention. Because these four attitudinal variables were intercorrelated, it is possible to select from these four variables one or two of the best variables that can yield almost equal predictive ability to the one obtained by using all four variables. On the other hand, it is not certain whether all these four variables fit the research model and contributed equally in predicting behavior intention.

To test the fitness of the attitudinal variables to the research model, a stepwise regression analysis using the four attitude variables as independent variables was conducted. Behavioral Intention was the dependent variable. The Past Experience variable was also included as an independent variable in the regression analysis. In the stepwise

regression analysis, each variable is entered one at a time to determine its contribution in the equation. Those that contribute the most will enter the equation first; those that can not meet the criterion of the test will not enter the equation. The criterion for entering into the equation is the t value -- each variable must be significant at the 0.05 or 0.1 level. The corrected correlation matrix was used in the regression analysis. The results of the first stepwise regression analysis is provided in Table 4.14.

It can be seen in Table 4.14 that for the five variables used to predict Behavioral Intention, only two variables -- Perceive Control and Past Experience -- entered in the equation; the other three variables -- Threat to Self, Threat to Environment, and Personal Responsibility -- were not included in the equation. Perceived Control entered the equation first, which indicates that it explained more of the variance in Behavioral Intention variable than did Past Experience. From the corrected observed correlation matrix (Table 4.13), it can be seen that although all four attitude variables were positively correlated with Behavioral Intention, the correlation coefficients were quite small (most of them ranged from 0.19 to 0.20), representing rather weak relationships. The variable Perceived Control had the highest correlation coefficient with Behavioral Intention among the four attitude variables; therefore, it became the most important predictor for Behavioral Intention. The perception

of control was originally designed to measure the "confidence" and "ability" (Fridgen, 1992, p.6) of individuals to response to an environmental threat. The implication of Perceived Control entering the equation first is that if people are confident that their actions can improve environmental quality, they are more likely show a high intention to take some actions. This finding has significant implication for the design of environmental education programs, community services, and assistance programs.

Table 4.14 Stepwise Regression Analysis for Selecting Variables Predicting the Behavioral Intention

Variables in the Equation					
Variable	R	R ²	Beta	T	Sig T
TControl	.237	.056	.208	3.52	.0005
Exp3	.292	.085	.174	2.95	.0034
Variables not in the Equation					
TSelf			.0981	1.50	.1346
TEnviron			.0903	1.42	.1552
TPersp			.0940	1.49	.1373
Multiple correlation coefficient = 0.29; R-square = 0.08					
F = 12.65; Sig F = 0.0000					

Note: R refers to multiple regression coefficient; R-square refers to coefficient of determination; Beta refers to standardized partial regression coefficient.

After selecting the best variables in predicting Behavioral Intention, the next step was to evaluate the variables that best predict reported Behavior. After the first stepwise regression analysis, there were only four variables left in the research model: Perceived Control, Past Experience, Behavioral Intention, and Behavior. According to the theory of reasoned action (Fishbein and Ajzen, 1975), it is inappropriate to use the attitude variable directly to predict a behavior; and, from the observed correlation matrix in Table 4.13, the correlation coefficient between Perceived Control and Behavior was only 0.086 after correction of attenuation. Thus Perceived Control was not included in the second stepwise regression analysis, which was designed to evaluate the relative contribution of each independent variable in predicting reported Behavior. The results from the second stepwise regression analysis are presented in Table 4.15. The two variables, Behavioral Intention and Past Experience, each entered the equation. The Behavioral Intention variable entered in the equation first; the multiple correlation coefficient was 0.537 and accounted for about 29 percent of the explained variance. When Past Experience entered in the equation, the multiple correlation coefficient increased to 0.62; together, the two variables accounted for about 38 percent of the total explained variance.

Table 4.15 Stepwise Regression Analysis for Selecting Variables Predicting Behavior

Variables in the Equation					
Variables	R	R ²	Beta	T	Sig T
Intention	.537	.288	.471	9.63	.0000
Exp3	.617	.381	.311	6.36	.0000

Multiple correlation coefficient = 0.62; R-square = 0.38
 F = 83.12; Sig F = 0.0000

Note: R refers to Multiple regression coefficient; R-square refers to coefficient of determination; Beta refers to standardized partial regression coefficient.

Path Analysis

The last objective of this study was to develop and test a causal model in predicting the environmental behavior. After two separate stepwise multiple regression analyses, a finalized research model was built to illustrate the causal relationship between the research variables. This finalized research model is presented in Figure 4.1. It can be seen in Figure 4.1 that on the first level, Perceived Control was assumed to be dependent on Past Experience; on the second level, Behavioral Intention was assumed to be dependent upon two variables -- Past Experience and Perceived Control; and on the third level, Behavior was assumed to be dependent upon two variables -- Past Experience and Behavioral Intention.

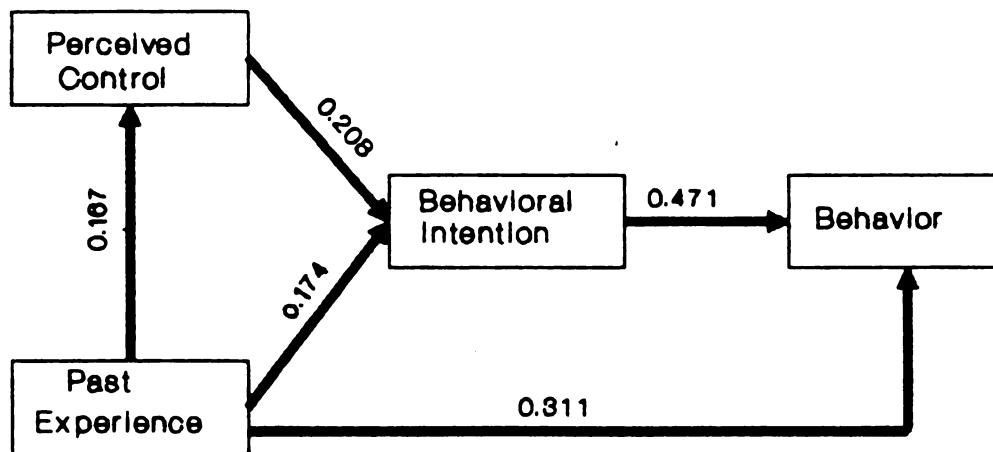


Figure 4.1 The Research Model and Path Coefficients

In order to examine the goodness of the fit of the model with the research data, first, a research model was built using the corrected observed correlation matrix. This original observed correlation matrix is presented in Table 4.16.

