From a Contractors Perspective: What is Needed to Recover Used CCA Treated Lumber?”

Delton R. Alderman, Jr.
Research Scientist
USDA Forest Service, Northeastern Experiment Station
dalderman@fs.fed.us
241 Mercer Springs Road, Princeton, WV 24070
phone: 304-431-2734, fax: 304-431-2772

Robert L. Smith
Associate Professor and Extension Specialist
Department of Wood Science & Forest Products
Virginia Tech, Blacksburg, VA

Philip Araman
Project Leader
USDA Forest Service, Southeastern Research Station
Blacksburg, VA

ABSTRACT: The rationale of this research was to discern the factors that currently are preventing contractors from recovering and recycling spent chromated copper arsenate (CCA) lumber. This study examines the effects of evaluations and beliefs, subjective norms, perceived behavioral control, and awareness of the contractor's decision intention to recover used CCA lumber. We utilized a modified version of the theory of planned behavior to discover factors affecting a contractor’s decision intention to recover spent CCA lumber. This study proposed that the contractor’s decision intention to recover is affected by attitude, normative beliefs, and perceived barriers to recovery. The study included a mail questionnaire sent to over 2,800 contractors. The findings of this research indicate that perceived behavioral internal and external controls towards the recovery of used CCA treated lumber have a significant impact on a contractor's decision intention to recover spent CCA lumber. Moderator analysis indicates that for recovery intention, an interaction between attitude towards recovery and external control plays a significant role in the decision intention. Significant correlations were also found between a number of the constructs. Finally, the authors present the public policy and marketing implications and recommendations from this investigation.

Introduction

During the past 30 years, environmental issues have been in the forefront of American society. in one form or another, forest management and forest product issues have too garnered appreciable attention. United States manufacturers and citizens produce and consume over 510 million cubic meters of wood and forest products each year (Haygreen & Boyer 1996). Americans also consume more wood products per capita than any other people groups on the Earth (Natural Resources Defense Council 2001). One method for extending the life of wood products and concurrently reducing the demand on forests is to preservatively treat wood products. The preservative treating of wood, particularly Southern yellow pine, exhibited dramatic growth in the early to mid-1970’s and continues to this day. Treating wood products extends the life of these products by protecting wood from bacteria, insect, and fungal attacks. Chromated copper arsenate (CCA), a water borne preservative, has been the primary preservative treatment chemical ‘used in the United States.

The rationale of this research was to discern the factors that currently are preventing contractors from recovering spent CCA lumber. Moreover, we sought to apply theory and thus this is not a test of theory. Our focus was in application and the proffering of interventions and recommendations to enhance the recovery process. We utilized a modified Theory of Planned Behavior to investigate contractors and their intention to recover spent CCA lumber. Specifically, the theory was applied to discern the beliefs that affect the recovery intention. In 1971, Kotler and Zaltman referred to social marketing as designing, implementing, and controlling programs that are developed to influence the acceptability of social ideas. They also stated that social marketing included product planning, pricing, communication, and distribution. Shum *et al.* (1994) viewed recycling as the marketing mix and included marketing research in the mix. Pieters *et al.* (1998) observed that a pressing research priority is determining what actually motivates people to recover and recycle.

Background

CCA Treated Lumber

Forest products, particularly treated lumber, can be used to fabricate decks, porches, patios, and balconies. The American Housing Survey of 1999 estimated nearly 120 million residences were in place, and that 92.2 million decks, porches, patios, and balconies were attached to those residences (American Housing Survey 1999). Truini (1996) estimated there were approximately 30 million decks in the United States in 1996 and that the majority of residential decks are believed to be located in the Southern United States.

To illustrate the extraordinary growth of treated wood products, let us consider the species group Southern yellow pine (SYP). The preservative treating of SYP has increased steadily from 600 million board feet (50 million cubic feet) in 1975 to 6.1 billion board feet (508.3 million cubic feet) in 2000. Over 5.5 billion board feet of SYP have been preservatively treated annually since 1996, and the number topped 6 billion board feet in 1998. From 1997 to 2001, an estimated 2 billion board feet annually has been used to fabricate or remodel residential decking, nearly 38 percent of all SYP that is preservatively treated (Southern Forest Products Association (SFPA) 2000). Wood products in the Southeast have a greater potential for deterioration, as the climate is very conducive for insects, bacteria, and fungi. In addition, the majority of CCA treated lumber is believed to be utilized in the Southern United States (McQueen & Stevens 1998).

Salient issues are currently looming on the horizon for CCA preservatively treated lumber. The first issue concerns the quantities of CCA treated lumber that are currently being removed from service and are projected to be removed from service. Cooper (1993) projected that 9 billion cubic feet would be removed in the year 2004 and nearly 18 billion cubic feet would be removed from service by the year 2020.

With the increased usage of CCA treated lumber for decking and children's playground equipment, increasing concern is being directed towards the leaching of treatment chemicals from decking and playground equipment. Recent headlines in the U.S. media have exclaimed the following: "The poison in your backyard" and "Arsenic fears rise over treated wood disposal" (Hauserman 2001ab). In July 2001, a Time magazine headline extolled "Toxic Playgrounds" and another "Arsenic–treated wood criticized" (Bond 2001). The other major problems associated with CCA treated lumber are preservative chemicals are leached *in situ* applications; consumption of available land in landfills; leaching of preservative chemicals in the landfills (even lined landfills leak) (Blaisdell 2000); and the loss of CCA treated lumber that could be utilized for other purposes.

To illustrate the leaching problem, recent work in the State of Florida indicates that arsenic levels underneath residential decks exceeded the quantity found naturally in Florida's soils. The natural arsenic level is roughly 0.42 mg/kg, and soil samples taken from underneath residential decks averaged over 28.0 mg/kg (CCA–Treated Wood Projects 2001). The United States Environmental Protection Agency recommends that soil arsenic levels not exceed 0.8 mg/kg for residential areas (CCA–Treated Wood Projects 2001). CCA–Treated Wood Projects (2001) also found that metal concentrations (in the soil adjacent to a deck) could be attributed to leaching from only a fraction of the CCA originally present in the deck lumber. In addition, the State of Minnesota recently conducted hearings concerning banning CCA treated lumber (Sierra Club 2001).

Fear of chemical leaching and the quantities of spent material taken out of service have led to an increased urgency for recovery and the necessary programs and facilities to facilitate recovery. We believe that decking contractors are the most logical subjects to research, as they fabricate, deconstruct, or demolish decking. To gain an understanding of the recovery factors from the contractor's perspective addresses the issues concerning lumber recovery and may alleviate the necessity for expensive, technological interventions to facilitate recovery.

In this research, our goal was not to expand existing theory; rather we test a paradigm for contractor recovery intention as it relates to the recovery of spent CCA lumber. We contend that recovery is the initial and necessary step in recycling and the factors influencing recovery must be addressed before suggesting interventions to facilitate the recovery of CCA lumber.

Past research also has addressed and concentrated on waste/residue recycling behaviors and diverse factors affecting recovery (e.g., Biswas et al. 2000; Taylor & Todd 1997, 1995; DeYoung 1996; DeYoung et al. 1993; DeYoung & Kaplan 1990, 1989, 1986; Bagozzi & Dabholkar 1994; Shum, Lowery, & McCarty 1994; McCarty & Shum 1993; Vining & Ebreo 1992; Ellen et al. 1991).

However, minimal research has been directed towards discovering the basic steps (e.g., programs and facilities) for recovering materials and associated beliefs regarding waste/residue recovery. Specifically, we sought to: 1) determine the influences that shape contractor attitudes toward recovering used CCA treated lumber, and 2) identify the factors that influence a contractor's decision intention to recover spent CCA lumber. We chose to research contractor recovery intention as the result of the increasing interest in CCA lumber and its having become both a national and regional concern.

Theoretical Framework

To frame and research the aforementioned constructs, a modified version of the theory of planned behavior (Ajzen 1991) was developed (Figure 1). This theory incorporates both the situational and individual factors that may influence a contractor's decision intention to recover. The essence of this theory is that by investigating intention one often can predict behavior. Intention is shaped by attitudes toward a specific behavior and is assumed to capture the motivational factors that influence a specific behavior and the quantity of effort one plans to apply in order to perform a discrete behavior (Ajzen 1991).