Table 4.16 The Observed Correlation Matrix for the Research Variables in the Finalized Research Model

Scales	(1)	(2)	(3)	(4)
(1) TControl	1.00			
(2) Experience	0.16	1.00		
(3) Intention	0.23	0.21	1.00	
(4) Action	0.08	0.41	0.53	1.00

Note: Valid cases are 252.

Second, the path coefficient was calculated based on the corrected correlation matrix. When a variable is conceived to be dependent on a single cause (variable), the path coefficient is equal to a zero-order correlation between the two variables. This is the case for the path coefficient of Past Experience to Perceived Control. When a variable is assumed to be dependent on two or more variables, the dependent variable is regressed on the variables upon which it is assumed to depend; each coefficient is equal to the standardized regression coefficient β associated with the same variable. One correlation analysis and two separate multiple regression analyses were applied to the corrected correlation matrix to calculate path coefficients. The results are

presented in Table 4.17. The path coefficient of Past Experience to Perceived Control was 0.16; the path coefficients of Perceived Control to Behavioral Intention and Past Experience to Behavioral Intention were 0.21 and 0.17 respectively. The path coefficients of Behavioral Intention to Behavior and Past Experience to Behavior were 0.47 and 0.31 respectively.

Table 4.17 Path Coefficients for the Research Variables in the Research Model

Scales	(1)	(2)	(3)	(4)
(1) TControl	1.00			
(2) Experience	0.16	1.00		
(3) Intention	0.21	0.17	1.00	
(4) Action	-	0.31	0.47	1.00

Note: Path coefficient here was equal to the standardized regression coefficient.

Are the data consistent with this finalized model? In other words, how well does the model fit with the research data? To answer this question, it is necessary to compare the original correlation matrix with the reproduced correlation matrix. If the discrepancies between the original and the reproduced correlations are small and the number of such discrepancies in the matrix are relatively few, then we may conclude that the model fits with the data.

The path coefficients calculated in the research model were used to reproduce the original correlation matrix. When

a variable is dependent on a single variable, the reproduced coefficient is equal to the path coefficient between the two variables. This is the case between Perceived Control and Past Experience, which can be expressed in the following equation:

$$R_{12} = p_{21} \quad (4.1)$$

Where R_{12} is the reproduced correlation coefficient for the two variables, the first subscript represents the dependent variable, the second subscript refers to the independent variable, and p_{21} is the path coefficient between the two variables.

When a variable is dependent on two or more variables that are not independent of each other, each reproduced correlation can be obtained from the following equation:

$$R_{13} = p_{31} + p_{32}r_{12} \quad (4.2 \text{ a})$$

$$R_{23} = p_{31}r_{12} + p_{32} \quad (4.3 \text{ a})$$

Where r_{12} can be substituted by p_{21} , the above two equations can be expressed as:

$$R_{13} = p_{31} + p_{32}p_{21} \quad (4.2 \text{ b})$$

$$R_{23} = p_{31}p_{21} + p_{32} \quad (4.3 \text{ b})$$

Similarly, other reproduced correlation coefficients can

be calculated with the following equations:

$$R_{24} = p_{41}r_{12} + p_{42} + p_{43}r_{23} \quad (4.4)$$

$$R_{34} = p_{41}r_{13} + p_{42}r_{23} + p_{43} \quad (4.5)$$

Table 4.18 is the comparison of the observed correlation matrix with the reproduced correlation matrix. The observed correlation matrix is in the lower diagonal and reproduced correlation matrix is in the upper diagonal. As can be seen in Table 4.18, the reproduced correlations matched the observed correlations very well except for one deviation of .009. Therefore, it can be concluded that the proposed causal model fits the data. The results of the path analysis indicating the direction and strength of the causal relationships between the research variables is shown in Figure 4.1.

Table 4.18 Comparison of the Observed Correlations and the Reproduced Correlations of the Variables in the Research Model

Scales	(1)	(2)	(3)	(4)
(1) TControl		0.167	0.237	-
(2) Experience	0.167		0.209	0.419
(3) Intention	0.237	0.209		0.537
(4) Action	-	0.410	0.537	

Note: Corrected correlations are shown in lower diagonal and reproduced correlations are shown in upper diagonal.

The result of the model's fit test suggests that a causal relationship exists among the variables that predict reported

behavior. A relatively high positive path coefficient between Behavioral Intention and Behavior indicates that Behavioral Intention is the best predictor of reported Behavior in this study. The result of the path analysis provides evidence of the applicability of Fishbein and Ajzen's theory of reasoned action to environmental problems. The results also suggest that there are no direct causal relationships between attitudes toward the technological hazards and actions taken for proper disposal of the hazardous waste -- this relationship was mediated by Behavioral Intentions. Past Experience with environmental pollution played a very important role not only in affecting people's attitudes and behavioral intention, but also in the prediction of reported behavior.

CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

In the final chapter, a brief overview of the study and summary of the results are presented. Following the overview is a discussion of the research findings and implications for future research.

Summary of the Study

The present study was based upon a secondary analysis of the data originally collected by Fridgen (1992) in the study of Human Disposition toward Hazards: Testing the Environmental Appraisal Inventory. The major purpose of the original study was "to better understand the variables that affect people's appraisal of and subsequent behavioral response to elements of environmental threat or hazard" (Fridgen, 1992, p.3). The target of the study was the management of small quantities of nonregulated household hazardous waste materials. The primary instrument used in the original study to measure people's environmental disposition was the Environmental Appraisal Inventory (EAI), developed by Schmidt and Gifford (1989) and expanded by Fridgen (1992). The 28 items used in the expanded EAI represented 28 different environmental hazards. People's

appraisals of these 28 hazards were assessed along four dimensions, i.e., threat to self, threat to environment, perceived control, and personal responsibility.

The purposes of this study were twofold. The first purpose was methodological: to modify the expanded EAI and construct a test instrument capable of assessing the environmental disposition of a specific threat -- hazardous materials. The second purpose was to test the applicability of the theory of reasoned action, developed by Fishbein and Ajzen (1975), to a special problem area, i.e., the management of household hazardous waste.