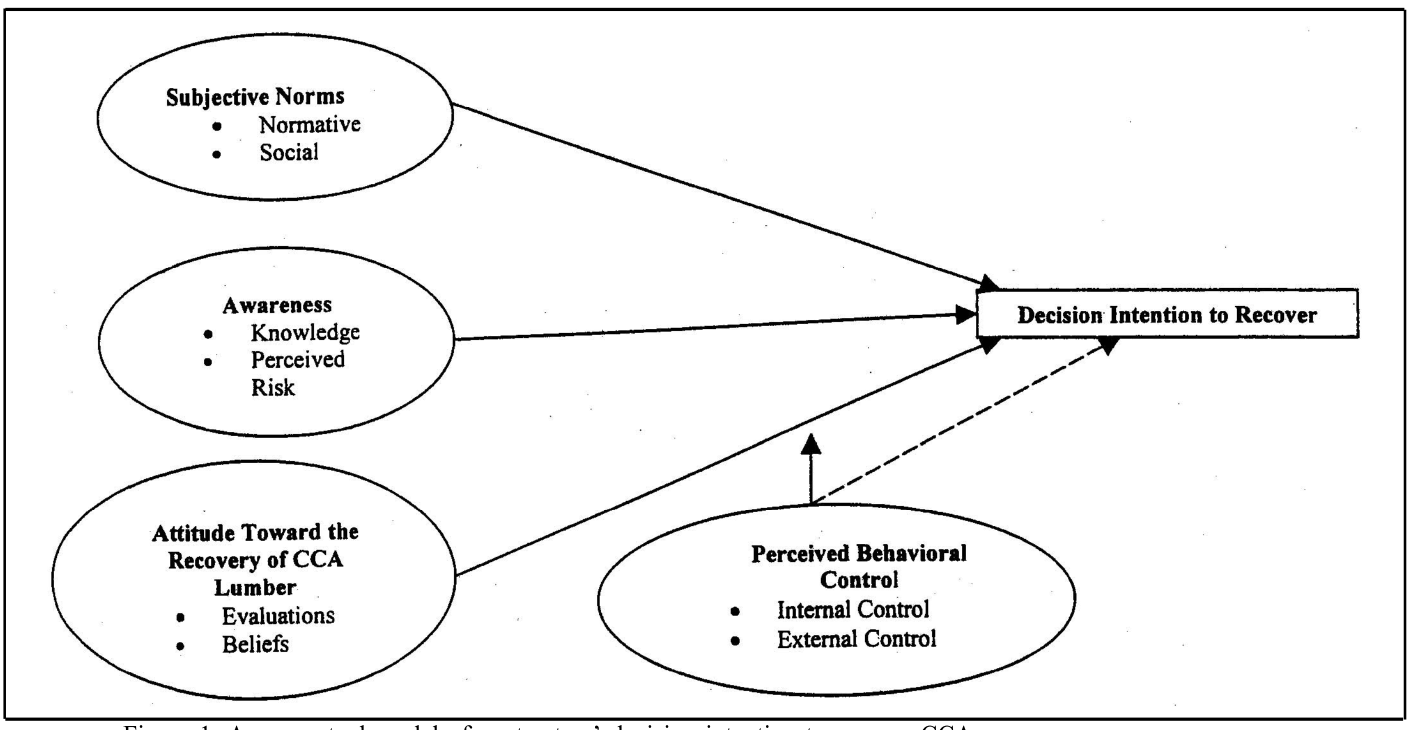

Figure 1. A conceptual model of contractors' decision intention to recover CCA treated lumber.
Source: The Theory of Planned Behavior Ajzen (1991).

In keeping with the constructs and terminology of the theory of planned behavior (Ajzen 1991), the independent variables of interest were: 1) evaluations and beliefs, when combined, form the attitude toward the decision intention to recover used CCA lumber; 2) the social influence of others or subjective norms concerning the recovery intention; and 3) perceived behavioral control. Perceived behavioral control can be further delineated into two components: a) internal control factors, and b) external control factors. Finally, 4) awareness regarding the recovery of spent CCA treated lumber, which included both perceived risk and recovery knowledge (Figure 1).

The theory of reasoned action (Fishbein & Ajzen 1975; Ajzen & Fishbein 1980) and the theory of planned behavior (Figure 1), (Ajzen 1985, 1991) have been employed for over 20 years to study a wide variety of intentions and behaviors. This theory also has been used to investigate recycling (e.g., Biswas et al. 2000; Taylor & Todd 1997; DeYoung 1996; Bagozzi & Dabholkar 1994; Shum, Lowery, & McCarty 1994; Vining & Ebreo 1992).

Theory Constructs

Attitude Toward a Behavior

Both the theory of planned behavior and reasoned action (Ajzen 1991; Fishbein & Ajzen 1975) posit that one's attitude toward a behavior is personal and captures the positive or negative evaluation of one performing a specific behavior. Attitude toward a behavior is determined by the total set of accessible behavioral beliefs about an object and links the behavior to various outcomes and other attributes (Ajzen 2000, 1991). In this study, a contractor's evaluation (i.e., attitude toward a behavior) regarding the recovery of spent CCA was of primary concern.

Currently many researchers view evaluation as a primary component of an attitude, with an evaluation defined as one's degree of favorableness or unfavorableness of an object. Evaluations were measured by directly asking participants to assess the recovery of spent CCA lumber.

Beliefs

In addition to evaluations, beliefs about an object are the second component that comprise an attitude. In Fishbein's (1967) theory of reasoned action, a person's evaluation of an object is determined by "accessible beliefs about an object" and beliefs are defined as the "subjective probability of a connection between the attitude object and the attribute, and the greater the subjective probability, the stronger the belief' (Fishbein & Ajzen 1999, 1975).

Behavioral beliefs connect the behavior of interest to the expected outcome of executing a particular behavior. One may hold many beliefs with respect to any discrete behavior, however, only a very small quantity are easily accessible at a particular moment. A primary assumption is that accessible beliefs, combined with the subjective values, determine the predominant attitude toward a behavior. Thus, the "evaluation" of each outcome contributes to the attitude in direct proportion to the one's subjective probability that a behavior will produce the outcome in question (Ajzen 2000, 1991).

Subjective Norms

Normative beliefs are defined as the perceived expectations (by an individual) of important referent individuals or groups (e.g., coworkers, spouse, family, friends). It is assumed that the normative beliefs, combined with an individual's motivation to comply with the different referents, determine the prevailing subjective norm. Expressly, "the motivation to comply with each referent contributes to the subjective norm in direct proportion to the person's subjective probability that the referent thinks the person should perform the behavior in question" (Ajzen 2000, 1991).

Subjective norm is defined as the perceived social pressure to engage or not to engage in a behavior. Subjective norms concern the likelihood that significant individuals, coworkers, or groups in a person's life approve or disapprove of an individual performing a specific behavior, that is, the "strength of each normative belief *(n)* is weighted by motivation to comply *(m)* with the referent in question, and the products are aggregated" (Ajzen 2000, 1991). The subjective norms were measured by directly asking participants to indicate whether important others would approve or disapprove of them recovering spent CCA lumber.

Researchers using this construct have often found that subjective norms had minimal impact on behavioral intentions as compared to other constructs in the theory (Chamberlain 2000; Biswas et al., 2000; Kurland 1995). For example, Chamberlain (2000) discerned that subjective norms failed to predict intention. Despite the subjective norm constructs inconsistency, environmental psychology research has generally supported the influence of social norms on environmental behaviors (DeYoung 1996; Vining & Ebreo 1992).

Perceived Behavioral Control

Ajzen (1988) surmised that performing a particular behavior might be beyond one's volitional control. Simply, perceived behavioral control refers to one's perception of their ability to perform a given behavior and concerns the absence or presence of the necessary resources and opportunities to execute a behavior. Ajzen differentiated between internal and external perceived behavioral control (Ajzen & Madden 1986). Ajzen (1991) also noted that perceived behavioral control was similar to Bandura's self-efficacy theory; where Bandura (1977) hypothesized that self-referent thoughts are the foundation of one's perceived control over a situation.

Control beliefs concern the perceived presence of factors that may facilitate or hinder the performance of a specific behavior. A primary assumption is that control beliefs, combined with the perceived power of each control factor, determine the prevailing perceived behavioral control. Further, it is assumed that perceived behavioral control is determined by the total set of accessible control beliefs (i.e., beliefs about the presence of factors that may facilitate or impede performance of the behavior). The strength of each control belief *(c)* is weighted by the perceived power *(p)* of the control factor and the products are aggregated. To the extent that it is an accurate reflection of actual behavioral control, perceived behavioral control can, together with intention, be used to predict behavior (Ajzen 2000, 1991). Participants were asked to indicate their level of perceived behavioral control in a direct manner.

Self-Efficacy – Internal Control Ajzen (1991) described the perceived behavioral internal control construct as a person's expectancy about whether they can successfully perform a specific behavior. A similar description posits that individuals actively examine the connection between perceived skills and task demands when cogitating their capabilities for performing the task (Cervone 2000). In this research, self-efficacy concerned contractors having the time, manpower, or related economic issues (i.e., deconstruction costs and transporting spent materials), and with their ease or difficulty in beginning the recovery of used lumber.

Facilitating Conditions – External Control Ajzen (1988) defined the perceived behavioral external control as facilitating conditions or the factors that "determine the extent to which circumstances facilitate or interfere with the performance of a behavior." Alternatively, it can be described as having access to facilities or the equipment to perform a behavior. External control is described by Cervone (2000) as the non-execution of a behavior if there is doubt in the ability to perform the behavior. Taylor and Todd (1995) also operationalized external control as a "facilitating condition," which they defined as one having access to the facilities or equipment to perform a behavior.

Awareness

We operationalized awareness as a contractor having knowledge of the potential health risks associated with CCA treated lumber and whether contractors were cognizant of the necessity to recover spent CCA lumber. Awareness or knowledge has been researched in several recycling studies. Most notable was Oskamp et al. (1991) who reported that recyclers were more knowledgeable than non-recyclers were. Pieters (1998) studied the how, when, and where to recycle aspects of recycling. Vinning and Ebreo (1992) researched specific aspects of recycling knowledge. In all three studies, knowledge failed to predict actual recycling behaviors.

During our qualitative interviews and pre-testing, contractors inquired as to the need for recovering used CCA lumber and asked if there were health risks associated with CCA lumber. In our opinion, not addressing these issues would have diminished this study's practicality. For example, during pretesting contractors inquired as to why a need existed to recover and recycle used CCA lumber? Additionally, contractors asked if there were health risks associated with dismantling a deck, and surprisingly, what is CCA treated lumber?

Contractor Decision Intention to Recover Used CCA Treated Lumber

Intention is the cognitive representation of one's inclination to perform a particular behavior and is considered to be the direct antecedent of a particular behavior. Intention is founded on attitude toward the behavior, subjective norm, and perceived behavioral control (Ajzen 2000, 1991). Drawing upon examples from Ajzen (e.g., Ajzen & Fishbein 1980) and others (e.g., Biswas et al. 2000; Flannery & May 2000;

Bagozzi & Warshaw 1990), one item was used to measure the contractor's decision intention to recover spent CCA lumber.

METHODOLOGY

Sample Frame and Data Collection

The sample frame was obtained from the American Business Disc 2000 (InfoUSA 2000), which listed a total of 5,902 contractors (with the ability to construct decks) in Georgia, North Carolina, and South Carolina (Harmonized System Codes (HS) 15 and 17). The sample included deck and patio builders, deck builders, home builders, carpenters, handymen, fence contractors, and general contractors. Potential respondents were selected by utilizing a simple random sampling method and the total number of questionnaires mailed was 2,833.