There were five specific research objectives for this study. The first specific objective was to construct a Natural Hazards subscale and a Technological Hazards subscale and test the differences in people's appraisal of these two types of hazards. Both the original EAI and expanded EAI had proven to be useful instruments in assessing of people's general attitudes toward environmental hazards (Fridgen, 1992; Schmidt and Gifford, 1989). However, the instruments can not identify the differences in appraisal of specific environmental hazards; for instance, the differences between the natural hazards and technological hazards. Studies have shown that people perceive natural hazards and technological hazards differently (Churchill and Hutchinson, 1984; Dunes and Yulzy, 1965; Quarantelli and Dunes, 1976). Differences in appraisal often lead to different coping strategies (Rochford and

Blocker, 1991). Identifying the differences in appraisal of different types of environmental hazards would help us to build an instrument that is capable of evaluating more precisely people's attitudes toward specific environmental hazards.

The second specific objective of this study was to construct a Behavioral Intention scale and examine its relationship with attitudes and behavior. According to Fishbein and Ajzen (1975, 1980), behavioral intention has two functions: first is as a mediatory function between attitudes and behavior, and second is as a predictive ability to behavior. Many social scientists failed to find a strong and consistent relationship between attitudes and behavior in their studies (Ajzen and Fishbein, 1977; Wicker, 1971). Repeated failures forced many scientists to investigate the attitude-behavior relationship from different perspective (Calder and Rose, 1973; Campbell, 1963; Defleur and Westie, 1963). The development of behavioral intention theory was one such attempt (Fishbein and Ajzen, 1975). In the Fridgen study, a significant relationship between the environmental appraisal and action was not found. Constructing and testing a behavioral intention scale may find a meaningful linkage between a person's disposition toward specific environmental threat and actions taken to protect the environment.

The third specific objective of the current study was to build an action index and evaluate its relationship with

behavior intention. In the Fridgen study, the behavior criterion was a single act; i.e., the respondent acted or did not acted on information received from the Hazardous Materials Information Line. Fishbein (1973) noted that attitude toward general objects is often a poor predictor when behavior is measured by a single act, but a good predictor when multiple acts are used as the criterion of behavior. This study tried twofold efforts to bring a better relationship between attitudes and behavior; First, instead of using attitudes, it used behavior intention to predict behavior; second, it broadened the scope of the behavioral measurement to bring a closer correspondence between attitudes and behavior.

The fourth specific objective of this analysis was to investigate the role past experience with environmental pollution played in response to specific environmental hazards. In Fridgen's study, a strong influence of past experience on people's appraisal of environmental hazards was demonstrated. However, the relationships between past experience and behavioral intention and behavior were not tested. Does past experience have a direct effect on people's decision to take actions for protecting the environment? The answers to this question will have great impact on designing environmental education programs.

The final specific objective of the study was to apply the theory of reasoned action to the original data and test if a causal relationship exists among the variables predicting

the environmental behavior. The theory of reasoned action developed by Fishbein and Ajzen (1975) attempts to select from a large variety of attitudes and behaviors determinants to form a small number of concepts, and link them together in a single theoretical system. It posits a causal sequence of events in which actions with respect to an object follow directly from behavioral intentions; the intentions, in turn, are consistent with the attitude toward the object, and this attitude derives reasonably from salient beliefs about the object. The theory of reasoned action has been tested and supported in a large number of studies, such as consumer behavior, family planning, political voting, infant feeding methods, drug abuse, church attendance, etc. (Ajzen and Fishbein, 1980; Manstead et al., 1983). However, published results revealed that this theory had limited applications in environmental study. Therefore, this study was an attempt to apply this theory to a special environmental problem area. The results from testing the theory of reasoned action using Fridgen's data may provide an useful explanation of relationship between people's environmental attitudes and action.

Three new attitudinal measurements, i.e., Natural Hazards subscale, Technological Hazards subscale, and Behavioral Intention scale, were constructed and their validity and reliability were assessed. High factor loadings, communality, percent of variance explained by the first extracted

component, and alpha level indicated these new scales were valid and reliable measurements.

Five research hypotheses were proposed based on the general and specific objectives of this study. Major statistical techniques -- factor analysis, correlation analysis, multiple regression, and path analysis -- were used to test the hypotheses. All five hypotheses were supported by the results of statistical analysis.

Results of the Hypotheses Testing

1. The differences between people's appraisal of the natural hazards and the technological hazards have been identified by comparing of the mean scores of these two types of hazards in four dimensions (Table 4.11). In the threat to Self dimension, the mean score of Technological Hazards subscale was 4.46, which referred to a 'moderate' to 'strong' threat, while the mean score of Natural Hazards subscale was only 2.69, which represented a 'minimal' to 'mild' threat. The difference between the two mean scores was 1.76 and was significant at $p < 0.0001$ level.

In the threat to Environment dimension, the mean score of Technological Hazards subscale was 5.29, indicating a 'strong' to 'very strong' threat, while the mean score of Natural Hazards subscale was 3.65, which represented a 'mild' to 'moderate' threat. The difference between the two mean scores

was 1.63 and significant at $p < 0.0001$ level (Table 4.11).

In the Perceived Control and Personal Responsibility dimensions, the differences between means of the two subscales were 1.17 and 1.05 respectively, and both were significant at $p < 0.0001$ level. In addition, the mean scores of Technological Hazards subscale were also higher than the mean scores of the expanded EAI in the all four dimensions (Table 4.11).

2. Relationship between people's appraisal of the technological hazards and Behavioral Intention was assessed along four dimensions, i.e., threat to Self, threat to Environment, Perceived Control, and Personal Responsibility. Correlation coefficients were .209, .193, .237, and .193 respectively, and all were significant at $p < 0.001$ level, which indicated a weak, yet positive and significant linear relationship between people's appraisal of technological hazards and Behavioral Intention (Table 4.11).

3. Behavioral Intention exhibited the strongest relationship with Behavior (Table 4.11). The correlation coefficient between the two variables was .537 and significant at $p < 0.001$ level, which indicated that Behavioral Intention was the best predictor of Behavior.

4. Correlation between Past Experience and Behavioral Intention was .209 and significant at $p < 0.01$ level; correlation between Past Experience and Behavior was moderately strong and positive ($r = .41$) and was significant at $p < 0.001$ level (Table 4.11).

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5. Four variables were selected to form the finalized research model: Perceived Control, Past Experience, Behavioral Intention and Behavior. Correlation analysis and multiple regression analysis were applied to the corrected correlation matrix to calculate path coefficients. The path coefficient of Past Experience to Perceived Control was 0.167; the path coefficients of Perceived Control and Past Experience to Behavioral Intention were 0.208 and 0.174 respectively; the path coefficients of Past Experience and Behavioral Intention to Behavior were 0.311 and 0.471 respectively (Table 4.17).