The primary data collection tool was a self-elicitation mail survey questionnaire. The mail survey and sequencing were modeled after Dillman's (1978) Total Design Method. A prenotification letter was mailed on July 25, 2000, 2 weeks before the questionnaires were mailed. This was followed by three additional mailings of the questionnaires and reminder postcards. In total, 580 questionnaires were returned; 400 positive, nearly 700 bad addresses, and the adjusted total response rate was 27.1 percent. Response rates for studies of this particular profession have ranged from 6 to 14 percent (e.g., Eastin, Shook, & Simon 1999; Kozak & Cohen 1999; McQueen & Stevens 1998).

Questionnaire Development and Pretesting

The questionnaire was designed to gather data regarding evaluations, beliefs, subjective norms, perceived behavioral control, and awareness regarding the recovery of used CCA treated lumber.

Prior to final questionnaire development, contractors were contacted through personal visits and by phone in the Commonwealth of Virginia and the State of Maryland to solicit their thoughts regarding the recovery of used CCA lumber. Critical issues were ascertained by asking participants to list attributes of the recovery of used CCA lumber. In addition, participants were queried on several other factors believed to influence recovery. After this process, specific questions within the questionnaire were designed to meet research objectives. Additionally, university scholars and personnel from the USDA Forest Service also assisted in the questionnaire development.

Pretest

The questionnaire was pretested' in Virginia and Maryland during the spring of 2000 via a mail and facsimile survey. Respondents were asked to identify questions that may be troublesome to answer and for their input regarding question types and question wording. Of the 20 items pretested in factor analysis, 16 items loaded on three factors (theory constructs loaded appropriately on these factors as well) and these items were retained in the questionnaire. The pretests aided in the refinement of the items designed to capture a contractor's decision intention to recover spent CCA lumber.

Measurement of Items

Variable Measurement and Analysis

All measures were evaluated with maximum likelihood factor analysis and through confirmatory factor analysis (CFA). Reliability analysis was conducted after the completion of the factor analysis. Finally, ordinary least squares regression was used for hypothesis testing and a structural equation modeling program was utilized for full model analysis. Results from factor analysis resulted in a three-factor solution (theory constructs loaded appropriately on these factors as well), (Table 1) an indicator of both convergent and discriminant validity. The results from factor analysis also indicated that 60 percent of the variance was explained.

---

[1] Statistical contrasts were conducted between the pretest sample (i.e., Virginia and Maryland contractors) and study respondents (i.e., Georgia and North and South Carolina contractors). Contrasts included number of employees, number of decks built and/or demolished, size of decks built and/or demolished, deck age, average cost for demolition, and the percentage of decks built and/or demolished by the homeowner). No statistical differences were found at the alpha = 0.05 level.

Table 1. Factor loadings [a, b] of the independent variables.

Item	Factor 1	Factor 2	Factor 3
Recovery evaluation	*0.877*	0.130	0.075
Beneficial evaluation	*0.877*	0.147	-0.027
Recovery belief	*0.710*	0.321	-0.064
Beneficial belief	*0.750*	0.259	-0.056
Need to recover	0.519	0.284	0.056
Health risk	-0.058	-0.032	0.064
Guilty	*0.346*	0.288	-0.079
Others expectations	*0.214*	0.147	0.165
Ease or difficulty	0.260	0.545	0.178
Centers available	0.037	0.123	*0.991*
Programs in place	-0.017	0.108	*0.657*
Hauling distance	0.132	0.332	0.126
Time	0.190	*0.919*	-0.037
Manpower	0.216	*0.845*	-0.000

[a.] Extraction method: maximum likelihood.
[b.] Rotation Method: Varimax with Kaiser normalization.

Means, standard deviations, and correlations are presented in Table 2. Utilizing means as an analysis technique, the recovery and beneficial evaluations, centers available, and programs in place are most notable. These results indicate that contractor recovery and beneficial evaluations are quite strong. Additionally, it would not be a stretch to conclude that the lack of programs and facilities appear to obfuscate contractor ability to recover used lumber.

Not all of the independent variables were significantly correlated at either the $\alpha = 0.05$ or 0.01 levels. However, preliminary analyses of these bivariate correlations indicate a strong correlation between evaluations, beliefs, and perceived behavioral control, as they relate to the prediction of the contractor's intention to recover.

Table 2. Means, standard deviations, and correlations [a, b, c] among all variables.

No.	Item	Mean	S. D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Recovery evaluation	1.54	1.41														
2	Beneficial evaluation	1.40	1.44	0.792													
3	Recovery belief	1.08	1.52	0.654	0.640												
4	Beneficial belief	1.30	1.44	0.629	0.703	0.739											
5	Need to recover	0.87	1.61	0.413	0.494	0.487	0.554										
6	Health risk	-0.18	1.47	*-0.089*	*-0.087*	*-0.021*	*-0.011*	*0.004*									
7	Guilty	0.85	1.64	0.296	0.303	0.454	0.422	0.332	*0.047*								
8	Others expectations	-0.67	1.61	0.163	0.235	0.142	0.212	0.208	0.124*	0.220							
9	Ease or difficulty	-0.42	1.77	0.261	0.307	0.354	0.312	0.332	*0.017*	0.208	0.279						
10	Centers available	-1.84	1.50	*0.058*	*0.021*	*0.000*	*-0.001*	*0.113*	*0.061*	*-0.031*	0.191	0.253					
11	Programs in place	-2.00	1.37	*0.024*	*-0.022*	*-0.027*	*-0.045*	*0.026*	*0.005*	*-0.066*	0.103*	0.104*	0.665				
12	Hauling distance	-1.22	1.71	0.169	0.186	0.193	0.167	*0.091*	*0.003*	0.107*	0.116*	0.229	0.172	0.197			
13	Time	-0.78	1.77	0.302	0.304	0.429	0.369	0.330	*-0.048*	0.331	0.158	0.527	*0.082*	*0.094*	0.339		
14	Manpower	-0.59	1.89	0.307	0.320	0.409	0.369	0.330	*-0.074*	0.311	0.132	0.507	0.110*	*0.052*	0.296	0.822	
15	Intention	0.50	1.78	0.505	0.495	0.589	0.551	0.466	*0.047*	0.376	0.301	0.528	0.177	*0.058*	0.157	0.460	0.443

[a]. Non-italicized correlations are significant at the alpha = 0.01 level.
[b]. Correlations with an asterisk (*) are significant at the alpha = 0.05 level.
[c]. Italicized correlations are not significant at the alpha = 0.01 or 0.05 level.

Recovery Intention

Recovery intention was designated as the dependent variable and is defined as the contractor's overall assessment of the utility of recovering CCA treated lumber. A behavioral question was not included in this study; during qualitative interviews and pretesting it was discovered that recovery was not occurring, and therefore we deemed that a question concerning behavior was not in order. We propose that by researching the contractor's decision intention, discernment of the strengths of these influences on recovery intention and ultimately the behavior could be attained.

Recovery intention was measured with a seven-point bipolar scale. The item was straightforward and presented contractors with their likelihood of beginning the recovery of CCA treated lumber. We asked contractors to indicate their likelihood of beginning the recovery of CCA treated lumber (Quite likely = 3 to Quite unlikely = -3).

Independent Variables

Every independent variable was measured with statements attached to seven point bipolar scales and anchored by semantic differential scales. All items were patterned upon examples drawn from Ajzen (1991).

Evaluations and Beliefs – Attitude Toward Recovery

We asked participants to assess recovery with two evaluation recovery items: "If recovery centers were available, my attitude towards recovering used CCA lumber is" and "For me personally, my attitude toward CCA lumber recovery being a beneficial act can best be described as______ ." Both items were anchored by "Extremely favorable = 3 to Extremely unfavorable = -3."

Belief items were measured in the same manner: "I believe that if recovery centers were available, I would recover used CCA lumber" and "I believe the recovery of used CCA lumber is a beneficial act." Both items were anchored by "Strongly agree = 3 to Strongly disagree = -3."

Both evaluation items loaded highly on factor one and Cronbach's alpha (i.e., reliability analysis), (Cronbach 1951) for these items was 0.90. In addition, both belief items also loaded highly on factor one and reliability analysis yielded a Cronbach's alpha of 0.85.

To further assess convergent and discriminant validity, confirmatory factor analysis (Jöreskorg & Sorbom 1979; Fornell& Larcker 1981) was employed, and the results did provide support that evaluations and beliefs are discrete concepts. Regarding convergent validity, both the evaluation and belief items were forced into a two-factor solution via factor analysis. The results indicate that the items loaded on separate factors and the resulting Chi-square (χ^2) was 4.143 with a p-value of 0.04 ($\alpha = 0.05$). This also lends support that evaluations and beliefs are discrete concepts.

Next, both evaluations and beliefs were evaluated for discriminant validity by using a structural equation modeling program (AMOS 4®[2]). Initially, the evaluation and belief items were ran in a totally unconstrained model resulting in a χ^2 of 42.6, with four degrees of freedom (df). Next the items were analyzed in a fully constrained model and this yielded a χ^2 of 51.7, df = 5. The change in χ^2 was 9.1, df = 1; this is significant at the χ^2 critical value of 3.841 ($\alpha = 0.05$) with one df. This also lends support that evaluations and beliefs are discrete concepts in the attitude construct.

Subjective Norms

We presented the participants with two items to measure subjective norms: "I would feel guilty if recycling centers were available and I did not recover a large portion of used CCA lumber" and "Coworkers and other builders expect me to recover used CCA lumber." Both items were anchored with "Strongly agree = 3 to Strongly disagree = -3." The Cronbach's alpha for these items was 0.36 and neither subjective norm item loaded in a sufficient level (in factor analysis) to be included in the full model analysis.

Perceived Behavioral Control

Initially, the internal and external control items were run in a fully unconstrained model resulting in a χ^2 of 5.1 with one df. Next, the items were analyzed in a fully constrained model and this yielded a χ^2 of 24.8, df = 2.

[2] The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture or the Forest Service of any product or service to the exclusion of others that may be suitable.

The change in the χ^2 was 19.7, df = 1; this is significant at the χ^2 critical value of 3.841 ($\alpha = 0.05$) with one df. This finding also supports that both the internal and external control items are discrete constructs.

Internal control was assessed by asking participants to evaluate four items: "How easy or difficult it is for you personally to begin recovering used CCA treated lumber," "I have the time to recover used CCA lumber," "I have the manpower to recover used CCA lumber," and "I can haul used treated lumber a greater distance than other construction debris." All items were anchored with "Strongly agree = 3 to Strongly disagree = -3."

Factor analysis revealed that both time and manpower loaded highly on the same factor, and neither ease or difficulty, or hauling distance loaded highly (both loaded on the same factor). The four-item Cronbach's alpha was 0.77, after the deletion of both hauling distance, and the ease/difficulty item; the resultant Cronbach's alpha was 0.90. Time and manpower were retained for model analysis.

To assess external control, respondents were asked to assess two items: "Recovery and recycling centers necessary for the disposal of or collection of used CCA treated lumber are available," and "Currently recycling programs are in place for recovering used CCA lumber." Both items were anchored with "Strongly agree = 3 to Strongly disagree = -3."

Both centers available and programs in place loaded on the same factor, and reliability analysis resulted in a Cronbach's alpha of 0.80. Regarding convergent and discriminant validity, subsequent analysis did provide support that both items are distinct constructs. As a result of having negative degrees of freedom in the factor analysis, this type of analysis could not be conducted and the items were evaluated by using structural equation analysis.

Awareness

In order to discern contractor knowledge of CCA recovery issues, we asked participants to characterize their awareness with two items: "There is a need to recover discarded CCA treated lumber" and "The recovery of CCA treated lumber poses a health risk." The items were anchored by "Strongly agree = 3 to Strongly disagree = -3."

The results of factor analysis revealed that neither of these items loaded in a manner to be included in the final model analysis. The "need to recover" loaded highest on factor one (0.519) and "health risk" loaded positively on factor three (0.064). In addition, reliability analysis resulted in a Cronbach's alpha of 0.01 for the two items.

Results and Discussion

Non-Response Bias

Contractors that did not respond to the survey were randomly selected and contacted by phone. The questions asked primarily concerned demographics[3]. One significant statistical difference was discerned on one of the questions and question wording appears to be the source of the statistical difference. The question asked was "In your opinion, what percentage of decks are repaired or built by the homeowner?" This question should have been two separate and distinct questions as these actions are two discrete action types.

Statistical comparisons also were made between full-time and part-time deck builders on all items. The alpha level for all contrasts was 0.05. Of the 16 items contrasted, statistical differences were found on both of the external control items, "centers are available" ($p < 0.02$) and "are programs in place" ($p < 0.02$). These statistical differences may be attributed to the fact that full-time deck contractors are more directly involved with deck construction and CCA treated lumber, and recognize the impediments associated with recovery (e.g., costs, time, lack of recovery programs, and markets).

Model Analysis

Structural Equation Modeling Analysis

Structural equation modeling is *a priori* and forces a researcher to think in terms of a theoretical model. In addition, it is an explicit representation of distinct latent and manifest (observed) variables, and the core

[3] Statistical contrasts included number of decks built, number of decks demolished, size of decks built and demolished, deck age, average cost for demolition, and theory items.

statistic used in SEM is covariance among variables (Kline 1999). Latent variables can be operational&d by measured or manifest variables; latent variables are not directly observable and are identified by shared variance among a construct's measured variables (Arbuckle 2000). To test construct relationships in a simultaneous manner, path analysis was performed using SEM, with raw data as the input. In order to reduce the complexity of the model, the awareness and subjective norms were dropped from the model analysis (in factor analysis, neither construct loaded, in a sufficient manner to be retained).

A path model was estimated utilizing evaluations, beliefs, internal control, and the external control constructs. Nine observed endogenous variables were predictors for the unobserved exogenous predictors (4), and recovery intention was an observed endogenous predictor variable. Contractor's decision intention (the dependent variable) was an unobserved endogenous variable. Paths were drawn from each of the predictor variables to the unobserved endogenous variable–contractors' DI and paths were estimated from each predictor variable to the dependent variable.

Path Analysis

The path model was first estimated by evaluating the full model to assess main effects. Secondly, each construct was added sequentially in order to test for construct statistical significance (Figure 2).

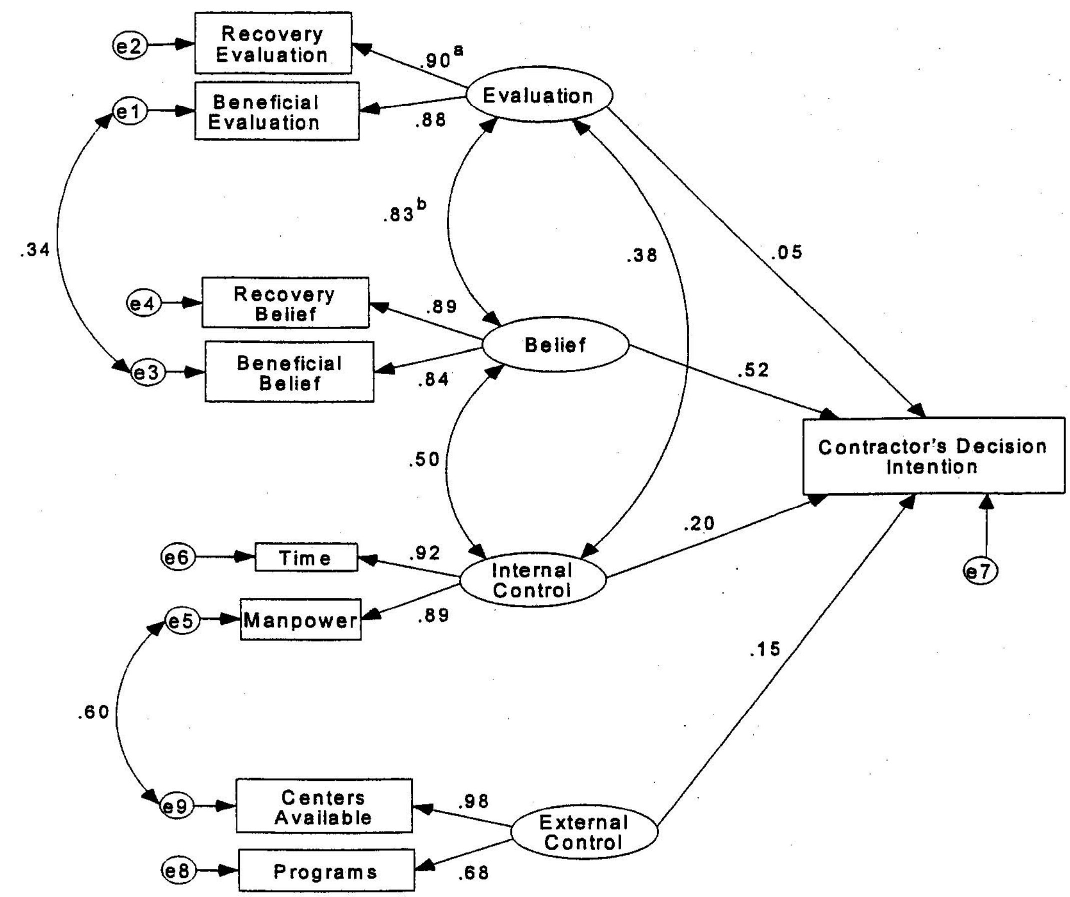

Figure 2. Final path model of contractor's decision intention to recover.
[a]. Standardized regression weights.
[b]. Correlation.

The initial model resulted in a χ^2 of 429.79, df = 25 and a significant p-value ($p < 0.01$). This is defined as the chi-square fit index (Jaccard & Wan 1996) and the initial results indicate that the model did not achieve a good fit. For confirmatory analysis, the evaluation and belief constructs were allowed to correlate. This resulted in a χ^2 of 124.70, df = 24, and a significant p-value ($p < 0.01$). Third, a correlation between beliefs and internal control was executed. This resulted in a χ^2 of 88.40, df = 22, and a significant p-value ($p < 0.01$). Next, the error terms between beneficial evaluations and beliefs were allowed to correlate resulting in a χ^2 of 24.80, df = 21, and a non-significant p-value ($p > 0.25$). The result from step four indicates that the model fits the data reasonably well and was acceptable. In order to achieve an improved model fit, the error terms for manpower and centers available were allowed to correlate. This resulted in a χ^2 of 17.64, df = 20, and a non-significant p-value ($p = 0.611$). The final result indicates that the model does fit the data reasonably well (Figure 2).

Other fit measures have been developed and are calculated by AMOS to indicate whether a model has achieved proper fit. Included are the goodness-of-fit-index (GFI) and adjusted goodness-of-fit-index (AGFI). The scores for these indices Can range from 0 to 1. A model with good fit should be greater than 0.90 (Tinsley & Brown 2000). Results of the analysis included a GFI score of $p = 0.99$ and an AGFI of $p > 0.97$.

Two other fit indices typically are reported as well: the standardized root mean square residual (RMR) and root mean square error of approximation (RMSEA). RMR scores should be ≤ 0.05 (Kline 1999) and RMSEA scores should be ≤ 0.06 (Hu & Bentler 1995). The analysis resulted included RMR ($p = 0.05$) and RMSEA ($p < 0.01$). The aforementioned test results indicate that a close fit was achieved for the model. In addition, the RMSEA-PCLOSE value for testing model fit was 0.991 also indicating that a close fit was achieved.