Comparison of the corrected observed correlation matrix with the reproduced correlation matrix demonstrated that the model fitted the research data very well, and it can be concluded that there was a causal relationship between people's environmental attitudes, behavioral intentions, and reported behavior.

Findings and Conclusions

Three major conclusions can be drawn from the findings of this study. First, the Technological Hazards subscale is a useful instrument capable of more precisely assessing people's environmental disposition toward a specific human-generated threat or hazard. Second, there is evidence to support the applicability of the theory of reasoned action to environmental attitudes and behavior research. Third, past

experience with environmental pollution has a strong impact on people's action to protect the environment. These three conclusions are discussed in detail in below.

1. As noted in the literature review, one of the major explanations for attitude and behavior inconsistency is that many studies utilize a general attitude measure to predict or explain a specific behavior (Ajzen and Fishbein, 1977; Kiesler et al., 1969; Jaccard et al., 1977; Wells, 1980). Over the last 20 years the importance of person-environment interactions has been widely recognized. There have been several notable attempts to assess various aspects of environmental disposition (Kaplan, 1977; Little, 1976; McKechnie, 1974; Taylor, 1979). The most famous work was McKechnie's Environmental Response Inventory (McKechnie, 1974, 1977), and the most recent effort was Schmidt and Gifford's Environmental Appraisal Inventory (Schmidt and Gifford, 1989). Most of these instruments were multidimensional measures of environmental disposition. When attitudes measured by these instruments were used to predict a specific behavior, the results were often disappointing. Fishbein (1973) suggested that attitude and behavior show a strong relationship when both are measured at an equivalent level of generality or specificity. In other words, if the purpose of a study is to predict a specific behavior, an instrument that can measure the equivalent level of specific attitudes is needed.

This study represents a response to that need. The 28

items used in the expanded EAI represented a wide range of environmental hazards. Schmidt and Gifford (1989) realized that the different types or groups of hazards in the EAI were appraised in similar ways and suggested that useful EAI subscales as a 'Large Natural Hazard subscale' and an 'Indoor Workplace Hazard subscale' should be developed. Fridgen (1992) made similar suggestion in her study. The demonstration of significant differences between people's appraisal of technological hazards and natural hazards in the current study supports the assumption that attitudes and behavior should be measured at an equivalent level of generality or specificity if attitude measurement is to be used to predict behavior.

Another significant advantage of the Technological Hazards subscale was that a much smaller number of items were used in the subscale than in the expanded EAI. In the expanded EAI there were 28 items, while in Technological Hazards subscale there were only eight items. Although the number of items used to construct a subscale was greatly reduced, the validity and reliability of the subscale were not reduced. One important indicator of the level of validity, the percent of variance explained by the first extracted component, was even higher in all the four dimensions in Technological Hazards subscale than in the expanded EAI. The reliability coefficients of the Technological Hazards subscale were also high (alpha values were all above .92). The mean scores of the Technological Hazards subscale were also higher than the mean

scores of the expanded EAI in all the four dimensions. These three important indicators demonstrated that the newly constructed Technological Hazards subscale was an efficient instrument in measuring people's environmental disposition.

This finding once again provides evidence to support the principle of parsimony. A study of 20 variables is not necessarily more enlighting or fruitful than a study of 10 variables. As a matter of fact, to understand or to explain a phenomenon (any phenomenon), one should look for the minimum number of factors that can account for it. If there are several possible explanations, one should choose the one with the least number of factors or assumptions. This is known as the principle of parsimony in formulating scientific hypotheses (Li, 1973). When two factors are sufficient, there is no need to introduce a third. In other words, people should always seek the simplest explanation of a phenomenon. Another important reason to use the principle of parsimony in scale construction is the cost of conducting a social survey research in terms of money and time.

2. The testing of the theory of reasoned action in the current study was another attempt to solve the problem of attitude-behavior inconsistency. According to Fishbein and Ajzen (1975, 1980), the basic assumption behind the theory of reasoned action is that "human beings are usually quite rational and make systematic use of the information available to them" and they "consider the implications of their actions

before they decide to engage or not engage in a given behavior" (Fishbein and Ajzen, 1980, p.5). This is why the model is named "the theory of reasoned action."

The most important component of the theory of reasoned action is the behavioral intention variable, which is viewed as the immediate determinant of an action being considered and an intermediate factor between attitude and behavior. The results from this study prove the utility of behavioral intention in predicting the action. In the Fridgen study, when people's attitudes toward general environmental hazards were used to predict action, no significant correlation was found. However, when behavioral intention used to predict action, as in this study, a moderately strong and positive correlation was obtained. Results from the multiple regression analysis indicated that behavioral intention accounted for about 29 percent of the variance of the behavior. Actually, compared with other variables in the research model, Behavioral Intention was the best predictor of reported behavior.

The intermediate function of the behavioral intention was also confirmed by the results of path analysis in this study. One explanation of why behavioral intention can play an intermediate role is that "intentions guide goal-directed behavior and are at an intermediate level of abstraction between concrete actions and abstract attitudes" (Triandis, 1971).

3. A third widely accepted explanation for attitude-

behavior inconsistency is the "other variable" theory which postulates that attitudes are only one of several variables that influence behavior, and if all the other variable were taken into consideration, better behavior prediction could be achieved (Weiseberg, 1965, Wicker, 1971). One of the major purposes of this study was to test this assumption. In attitude-behavior research, people's demographic profile, socio-economic background, and past experience are often considered as 'other variables'. In the Fridgen study, past experience with environmental pollution accounted for 9 percent of the total explained variance in the threat to Self dimension, which indicated the importance of past experience in influencing people's cognitive world. However, the impact of past experience with environmental pollution on people's behavioral intention and reported behavior was not tested. Including a past experience variable in the proposed research model in the current study was an attempt to test the 'other variable' assumption. Results from the data analysis exhibited that past experience not only influenced people's behavioral intention, but also had strong impact on reported behavior. As was mentioned before, when Behavioral Intention alone was used to predict behavior, the percent variance explained by behavioral intention was 29 percent; when both Behavioral Intention and Past Experience were used to predict behavior, coefficient determinant, R^2 increased to 0.39; in other words, 39 percent of the total explained variance was caused by these

two variables. Past experience alone accounted for about 10 percent (39 - 29) of the total explained variance. This study provided empirical evidence that the 'other variable', e.g., past experience, did play an important role in more accurate prediction of behavior.