Common fit measures also were produced and include the comparative fit index (CFI), incremental fit index (IFI), normed fit index (NFI), and the Tucker-Lewis index (TLI). Each of these procedures compares the study model to a baseline model that is generated by the program. The scores for these indices range from 0 to 1, and scores less than 0.90 are considered unacceptable (Tinsley & Brown 2000). Analysis of the final model (Figure 2) resulted in CFI scores of $p = 1.00$, IFI ($p = 1.00$), NFI ($p > 0.99$), and TLI ($p = 1.00$). All of the aforementioned indices indicate that an acceptable model fit was achieved.

From the analysis, evaluations were not a significant predictor of the contractor's decision intention to recover spent CCA lumber ($p > 0.58$, $\beta = 0.050$), (Table 3). The path from beliefs to decision intention was the strongest indicator, with a standardized beta coefficient of over 0.52 and a $p < 0.01$. This lends additional support that beliefs are a critical component in the theory of planned behavior and lends credence to the development of a well-conceived marketing communications campaign to be directed towards contractors.

The internal control construct also was highly significant ($p < 0.01$, $\beta > 0.20$) and the standardized beta value was higher than discerned in regression analysis. The analysis for external control yielded a standardized beta of over 0.15 and the path was significant ($p < 0.01$), (Table 3, Figure 2). While the findings regarding the magnitude of the perceived behavioral control components were unexpected, the results do lend support for recovery programs and convenient facilities being established. Following is a discussion on the correlations and covariances discerned between the constructs.

Table 3. Path analysis of contractors' decision intention (DI).

Path	Unstandardized Beta	Standard Error	Standardized Beta	p-value
Evaluations → DI[a]	0.070	0.128	0.050	0.58
Beliefs → DI	0.770	0.151	0.521	< 0.01
Internal control → DI	0.215	0.053	0.203	< 0.01
External control → DI	0.295	0.076	0.155	< 0.01
Beneficial evaluation → Evaluation	1.000		0.880	
Recovery evaluation → Evaluation	0.998	0.050	0.898	< 0.01
Beneficial belief → Belief	1.000		0.836	
Recovery belief → Belief	1.119	0.058	0.886	< 0.01
Time → Internal control	0.976	0.062	0.925	< 0.01
Manpower → Internal control	1.000		0.888	
Programs → External control	1.000		0.681	
Centers Available → External control	1.576	0.091	0.978	< 0.01
Intention → DI	1.000		0.705	

[a] Decision intention.

The path analysis yielded covariances and correlations among the constructs. First, the covariance and correlation between evaluations and beliefs are relatively high (1.26, $r = 0.83$, respectively). Beliefs appear to be mediating evaluations and this finding should be expected as both constructs are combined to form attitude toward recovery of spent CCA treated lumber. The covariance between beliefs and internal control was strong (1.02) and the correlation was also high ($r = 0.50$). The correlation between evaluations and internal control was moderate and the covariance was low as well (Table 4, Figure 2).

Table 4. Covariance and Correlations among Constructs and Error Terms.

Path	Covariance	Standard Error	r	p-value
Evaluation ↔ Beliefs	1.259	0.130	0.828	< 0.01
Beliefs ↔ Internal control	1.016	0.138	0.505	< 0.01
Evaluation ↔ Internal control	0.809	0.134	0.381	< 0.01
Beneficial evaluation error ↔ Beneficial belief error	0.184	0.046	0.342	< 0.01
Manpower error ↔ Centers available error	0.164	0.062	0.599	0.008

Also of note was the covariance between the beneficial evaluation and the recovery belief error terms. The correlation and covariance between error terms may represent variability in the beneficial errors that is not due to the variation in the evaluation and belief constructs. Both the beneficial belief and evaluations were scale scores in the instrument. This may indicate that the variables share a common variance between the two constructs that is not being accounted for by either item, the items are sharing the variance, or there is another item that could account for the variance. This unknown variable could account for a significant amount of the variance from the participant responses. The covariance was positive at 0.18 and both items were moderately correlated ($r > 0.34$.) The other correlation was between manpower and centers available. Here the shared covariance was (0.16) and also resulted in a moderate correlation (0.59.) Again, this may indicate that the two items measure a commonality that is not represented in the model (Table 4).

Model Research Summary

The study findings appear to provide strong support for the proposed intention model as a viable method for examining the effects of evaluation, beliefs, subjective norms, awareness, and internal and external control on the contractor's decision intention to recover spent CCA treated lumber.

Structural equation modeling was used to examine the decision intention. Regarding evaluations, results from the analysis indicated that evaluation did not have a similar impact on intention as beliefs. Nevertheless, the analysis indicated that evaluation plays a vital role in the examination of contractor's decision intention. Moreover, when evaluation is combined with beliefs, both constructs are viable mechanisms for examining the contractor's decision intention.

In this analysis, the strength of beliefs was very significant. This not only supports beliefs role in the theory of planned behavior, the findings also indicate contractors appear to have a positive (low) belief concerning recovery, if the recovery centers and programs were made available, This is not only evidenced by the strong correlations between recovery belief and intention, but also with the beneficial and recovery evaluations. Secondly, regarding the contractor's beneficial belief, the recovery of CCA lumber appears to be regarded as a beneficial act. Analysis also indicated that the beneficial belief corresponds strongly with the same items as the recovery belief.

When reviewing the impact of beliefs on evaluations and intention, it is clear that beliefs appear to be a significant driver of the contractor's decision intention, The implication being that recovery centers and programs should be considered to facilitate recovery. In addition, this also supports a focused promotional message being developed and implemented concurrently with the establishment of recovery centers and programs.

Concerning the perceived behavioral control construct, both internal and external control played a significant role in explaining the factors involved in a contractor's decision intention. It could be argued that internal control is economic in nature, apparently reflecting the need for both financial incentives and recovery programs being developed. The impact of external control appears to indicate that the requisite facilities are currently not in place for recovery, and must be developed. Additionally, there was a significant interaction between evaluation and external control, indicating that contractors "perceive" that they do not have volitional control over recovery.

In regards to subjective norms, this construct is a reasonable mechanism for explaining the contractor's decision intention. On further investigation, the "guilty" item played a significant role in the findings than the social norm item. "I would feel guilty if recovery centers were available and I did not recover used CCA lumber," correlated strongly with both of the belief items. This lends support to the need for a promotional message, and for the establishment of recovery centers and programs, as it appears that contractors would feel guilty if they did not recover. The findings regarding subjective norms are similar to those found by Chamberlain (2000) and Bagozzi and Dabholkar (1994). In these studies, subjective norms were significant, but the construct did not explain an appreciable amount of variance.

While the awareness construct was significant, the variance explained was not statistically significant. However, it was and is a construct worth investigating, as several contractors inquired about the necessity of recovering used CCA treated lumber. This finding also lends support for the development of a promotional message that addresses the need for recovery. As alluded to earlier, the promotional message will have to be focused and implemented concurrently with the development of recovery programs and centers.

Qualitative Question Results

The respondents were asked an open-ended question regarding what programs or incentives could be instituted or developed to initiate the recovery of spent CCA lumber.

Respondents offered 321 ideas or opinions on possible initiatives; 129 respondents mentioned financial incentives. Contractor responses indicated that some type of financial incentive needed to be offered to facilitate recovery (Figure 3). Concerning the financial incentives that could be offered, 31 percent reported that some type of financial incentive should be offered. Next, nearly 29 percent indicated that there should not be any tipping fees or a reduction in tipping fees. Fourteen percent indicated that the incentive should be based by the pound or by the ton. Next, 11.6 percent of the respondents reported that they should be paid to recover the material. Nearly 8 percent indicated that some type of tax break should be instituted. Other incentives included retailer discounts (2.3 percent) and penalties or fines should be incorporated to initiate recovery (2.3 percent). Less than 2 percent (1.5 percent) indicated that they should receive a discounted price at the time of purchase, and less than 1 percent (0.3 percent) indicated that a fund should be established for demolition.

The establishment of recovery facilities was the next most frequently reported response. Nearly 70 percent of the respondents indicated that recovery centers needed to be developed and easy access to those facilities should be available to contractors. Next, over 17 percent responded that separate areas should be developed at the landfill site. Participants also reported that business establishments such as Home Depot or Lowe's should establish the recovery centers (5.4 percent). The respondents also reported that dumpsters or containers should be made available at the job site (3.2 percent), the recovery facilities should also receive spent lumber that contain nails (3.2 percent), and treated lumber manufacturers should provide recovery centers and accept used treated lumber (1.1 percent), (Figure 3).

The establishment of recovery programs was the next highest rated response category at 11.2 percent (Figure 3). The most frequently reported option was the development of a buyback program (36.1 percent). This was followed by the establishment of industry or government pickup programs at the job site (27.7 percent). Next, both the development of a county government recovery program or building associations in conjunction with a government agency recovery program were recommended equally (13.9 percent). The next three response categories each were mentioned equally (2.8 percent) and included local governments contracting with builders, the establishment of a community recycler, and programs developed should not include any government agency participation.

Several respondents indicated that public education programs needed to be developed, nearly 9 percent (Figure 3). Respondents reported that the public education program should include methods for demolition, material on why the recovery of spent CCA treated lumber was necessary, and literature on the potential health risks associated with the building and demolition of CCA treated structures.