It is noted that behavior response is a very complicated phenomenon and involves many factors. These factors range from inner, organismic reactions to external, socio-cultural attributes (Moore, 1986). The decision to act or not to act is not determined by one or two factors. That was why Past Experience and Behavioral Intention, two variables, only accounted for 39 percent of the total explained variance. Only a rather small portion of the problem was explored in the current study; there are a great many causes and attributes that we still do not know about or which have not been explored. Therefore, we should be cautious in interpreting the results of this particular part of the study.

Implications

1. Methodological Implication.

In the current study, four different strategies were tried to bring a better correlation between environmental attitude and behavior, and all the four strategies were proven to be useful. These four strategies were 1) construction of a test instrument that is capable of assessing more specific

attitudes so that both attitudes and behavior could be measured at the same level of specificity; 2) building a behavioral intention scale to mediate relations between attitudes and behavior, and using behavioral intention to predict reported behavior; 3) including other variables, such as past experience with environmental pollution, into the prediction equation; 4) instead of using single act criteria, building a multiple-items action index as the behavior criterion.

These strategies were proven to be successful in the current study and can be used in future environmental attitude and behavior research, especially in designing and constructing test instruments. For instance, empirically, most attitude-behavior studies are action-, target-, content-, and sometimes even time-specific; therefore, attitudes and behavior measurements should be built at same level of generality or specificity.

2. Implications for Management of Household Hazardous Waste

The ultimate goal of attitude-behavior study is to understand an individual's behavior, not merely predict it. It should be clear that the notion that intentions are the best predictor of behavior does not provide much information about the reasons for the behavior. The important thing is to identify the determinants of intentions. According to Fishbein and Ajzen (1975), people usually tend to act according the

information they have and beliefs they hold about the act. This is also the one of two determinants of intentions and is defined as attitudes toward the behavior (the other determinant is subjective norm). In the current study, four attitudinal variables were used to assess people's environmental disposition, and all these four attitudes were positively correlated with behavioral intention. However, in testing the research model, only one variable, Perceived Control, entered in the equation. This result has a meaningful implication to the management of household hazardous waste.

Perception of threat is often considered as an indicator of behavioral intention; however, this intention might be bidimensional. A strong threat to one's life or health may prevent an individual from taking any action. In this study, Perceived Control, as designed by the original researchers, was intended to measure "how much control the individual could exercise against a hazard if it became a threat" (Schmidt and Gifford, 1989, p.58). According to Fridgen (1992), Perceived Control represents a kind of "confidence that one's actions will make a difference." Therefore, Perceived Control as a major cause of behavioral intention has significant implications to HHW management.

Arnkoff and Mahoney (1979) defined the term control as having four related meanings: 1) skill; 2) power; 3) direction, regulation, and coordination; and 4) restraint or reserve. "Skill" refers to the internal capability to act and

"power" represents the capability to achieve an external effect. While skill and power refer to choices in actions, regulation, direction, and coordination refer to management of these choices. To meet both short- and long-range personal goals, choices must be coordinated and there must be a balance between self and societal concerns. The capacity to regulate can itself be seen as a type of skill, and it can serve to increase personal power. Restraint or reserve refers to the inhibition of some behaviors in order to meet a goal and can also be considered as personal responsibility. According to Arnkoff and Mahoney (1979), skill and personal power imply freedom in the choices available for action. Regulation and restraint, on the other hand, imply limits on freedom. Therefore, the term control has a dual nature and is also adaptive.

The dual nature of control has significant implication to HHW management. Skill can be considered as the knowledge and methods necessary for proper handling and managing HHW. Power can be considered as personal confidence and belief that individual's action can make a difference. On the other hand, individual's action should be self-regulated and limited so that sources for further polluting the environment will be reduced. The sense of personal responsibility to environmental quality is the key to self-regulation; this is especially important for HHW management since there is no government regulations to control the purchase, use, and disposal of

small quantity of consumer goods that may contain hazardous materials.

The mean score of Perceived Control in the previous two assessments was relatively low, which suggested that people felt "they had little control over these environmental hazards" (Schmidt and Gifford, 1989, p.60) and "indicated a sense of 'powerlessness' " (Fridgen, 1992, 63). Therefore, there is a need to improve people's perception of control over these environmental hazards. In planning and designing future programs for management of hazardous waste, more effort should be made to reinforce the dual nature of control -- for instance, through demonstration and community education program -- to raise people's confidence about their ability and power to handle these hazardous materials properly. In addition to technical assistance programs, local government should also initiate regulatory programs to limit people's actions.

3. Implications for Environmental Education Programs

As was discussed in Chapter I, public education is an important component of the programs aimed to control household hazardous waste. Education programs can be useful means to help people establish correct beliefs and attitudes about hazardous materials and provide the best methods to handle them. One important aspect that should be incorporated into the planning of the future environmental education programs is people's past experience with environmental pollution. In the

current study, past experience with environmental pollution not only "emerged as one of the most powerful contributors to environmental awareness and to people's appraisal of threat" (Fridgen, 1992), but also as a strong predictor of behavioral intention and behavior. Rychman (1979) noted that those people who have strong perception of control are more likely to use their past experiences as the basis for generalizing to future performances. Their cumulative experiences of past events can help them to develop better problem-solving strategies and make more accurate and realistic assessments of their environment. Education programs can be designed to simulate the pollution process and give individuals a chance to 'experience' the damage or threat pollution could cause.

Limitations of the Study

1. The great advantage of using secondary data in this study is that it is less expensive, both in terms of money and time. Generally, secondary data can be scrutinized before hypotheses or models are specified. However, the disadvantage is that such data are not collected under the current researcher's control. Lack of control can be serious because (1) aggregation levels used in previous studies may not be appropriate to the current study, (2) definitions of variables and measurement scales may not be compatible with the current study, (3) levels of precision associated with variables may

not be adequate for the current study. Although the data used in the current study meet the information requirements for the research problems, some of the measurements, for example, the action measurements, were not well constructed. As Fridgen (1992) summarized: "Although the questionnaire was designed to create an index of action based upon multiple items, the response patterns requested of the respondents apparently were overly complex and the results were not usable" (p.71). This not only caused problems for the original study, it also complicated the new scale construction for the current study.

2. The research sample was not randomly selected. The respondents of the survey questionnaire were those who called the Hazardous Material Information Line during a fixed period of time. From the analysis of the demographic data, we can see that the sample slightly overrepresented segments of the Michigan population. These callers can be considered as "concerned citizens" or "early adopters," so some of the research findings may not be appropriate for generalization to the larger population.

3. There are limitations in the theory of reasoned action. One major assumption behind the theory of reasoned action is that people's actions are largely under volitional control. That is to say, people can easily perform certain behaviors if they so prefer, or avoid performing them if they decide against it. However, in the actual life, this may not always be true. A hazardous materials collector might not

necessarily prefer that work, but might need the job. Or a person who did not participate in community collection day's activity might not be against it, but might have been away. Therefore, if both behavioral intention and behavior measurements were built based one's preference, it might simplify the study of the human behavior process.

Another weakness of the theory of reasoned action is that it does not include the "other variables" in the model. Fishbein and Ajzen considered the other variables, such as demographic characteristics or personality traits, as external to the theory and minimized their roles in predicting behavior. The findings of current study indicated that these 'other variables', such as past experience with environmental pollution, played important role in predicting reported environmental behavior; and in future attitude-behavior study, these 'other variables' should be given more attention.

Recommendations for Future Research

1. In future study, perceived control and personal responsibility should be evaluated with more accurate and explicit measurements. In the current study, perceived control and personal responsibility were evaluated by using the same 28 items that were used to evaluate the perceptions of threats to self and to the environment. However, perceived control and personal responsibility are concepts that are actually

different from the perceptions of threat to self and to the environment. Even when the questions were asked with different headings, requiring the respondents using the same 28 items repeatedly to assess four different concepts may cause some confusion, and checking through the same long list of 28 items four times is somewhat boring. Therefore, perceptions on control and responsibility should be assessed differently from the perceptions of threat and hazards.

2. In future research, the behavior criterion should be defined more carefully and multiple-items measurement should be used to collect action information. In addition, other variables, such as demographics and socio-economic characteristics, should be included in the research model.

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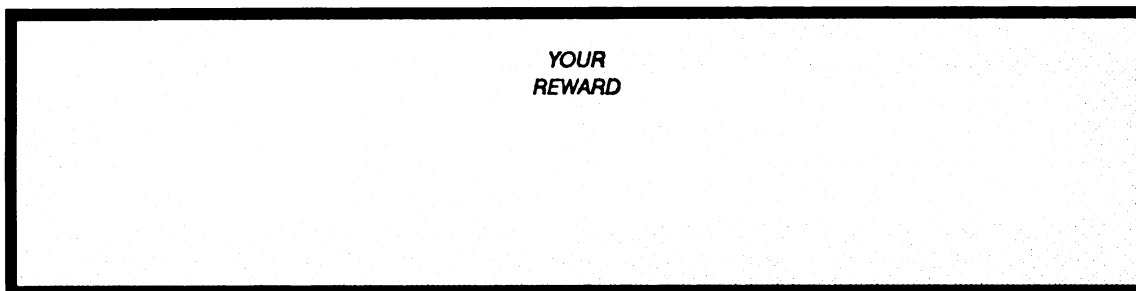
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APPENDIX

APPENDIX

GUIDE TO HAZARDOUS PRODUCTS AROUND THE HOME SURVEY



FOR BEING ENVIRONMENTALLY AWARE

Dear Survey Participant:

Within the last 18 months you have contacted one of the Hazardous Materials Information Services, either in Baraga, Cheboygan, Oakland, or Ingham counties. As a result of your responsible behavior, some aspect of the environment is better protected.

In an effort to improve the quality of our service, we need to better understand you and your response to the issue of environmental problems.

In return for your time and effort, we would like to send you a copy of the book, *Guide to Hazardous Products Around the Home*, shown above.

We would appreciate your return of this questionnaire by November 15, 1990. Thank you.

Cynthia Fridgen
Waste Management Specialist

Instructions

LIST YOUR ZIP CODE HERE _____

Please read the question at the top of each set of scales carefully. The scale items are identical but the question is different. Respond to every item—even if a certain hazard is not a factor in your life or you have never heard of it, you can choose the response "no threat." Work fairly quickly; do not deliberate long over each hazard.

DO NOT PUT YOUR NAME ON THIS QUESTIONNAIRE! You indicate your voluntary agreement to participate by completing and returning this questionnaire; all responses will be confidential. Your questionnaire is coded for the purpose of documenting its return and prompting us to send you a copy of *A Guide to Hazardous Products around the Home*. At this point the relationship between your name and your questionnaire will be destroyed. Please direct any questions concerning this questionnaire to Cynthia Fridgen (517/355-9578). Thank you for your cooperation. Your support will help us design more responsive environmental education and assistance programs.

Please return this questionnaire to:

Hazardous Materials Management Project
302 Natural Resources Building
Michigan State University
East Lansing MI 48824-1222

PLEASE READ THE FOLLOWING DIRECTIONS:

- Use a soft black (no. 2) pencil only.
- Do not fold, staple, or make stray marks on the form.
- Circle the answer of your choice.
- Erase cleanly when you want to change an answer.

- I. Please rate how threatening the following problems are TO YOU by marking the response that best describes your position.

		No Threat	Minimal	Mild	Moderate	Strong	Very Strong	Extreme
1.	Water pollution	1	2	3	4	5	6	7
2.	Storms—lightning, hurricanes, tornados, snow, etc	1	2	3	4	5	6	7
3.	Pollution from cars, factories, and burning trash	1	2	3	4	5	6	7
4.	Smoking in public buildings	1	2	3	4	5	6	7
5.	Acid rain	1	2	3	4	5	6	7
6.	Pollution from office equipment, e.g., ozone from photocopiers	1	2	3	4	5	6	7
7.	Number of people—crowding, increasing population	1	2	3	4	5	6	7
8.	Fluorescent lighting	1	2	3	4	5	6	7
9.	Water shortage, e.g., drought, water depletion	1	2	3	4	5	6	7
10.	Noise pollution	1	2	3	4	5	6	7
11.	Visual pollution—billboards, litter, etc	1	2	3	4	5	6	7
12.	Radioactivity in building materials, e.g., radon gas							7
13.	Change to the ozone caused by pollution	1	2	3	4	5	6	
14.	Earthquakes	1	2	3	4	5	6	7
15.	Soil erosion	1	2	3	4	5	6	7
16.	Impure drinking water	1	2	3	4	5	6	7
17.	Forest fires	1	2	3	4	5	6	7
18.	Floods or tidal waves	1	2	3	4	5	6	7
19.	Germs or micro-organisms	1	2	3	4	5	6	7
20.	Radioactive fallout	1	2	3	4	5	6	7
21.	Fumes or fibers from synthetic materials— asbestos, carpets, plastics, etc	1	2	3	4	5	6	7
22.	Chemical dumps	1	2	3	4	5	6	7
23.	Video screen emissions	1	2	3	4	5	6	7
24.	Pesticides and herbicides	1	2	3	4	5	6	7
25.	Groundwater pollution from landfill seepage	1	2	3	4	5	6	7