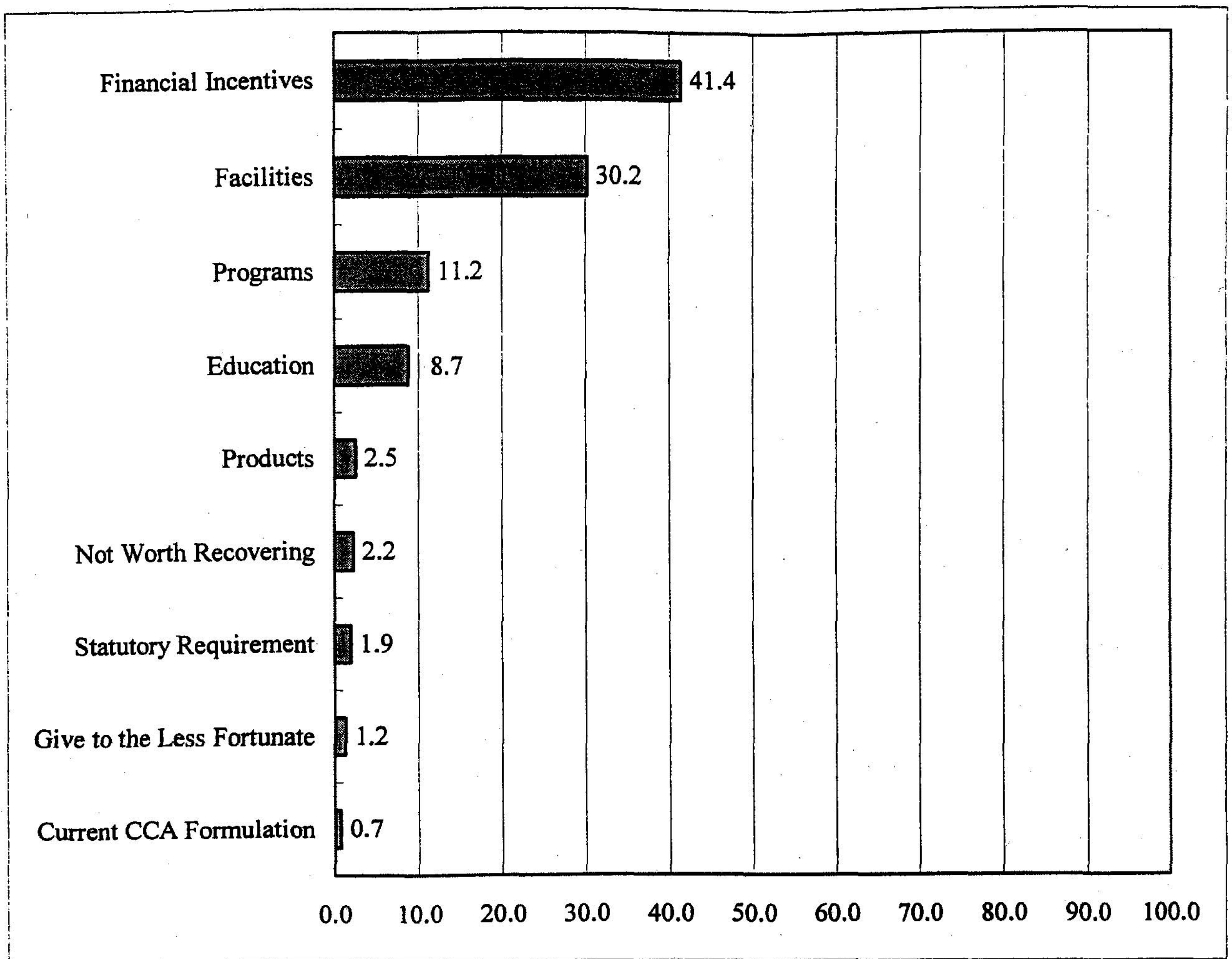

Figure 3. Frequency distribution of suggested recovery incentives or programs.

The next highest rated response category involved products and processing equipment (2.5 percent), (Figure 3). The respondents indicated that the development of a viable product line was necessary (71.4 percent). Next, the development of processing equipment and processing techniques should be incorporated (13.3 percent each). Finally, respondents reported that a listing of alternative products to CCA treated lumber should be made available to them (2 percent).

Over 2 percent of the respondents indicated that the used CCA treated products were not worth recovering. Next, nearly 2 percent of the respondents reported that statutes should be instituted to initiate the recovery of spent CCA treated products. More than 1 percent of the participants reported that the used CCA treated materials should be given to the less fortunate in local communities (Figure 3).

The final category involved the constituents of CCA treated lumber products currently being manufactured and was less than 1 percent of the responses (Figure 3). Responses indicated that the retention level of CCA treated products should be increased or improved, or that the arsenic contained in CCA products should be removed.

Qualitative Research Summary

When observing the results from the recovery importance factors, the most striking results are "lack of recycling programs" and a "lack of recycling facilities." Other highly rated importance factors are costs, time, and manpower. It should be self-evident that programs and facilities will have to be developed to make the recovery of treated lumber a viable option.

The largest percentage of responses indicated that financial incentives should be instituted to facilitate the recovery of CCA treated lumber. While most were not specific in their response, participants indicated that some type of financial incentive needed to be developed. Incentives that could be developed include tax credits; standardized deductions, reduced or the elimination of landfill tipping fees; and incentives could be based on the pounds or tons of material recovered. Each of these should be considered and could be incorporated to encourage the recovery and recycling of used treated lumber.

The next response category concerned facilities, the overwhelming response was that recovery centers needed to be built and easy access to these facilities was also a requirement. Followed by the establishment of programs was another category frequently mentioned. Respondents indicated that the development of the buyback program should be considered. Other respondents indicated that the industry or government should sponsor pickup programs at the job site.

Another interesting category was education. Participants indicated that public education programs needed to be developed. It was also mentioned that education programs should include methods for demolition or dismantling, material on why the recovery of spent CCA treated lumber was necessary, and literature on potential health risks should be made available.

The results of this research indicate that the financial incentives, recovery programs and facilities, and a promotional campaign to address the benefits of recycling all are important factors and issues with the contractor. For the recovery of treated lumber to become a viable alternative to disposal, it is vitally important that we fully understand what contractors will need to begin the recovery of discarded CCA treated lumber. Understanding these needs and contractor attitudes will benefit the producers of Southern yellow pine, the treating industry, consumers, municipalities, and our forests.

Public Policy and Managerial Implications

The findings from this research have salient public policy and managerial implications. Typically, the act of recovery and recycling produce direct rewards to the commonwealth of society as a whole and not to the recycler. However, in the recycling of wood products, it appears that immediate individual rewards and benefits can be attained by implementing recycling programs and through the development of a recovery infrastructure. From this researcher’s perspective, the preservative treating and wood products industries should be the leaders in this arena. Both industries could establish substantial goodwill and develop strong public relations with contractors and consumers. However, if the federal or state governments are relied upon to initiate the programs and facilities, the goodwill that could have been established is perhaps lost. Additionally, if government agencies become involved, the associated costs and regulations possibly will increase as well. Also lost is the opportunity for a truly positive marketing communications campaign.

Secondly, a marketing communications campaign promoting all facets of recovery and recycling should be developed. An inimitable opportunity exists for both social and forest products marketers, as the prospect for influencing a relatively novice group in terms of recycling wood products. Inasmuch that contractor attitudes regarding the significance of recovering can be positively altered, targeting beliefs could potentially influence contractor attitudes towards the need for recovery. Our findings indicate that contractors have mildly positive evaluations and beliefs concerning recovery, and highlight the importance of designing a marketing communications program that decidedly shapes contractor attitude toward recovery.

We also suggest modeling the recovery/recycling program after work presented by Shum et al. (1994). Moreover, developers of recycling programs should work with local waste management officials and contractors. As presented in Pieters et al. (1998), local contractors should be utilized in advertising (e.g., workshops, seminars, and promotional materials), as contractors could possibly relate more strongly to the promotional message.

Recovery and Marketing Strategy

In 1971, Kotler and Zaltman defined social marketing as “The design, implementation, and control of programs developed to influence the acceptability of social ideas and involving considerations of product planning, pricing, communication, distribution, and marketing research.”

Following Kotler and Zaltman, Shrum *et al.* (1994) envisioned recycling as managing the marketing mix. The recycling behavior or recycling program was operationalized as the product, recycling cost(s) as the price, and promotion (communication) being different strategies to reach diverse groups. Finally, distribution (place) may be thought of as the means to accomplish a given behavior.

Building upon the work of Kotler and Zaltman and Shrum *et al.,* the following is a conceptualization of a marketing strategy for the recovery of used CCA lumber. Each of the recommendations will be made by addressing the traditional *four-p's* of marketing.

It is recommended that both the treating and forest products industries become leaders in developing and implementing the recovery programs and facilities required for the recovery of spent CCA treated lumber. This researcher strongly suggests that the industries form a strategic partnership with state and local government waste management officials to develop these programs and facilities. The strategic partnership also may assist in creating a positive public image and reduce costs associated with the development of these programs.

These recommendations are not made lightheartedly; it is realized that the development of the programs will require substantial personnel, time, and monies. When one considers the financial and personnel requirements, it appears an unwieldy proposition; however, what are the alternatives? Inaction by the treating and forest products industries risk the potential of negative publicity (of which the forest products industry should be well aware) resulting from both the leaching and disposal of spent CCA lumber.

Studies over the past decades have addressed attitude formation and beliefs, as well as research regarding methodologies for affecting attitude change. The consensus results from these studies indicate that once attitudes are formed, they are extremely difficult to change, even when copious sums of money and messages have been directed to change the prevailing attitude. Therefore delay in enacting both the promotional campaign and recovery/recycling programs could possibly be deleterious to the industries. In addition, both industries will lose the opportunity for a truly positive marketing communications campaign that extols the benefits of recovery and the "caring" services both industries are providing the public.

Several industries have developed recycling programs and actively partner with local governments; these industries include plastic, steel, aluminum, wooden pallets, and paper. These particular recovery programs could be utilized in developing a recovery model for spent CCA treated lumber.

Place – Distribution

Place or distribution refers to the availability and location of CCA lumber recovery facilities. Shrum *et al.* (1994) describe distribution as " . . . the manner in which the consumer participates in the behavior." Through the analysis and personal interviews, it became clear that the lack of recovery facilities was a significant impediment to recovery. Several suggestions were offered, including pickup programs and separate recovery facilities.

It appears the most viable option is the location of CCA lumber recovery sites within the county landfill, whether the facility is a MSW or a C&D facility. This setup would offer a convenient drop-off point for the contractors, and in this manner would require the least amount of participation from the contractor. The location of the recovery site within the landfill. should also assist in word-of-mouth communications, The potential for contractors communicating among themselves about the recovery of CCA lumber will be greatly enhanced. Additionally, the recovery facility would not have to invest in technologies to identify treated lumber; they also have the equipment and manpower on site to begin the recycling process.