	<u>No Threat</u>	<u>Minimal</u>	<u>Mild</u>	<u>Moderate</u>	<u>Strong</u>	<u>Very Strong</u>	<u>Extreme</u>
26. Air pollution from waste to energy incinerators . .	1	2	3	4	5	6	7
27. Surface water contamination from discarded . . .	1	2	3	4	5	6	7
28. Ocean pollution from dumping municipal solid waste	1	2	3	4	5	6	7

II. Please rate how threatening the following problems are TO THE PHYSICAL ENVIRONMENT by marking the response that best describes your position:

	<u>No Threat</u>	<u>Minimal</u>	<u>Mild</u>	<u>Moderate</u>	<u>Strong</u>	<u>Very Strong</u>	<u>Extreme</u>
1. Water pollution	1	2	3	4	5	6	7
2. Storms—lightning, hurricanes, tornados, snow, etc	1	2	3	4	5	6	7
3. Pollution from cars, factories, and burning trash	1	2	3	4	5	6	7
4. Smoking in public buildings	1	2	3	4	5	6	7
5. Acid rain	1	2	3	4	5	6	7
6. Pollution from office equipment, e.g., ozone from photocopiers	1	2	3	4	5	6	7
7. Number of people—crowding, increasing population	1	2	3	4	5	6	7
8. Fluorescent lighting	1	2	3	4	5	6	7
9. Water shortage, e.g., drought, water depletion	1	2	3	4	5	6	7
10. Noise pollution	1	2	3	4	5	6	7
11. Visual pollution—billboards, litter, etc	1	2	3	4	5	6	7
12. Radioactivity in building materials, e.g., radon gas				4	5	6	7
13. Change to the ozone caused by pollution	1	2	3	4	5	6	7
14. Earthquakes	1	2	3	4	5	6	7
15. Soil erosion	1	2	3	4	5	6	7
16. Impure drinking water	1	2	3	4	5	6	7
17. Forest fires	1	2	3	4	5	6	7
18. Floods or tidal waves	1	2	3	4	5	6	7
19. Germs or micro-organisms	1	2	3	4	5	6	7
20. Radioactive fallout	1	2	3	4	5	6	7
	1	2	3	4	5	6	7

	<u>No Threat</u>	<u>Minimal</u>	<u>Mild</u>	<u>Moderate</u>	<u>Strong</u>	<u>Very Strong</u>	<u>Extreme</u>
21. Fumes or fibers from synthetic materials— asbestos, carpets, plastics, etc	1	2	3	4	5	6	7
22. Chemical dumps	1	2	3	4	5	6	7
23. Video screen emissions	1	2	3	4	5	6	7
24. Pesticides and herbicides	1	2	3	4	5	6	7
25. Groundwater pollution from landfill seepage . . .	1	2	3	4	5	6	7
26. Air pollution from waste to energy incinerators . .	1	2	3	4	5	6	7
27. Surface water contamin- ation from discarded motor oil	1	2	3	4	5	6	7
28. Ocean pollution from dumping municipal solid waste	1	2	3	4	5	6	7

III. Please rate how much CONTROL you could personally exercise against each problem if it became a serious threat to you (mark one response).

	<u>No Control</u>	<u>Minimal</u>	<u>Mild</u>	<u>Moderate</u>	<u>Strong</u>	<u>Very Strong</u>	<u>Extreme</u>
1. Water pollution	1	2	3	4	5	6	7
2. Storms—lightning, hurri- canes, tornados, snow, etc	1	2	3	4	5	6	7
3. Pollution from cars, factories, and burning trash	1	2	3	4	5	6	7
4. Smoking in public buildings	1	2	3	4	5	6	7
5. Acid rain	1	2	3	4	5	6	7
6. Pollution from office equipment, e.g., ozone from photocopiers	1	2	3	4	5	6	7
7. Number of people— crowding, increasing population	1	2	3	4	5	6	7
8. Fluorescent lighting	1	2	3	4	5	6	7
9. Water shortage, e.g., drought, water depletion	1	2	3	4	5	6	7
10. Noise pollution	1	2	3	4	5	6	7
11. Visual pollution— billboards, litter, etc	1	2	3	4	5	6	7
12. Radioactivity in building materials, e.g., radon gas	1	2	3	4	5	6	7

	<u>No</u> <u>Control</u>	<u>Minimal</u>	<u>Mild</u>	<u>Moderate</u>	<u>Strong</u>	<u>Very</u> <u>Strong</u>	<u>Extreme</u>
13. Change to the ozone caused by pollution . . .	1	2	3	4	5	6	7
14. Earthquakes	1	2	3	4	5	6	7
15. Soil erosion	1	2	3	4	5	6	7
16. Impure drinking water . .	1	2	3	4	5	6	7
17. Forest fires	1	2	3	4	5	6	7
18. Floods or tidal waves . .	1	2	3	4	5	6	7
19. Germs or micro-organisms	1	2	3	4	5	6	7
20. Radioactive fallout	1	2	3	4	5	6	7
21. Fumes or fibers from syn-thetic materials— asbestos, carpets, plastics, etc . . .	1	2	3	4	5	6	7
22. Chemical dumps	1	2	3	4	5	6	7
23. Video screen emissions	1	2	3	4	5	6	7
24. Pesticides and herbicides	1	2	3	4	5	6	7
25. Groundwater pollution from landfill seepage . . .	1	2	3	4	5	6	7
26. Air pollution from waste to energy incinerators . .	1	2	3	4	5	6	7
27. Surface water contamination from discarded motor oil	1	2	3	4	5	6	7
28. Ocean pollution from dumping municipal solid waste	1	2	3	4	5	6	

IV. Please rate how much PERSONAL RESPONSIBILITY you feel for the existence of this hazard (mark one response).

	<u>No</u> <u>Respon-</u> <u>sibility</u>	<u>Minimal</u>	<u>Mild</u>	<u>Moderate</u>	<u>Strong</u>	<u>Very</u> <u>Strong</u>	<u>Extreme</u>
1. Water pollution	1	2	3	4	5	6	7
2. Storms—lightning, hurricanes, tornados, snow, etc	1	2	3	4	5	6	7
3. Pollution from cars, factories, and burning trash	1	2	3	4	5	6	7
4. Smoking in public buildings	1	2	3	4	5	6	7
5. Acid rain	1	2	3	4	5	6	7
6. Pollution from office equipment, e.g., ozone from photocopiers	1	2	3	4	5	6	7

	No Respon- sibility	Minimal	Mild	Moderate	Strong	Very Strong	Extreme
7. Number of people— crowding, increasing population	1	2	3	4	5	6	7
8. Fluorescent lighting							
9. Water shortage, e.g., drought, water depletion	1	2	3	4	5	6	7
10. Noise pollution	1	2	3	4	5	6	7
11. Visual pollution— billboards, litter, etc	1	2	3	4	5	6	7
12. Radioactivity in building materials, e.g., radon gas							
13. Change to the ozone caused by pollution . . .	1	2	3	4	5	6	7
14. Earthquakes	1	2	3	4	5	6	7
15. Soil erosion	1	2	3	4	5	6	7
16. Impure drinking water . .	1	2	3	4	5	6	7
17. Forest fires	1	2	3	4	5	6	7
18. Floods or tidal waves . .	1	2	3	4	5	6	7
19. Germs or micro- organisms	1	2	3	4	5	6	7
20. Radioactive fallout	1	2	3	4	5	6	7
21. Fumes or fibers from synthetic materials— asbestos, carpets, plastics, etc	1	2	3	4	5	6	7
22. Chemical dumps	1	2	3	4	5	6	7
23. Video screen emissions	1	2	3	4	5	6	7
24. Pesticides and herbicides	1	2	3	4	5	6	7
25. Groundwater pollution from landfill seepage . . .	1	2	3	4	5	6	7
26. Air pollution from waste to energy incinerators . .	1	2	3	4	5	6	7
27. Surface water contamin- ation from discarded motor oil	1	2	3	4	5	6	7
28. Ocean pollution from dumping municipal solid waste	1	2	3	4	5	6	7

1. Was your contact with the Hazardous Waste Materials information line related to (mark one)—

[] Home [] Farm [] Business

MILES

2. Would you be willing to drive (mark one) [1 5 10 15 20 25 30 farther] to dispose of a hazardous material?

MINUTES

3. Would you be willing to wait (mark one) [10 20 30 40 50 60 70 longer] to dispose of a hazardous material?

DOLLARS

4. Would you be willing to spend (mark one) [1 5 10 15 20 25 30 more] to dispose of one gallon of toxic material?

EFFORT

5. Would you be willing to make (mark one) [1 2 3 4 5 6 7 more phone calls] to find out the best possible option for disposing of an unwanted hazardous material?
6. Which of the following agencies/service units would you be most willing to contact for information about the disposal of an unwanted hazardous material? (Please check three in rank order with one being first choice.)

- ☐ State of Michigan/Department of Environmental Health
- ☐ County health department
- ☐ Michigan Department of Natural Resources
- ☐ Local community college
- ☐ Michigan State University/Cooperative Extension Service
- ☐ Local hospital
- ☐ University of Michigan
- ☐ United States Environmental Protection Agency (EPA)
- ☐ Wayne State University
- ☐ Other, please specify _____

BACKGROUND INFORMATION: In order to find out how different people feel about various issues, a demographic section is included below. Your answers to these questions are confidential.

Demographics: (Mark one)

- ☐ Female
☐ Male

AGE:

- ☐ 18-25
☐ 25-35
☐ 35-45
☐ 45-55
☐ 55-65
☐ 65+

INCOME: (Total taxable household income)

- ☐ Less than \$10,000
☐ \$10,000 to \$19,999
☐ \$20,000 to \$29,000
☐ \$30,000 to \$39,999
☐ \$40,000 to \$49,999
☐ \$50,000 to \$59,999
☐ \$60,000 to \$69,999
☐ \$70,000 or over

EDUCATION: (Level of education completed?)

- ☐ Less than high school
☐ High school graduate
☐ Some college
☐ Associate's or technical degree
☐ College graduate
☐ Graduate or professional degree

MARITAL STATUS:

- ☐ Single/separated/divorced
☐ Married/permanent relationship
☐ Widowed

FAMILY STATUS: (Mark all that apply)

- ☐ No children
☐ Preschool children
☐ Children K-12
☐ Grown children

YOUTH ENVIRONMENT: (Where did you spend most of your youth?)

- ☐ Urban
☐ Suburban
☐ Rural farm
☐ Rural nonfarm

Number of brothers/sisters:

- ☐ Only child
☐ 1 sibling
☐ 2 siblings
☐ 3 siblings
☐ 4 siblings
☐ 5 siblings
☐ 6 siblings
☐ 6 or more siblings

Your place in the family:

- ☐ Only
☐ Oldest
☐ Second oldest
☐ Specify _____

Please fill in the appropriate answer space.

EXPERIENCES:

1. Were your parents or grandparents involved in pro-environmental causes?
 Not involved 1 2 3 4 5 6 7 Very involved
 Don't know _____
2. Do you contribute money to environmental causes?
 None 1 2 3 4 5 6 7 Substantial amount
3. Have you or anyone in your family been affected by environmental pollution?
 Not affected 1 2 3 4 5 6 7 Seriously affected

ACTION:

1. Have you acted on the information you received from the Hazardous Materials Information line?
☐ Yes ☐ No

Describe briefly _____

2. If yes, did you act on the information within:
☐ 1 day ☐ 1 month
☐ 2 days ☐ 2 months
☐ 3 days ☐ more
☐ 1-2 weeks
3. If no, was it because of:
☐ Lack of opportunity
☐ Cost
☐ Inconvenience
☐ Other (explain if you like)

4. Do you feel your action made a difference in the quality of your environment?
☐ Yes
☐ No

5. If yes, rate this difference.
 Little difference 1 2 3 4 5 6 7 Big difference

6. Will you make different consumer decisions as a result of the information you received from the Hazardous Materials Information line?

☐ Yes

☐ No

Give one brief example _____

7. If yes, will these decisions cost more or less?
 Less 1 2 3 4 5 6 7 More

8. Have you (mark all that apply):

☐ spent more

☐ traveled farther

☐ waited longer

☐ made more phone calls

to dispose of hazardous materials than before you called the Hazardous Materials Information line?

9. How would you rate your personal commitment to preventing environmental pollution?
 Low 1 2 3 4 5 6 7 High

10. What changes have you made as a result of your contact with the agent responding to questions on the Hazardous Materials Information Line?

Thank you for your time and effort. Please return the questionnaire in the self-addressed, stamped envelope provided and we will send you a copy of the 220-page Guide to Hazardous Products Around the Home.