These facilities play a pivotal role - - providing a drop-off point for spent treated lumber products. Facility mangers should consider establishing recovery sites. The material could then be transported to regional or state facility sites. These facilities could provide storage until sufficient quantities are available for remanufacturing or processing. For example, if a chemical processing facility (e.g., steam explosion/wood liquefaction) were to be established, these sites could serve in a similar fashion as wood yards or log yards to processing industries.

Price

"Price can be conceptualized as the cost of the behavior" (Shrum *et al.,* 1994). The price or recycling cost concerns the monies spent directly or indirectly to recover used CCA lumber. Participants indicated overwhelmingly that financial incentives should be instituted to facilitate the recovery, and incentives could be based on the pounds of material recovered, tax breaks or credits, or that tipping fees should not be charged for the returned material.

It appears that the elimination of tipping fees for recovered CCA lumber would be both simple and the most cost-effective; contractors must dispose of the used material in some manner. Conveniently located recovery facilities also addresses certain aspects of price, as convenient facilities reduce costs associated with time and transportation.

Promotion

Shrum *et al.* (1994) describe promotions as being intervention strategies and can include several marketing communication tactics to reach the desired target to promote recycling. The importance of designing a marketing communications campaign that positively shapes contractor evaluations and beliefs was highlighted in this research. Promotional tactics for CCA lumber recovery could include recovery and material handling literature, educational programs, and advertising.

Literature should be made available that provides information concerning the necessity of recovery, address material handling, and the potential health risks of working with treated lumber. Educational programs should be offered and include the sponsoring of clinics or seminars. The seminars could offer demonstrations of deck dismantling and proper handling of spent lumber. If advertising is a component of the campaign, an option is using local contractors in the ads. In this manner, area contractors could perhaps relate more strongly to the message being promoted.

Previously mentioned was word-of-mouth communications. This may be initiated and partially controlled by advertising (e.g., promotional literature) to the contractors. The program leaders should strive to develop literature that encourages contractors to talk about recovery techniques and the recovery of spent CCA lumber. Contractors inevitably talk with each other, and positive remarks concerning recovery cannot be underestimated, Word-of-mouth communications are considered a powerful tool in the marketers' arsenal and could be effectively employed with contractors. Another alternative would be the selection of contractors who recycle and then setting up a referral system with them and possibly paying the contractors for their efforts.

Concurrent with the development of recovery facilities, a portion of the promotional effort could be designed to alter the degree of perceived barriers to recovery. The literature could be designed to convince contractors that the benefits of recycling spent CCA lumber outweigh the cost(s) of recovery. In addition, local media outlets should be contacted and invited to a deck dismantling, to an educational program, and to the recovery facility in order to create public awareness. Other literature could describe how the contractor can market their recovery operation to gain a competitive advantage over their competitors. The Charlotte-Mecklenburg (North Carolina) recovery and recycling program provides a good model for the development of recovery literature.

Product

The operationalism for product (Shrum *et al.,* 1994) is "The behavior or the recycling program is the product and it is being marketed to the general public or consumer." The recovery of spent CCA lumber (the product) is being marketed to deck builders and contractors, and the *product* is the recovery of CCA treated lumber. Given the population of interest, the marketing program should be directed to the target populations in the same manner as well as to waste management officials.

Implementation

1) *Commitment* – The treating industry and producers of Southern yellow pine should commit themselves to designing and implementing recovery programs for CCA treated lumber. This will include allocating sufficient personnel, time, and monies to the project.

2) *Strategic Partnership* – Relationships should be developed with state-level waste management officials. These officials are in contact with city/county officials and also are a source of recycling information. Additionally, the CCA recovery project probably will have to be test piloted in pre-selected cities. After review and adjustments, the program could be implemented on a wider scale. The relationships developed with state officials will assist in the aforementioned priorities. Working with these officials will also aid in the development of incentives, recovery sites, and a model for the development of the facilities.

3) *Recovery Program* – The recovery program will include recovery site locations, financial incentives, promotional campaign, and literature. The program should be well conceived and directed to both contractors and waste management officials.

4) *Promotion* – By working with state and local waste management officials, these individuals can direct program leaders to contractors they perceive to be leaders or would be approachable to recovery and recycling. Recovery literature should be mailed to contractors and made available at the recovery landfill site.

5) *Education* – Educational programs should be instituted and can be held at the recovery site or at establishments such as Home Depot or Lowe's. The late fall to early spring time frame appears to be the most logical, as building generally slows during this period.

6) *Monitoring* – The program should be monitored continually and in all phases. This will allow for determination of successful or unsuccessful methods and allow for the appropriate changes to be made in the program.

Conclusion

In this study, the contractor's decision intention towards the recovery of spent CCA treated lumber was examined. In particular, the incremental explanatory power of evaluations and beliefs toward recovery, subjective norms, a knowledge construct, and perceived behavioral control were examined.

Evaluations did not have a statistically significant impact in analysis of the full model. While evaluations were not significant in the final model, beliefs did have a significant affect on evaluations. The most salient finding was the magnitude that beliefs have on both evaluations and decision intention. The combination of evaluations and beliefs forms one's attitude toward a psychological object. The results from this study indicate that evaluations and beliefs do have a significant affect on the decision intention to recover used CCA lumber.

Regarding the subjective norms, while they were found to be statistically significant, the quantity of variance explained was marginal as compared to beliefs and evaluations. The subjective norm findings are similar to those found by Bagozzi and Dabholkar (1994). Here subjective norms were significant, but they did not explain an appreciable amount of variance. While there was just cause for the addition of awareness, the quantity of variance explained limits its effectiveness as a construct.

The perceived behavioral control component, as expected, had a significant effect on decision intention. Both the external and internal control components were significant and assist in explaining the contractor decision intention process.

The results of the path analysis demonstrated support that beliefs do have a significant effect on evaluations, and subsequently the decision intention to recover spent CCA lumber. The findings indicate that beliefs regarding the recovery of spent CCA treated lumber play a more significant role than evaluations. The findings indicate that "perceived" barriers to recovery exist (e.g., the availability of recovery centers and programs) and must be addressed before any substantial recovery will occur. It cannot be overemphasized that recovery centers and programs must be developed. A promotional message will have to be targeted to contractors and it will have to be well conceived and implemented.

Ultimately the recovery and recycling of used CCA treated lumber will have an affect in five principal areas: 1) conservation of both public and private softwood forests and extend the life of our natural resources, 2) reducing the area of public and private land utilized for landfills, 3) reduce the demand on the Nation's landfills, 4) enhance manufacturing profitability, and 5) new economic opportunities via the creation of recycling businesses.

Future Research and Study Limitations

This research focused on the factors affecting recovery and not on the manufacturing of products from recovered materials. The initiation of the recovery process is only the first step in the recycling chain. Recyclers apparently do not have recovery options for spent CCA lumber and this suggests that a viable recovery option must be developed.

The treating industry, the wood products industry, and university researchers need to develop a viable recovery process and products for spent treated lumber. The development of recovery programs cannot be undervalued. When one views the recovery/recycling programs and products today, one sees that the prices for the recovered materials are depressed. The end result is that many cities have dropped or dramatically cut back on their recovery programs. The prices received for the recycled materials do not cover the cost of recovery (King, 2000).

Research should address the issues of financial cost to the contractor. While two of the constructs in this study could be considered economic in nature, participants could be asked direct questions concerning financial cost. The influence of cost on the contractor's decision intention to recover may be revealed. In addition, financial costs also may be strong predictors of the recovery intention.

After recovery facilities and programs are in place, research could be conducted to ascertain the impact of the perceived behavioral control components and beliefs have on the contractor's decision intention to recover. Specifically, which construct plays a more important role, perceived behavioral control or beliefs? It may be found that perceived behavioral control affects beliefs, and strengthens the belief constructs role in explaining the decision intention.

Replication of this study to other geographic areas of the United States perhaps could expand the external validity of the results. This research was conducted in the States of Georgia, North Carolina, and South Carolina. After the recovery programs and facilities are established, a research project could be conducted to measure the impact of interventions. Further research into contractor attitudes would be useful in explaining the effect of motivation on the contractor's decision intention and specify which interventions are more effective (e.g., economic incentives vs. persuasive appeals).

Another possible limitation to this study was that the data were from a self-elicitation questionnaire and were collected by utilizing a mail survey. As a result of the data being collected at the same time, common method variance may explain some of the variance. However, common method variance is not plausible in this study as a result of the significant interaction found between attitude toward recovery and perceived behavioral external control. Participants would have to have known implicitly the theory being tested for this type of bias to explain the interaction.

Additionally, Harmon's one factor test was utilized (Podsakoff & Organ 1986), and results from the factor analysis indicate that the variables of interest loaded on more than one factor. In addition, one general factor did not account for the majority of covariance among the independent and dependent variables. While these results did not conclusively rule out the possibility of common method variance, the results indicate that such a bias is not a plausible alternative explanation for the findings.

Finally, we attempted to provide an understanding of the factors that affect pro-environmental intentions and behaviors concerning contractor's recovery of spent CCA lumber. We have demonstrated that both psychological and economic constructs correlate to evaluations, beliefs, and the decision intention. Only by gaining knowledge of these beliefs can we develop programs to prevent these available resources from being wasted and affect proenvironmental behaviors.

Literature Cited

AJZEN, I. 1985. From Intentions to Actions: A theory of planned behavior. In: Kuhl, J. and J. Beckmann, eds. *Action control:* From cognition to behavior. New York: Springer Verlag, 11–39.

_______ and M. Fishbein. 1980. *Understanding attitudes and predicting social behavior,* Englewood Cliffs, NJ: Prentice-Hall, Inc.

_______ and T.J. Madden. 1986. Prediction of goal-directed behavior: attitudes, intentions, and perceived behavioral control. J. of Exper. Soc. Psych., 22: 453–74.

_______ 1988. *Attitudes, personality, and behavior.* Open University Press.
Milton Keynes, United Kingdom.

______ 1991. The theory of planned behavior. Organizational Behavior & Human Decision Processes. Notes 50: 179–211.

______ 2000. <http://www-unix.oit.umass.edu/~aizen/tpb.html>. February 5, 2000.

AMERICAN HOUSING SURVEY. 1999. <http://blue.census.gov/hhes/housing/ ahs/pubs.html>. U.S. Dept. of Commerce, February 10, 2001.

ARBUCKLE, J. 2000. AMOS users' guide version 4.0. Smallwaters Corporation, Chicago, IL.

BAGOZZI, R. and P.R. Warshaw. 1990. Trying to consume. J. of Consumer Research. Vol. 17, September.

______ and P.A. Dabholkar. 1994. Consumer recycling goals and their effect on decisions to recycle: a means-end chain analysis. Psych. & Marketing. Notes 11(4): 313–340.

BANDURA, A. 1977. Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84 (2): 191–215.

BISWAS, A., J.W. Licata, D. McKee, C. Pullig, and C. Daughtridge. 2000. The recycling cycle: An empirical examination of consumer waste recycling and recycling shopping behaviors. J. of Public Policy & Marketing. Notes 19(1): 93–105.

BLAISDELL, J. 2000. Pollution prevention and environmental assistance, N.C. Dept. of Envir. & Natural Resourc. Personal interview. November.

BOND, P. 2001. Arsenic treated wood criticized. Atlanta Journal-Constitution, Atlanta, GA. July 7. E1

CERVONE, D.P. 2000. Thinking about self-efficacy. Behavior Modification, 24(1): 30–56.

CCA-TREATED WOOD PROJECTS. 2001. <http://www.ccaresearch.org>. Feb.11.
CHAMBERLAIN, III, J. 2000. The management of national forests of eastern United States for non-timber forest products. Ph.D. dissertation. Virginia Polytechnic Institute and State Univ., Blacksburg, VA. 300 p.
COOPER, P.A. 1993. Leaching of CCA: Is it a problem? Disposal of treated wood removed from service: the issues. Proceedings: Environmental Consideration in the Manufacture, Use, and Disposal of Preservative Treated Wood. Carolinas-Chesapeake Section of the Forest Products Society. May 13. Richmond, VA
CRONBACH, L.J. 1951. Coefficient alpha and the internal structure of tests. Psychometrika. 16: 297–334.
DeYOUNG, R. 1996. Some psychological aspects of reduced consumption behavior: The role of intrinsic satisfaction and competence motivation. Environ. & Behavior, Notes 28: 358–409.
_______ J. F. Duncan, N. Gill, S. Rothman, J. Shenot, A. Shotkin, and M. Zweizig. 1993. Promoting source reduction behavior: The role of motivational information. Environ. & Behavior. 25(1): 70–85.
_______ 1990. Recycling as appropriate behavior: A review of survey data from selected recycling education programs in Michigan. Resources, Conservation and Recycling, 3, 253–266.
_______ 1989. Exploring the difference between recyclers and non-recyclers: the role of information. J. of Environ. Systems. 18(4): 341–351.
_______ and S. Kaplan. 1986. Conservation behavior and the structure of satisfactions. J. of Environ. Systems. 15(3): 233–42.
DILLMAN, D. 1978. Mail and telephone surveys: The total design method. John Wiley & Sons, Inc., New York, NY.
EASTIN, I.L., S.R. Shook, and D.D. Simon. 1999. Softwood lumber substitution in the United States residential construction industry in 1994. Forest Prod. J. 49 (5): 22.
ELLEN, P.S., J.L. Wiener, and C. Cobb–Walgren. 1991. The role of perceived consumer effectiveness in motivating environmentally conscious behavior. J. of Public Policy & Marketing, 10(2): 102–117.
FISHBEIN, M. 1967. Attitude and prediction of behavior. In: M. Fishbein (ed.), Readings in attitude theory and measurement. John Wiley & Sons, NY, NY.
_______ and Ajzen, I. 1975. Belief, attitude, intention and behavior: An introduction to theory and research. Addison-Wesley, Reading, MA.
_______ and Ajzen, I. 1999. European review of social psychology, attitudes and the attitude-behavior relation: Reasoned and automatic processes. W. Stroebe and M. Hewstone (eds.). John Wiley & Sons, New York, NY.
FLANNERY, B.L. and D.R. May. 2000. Environmental ethical decision making in the U.S. metal finishing industry. Academy of Management J. 43(4): 642 – 662.
FORNELL, C. and D.F. Larcker. 1981. Evaluating structural equation models with unobservable variables and measurement error. J. of Marketing Research. Notes 18(2): 39–50.
HAUSERMAN, J. 2001a. Lawmaker to seek limits on arsenic. St. Petersburg Times Online, St. Petersburg, FL. March 28, 3B.
_______ 2001b. The poison in your backyard. St. Petersburg Times Online, St. Petersburg, FL. March 11, 1A.
_______ 2001c. Arsenic fears rise over treated wood disposal. St. Petersburg Times Online, St. Petersburg, FL. March 10, 12A.
HAYGREN, J.G. and J.L. Boyer. 1996. Forest products and wood science, An introduction. third edition. Iowa State University Press, Ames, IA: 431.
HU, L. and P. Bentler. 1995. Evaluating model fit. In: Hoyle, R.H. (Ed.), Structural equation modeling: Concepts, issues, and applications. Sage Publications, Inc, Newbury Park, CA.
INFOUSA. 2000. American business disc 2000. Omaha, NE.
JACCARD, J. and C.K. Wan. 1996. LISREL approaches to interaction effects in multiple regression. Newbury Park, CA, Sage Publications.
JÖRESKORG, K. and D. Sorbom. 1979. Advances in factor analysis and structural equation models. (ed.). Magidson, J (Ed.). ABT Books, Cambridge, MA.
KING, L. 2000. America wasting more, even as recycling sets records, cutting edge businesses and communities pursue 'zero waste' strategies. Institute for Local Self-Reliance. <http://www.ilsr.org/recycling/w2kpr.html.>. March 10.
KLINE, R. 1999. Principles and practice of structural equation modeling. The Guilford Press, NY, NY. 354 p.
KOTLER, P. and G. Zaltman. 1971. Social marketing: An approach to planned social change. J. of

Marketing Notes 35(3): 3–12.
KOZAK, R.A. and D.H. Cohen. 1999. Architects and structural engineers: An examination of wood design and use in nonresidential construction. Forest Prod. J. 49 (4): 39.
KURLAND, N. 1995. Ethical intentions and the theories of reasoned action and planned behavior. J. of Applied Social Psych. Notes 25: 297–313.
MCCARTY, J.A. and L. J. Shrum. 1993. The recycling of solid wastes: Personal values, value orientations, and attitudes about recycling as antecedents of recycling behavior. J. of Bus. Research, 30 (May), 53–62.
MCQUEEN, J. and J. Stevens. 1998. Disposal of CCA-treated lumber. Forest Prod. J. 48 (11/12): Notes 86–90.
NATURAL RESOURCES DEFENSE COUNCIL. 2001. <http:/www.nrdc.org>. January 20, 2001.
OSKAMP, S., M.J. Harrington, T.C. Edwards, D.L. Sherwood, S.M. Okuda, and D.C. Swanson. 1991. Factors influencing household recycling behavior. Environ. & Behavior, 23: 494–519.
PIETERS, R., T. Bijmolt, F. van Raaij, and M. de Kruijk. 1998. Consumers attributions of proenvironmental behavior, motivation, and ability to self and others. J. of Public Policy & Marketing. Notes 17(2): 215.
PODSAKOFF, P.M. and D.W. Organ. 1986. Self-reports in organizational research: problems and prospects. J. of Management. 12: 531–544.
SHUM, L., T.M. Lowery, and J.A. McCarty. 1994. Recycling as a marketing problem: A framework for strategy development. Psych. & Marketing. Notes 11(4): 393–416.
SIERRA CLUB. 2001. <http://www.northstar.sierraclub.org/>. January 20, 2001.
SOUTHERN FOREST PRODUCTS ASSOCIATION. 2000. Estimated treated southern pine lumber demand. Kenner, LA, October 26.
TAYLOR, S. and P. Todd. 1997. Understanding the determinants of consumer composting behavior. J. of Applied Social Psych. Notes 27: 602–628.
TAYLOR, S. and P. Todd. 1995. Understanding the determinants of consumer composting behavior. *Journal of Applied Social Psychology.* (27): 602–628.
_______ 1995. An integrated model of waste management behavior: A test of household recycling and composting intentions. Environ. & Behavior. 27 (September), 603–30.
TINSLEY, H. and SD. Brown. 2000. Applied multivariate statistics and mathematical modeling, Academic Press, NY, NY. P. 440–462.
TRUINI, J. 1996. Deck data. Home Mechanix. 92(805): 12.
VINING, J. and A. Ebreo. 1992. What makes a recycler? A comparison of recyclers and nonrecyclers. Environ. & Behavior. 22: 55–73.

Acknowledgements
U.S.D.A. National Needs Fellowship
U.S.D.A. – Forest Service, Northeastern Research Station, Princeton, WV
U.S.D.A. – Forest Service, Southern Research Station, Blacksburg, VA
Center for Forest Products Marketing and Management, Virginia Tech, Blacksburg, VA

Managing the Treated Wood Resource – II

Special Seminar sponsored by
American Wood-Preservers' Association
Utility Solid Waste Activities Group

Allen M. Kenderes, Chairman

Steering Committee Members

Pete Gaskin, GMR Associates
James C. Gauntt, The Railway Tie Association
John F. Hall, American Wood-Preservers' Association
Dennis Hayward, Western Wood Preservers Institute
Allen M. Kenderes, New York State Electric & Gas
James Roewer, Utility Solid Waste Activities Group

Thursday, May 1, 2003

Boston Marriott Copley Place
Boston, Massachusetts