ABSTRACT

ABBY GAYLE GOLDENBERG. Environmental labeling: Life Cycle Analysis Approach To Product Evaluation And Comparison. (Under the direction of Dr. FRANCES M. LYNN).

A life cycle analysis of the diaper product category was evaluated to illustrate the generic problems in using that approach in the context of an environmental labeling program. A report by Arthur D. Little Inc. titled "Disposable versus Reusable Diapers: Health, Environmental and Economic Comparisons" was used as a case study. The analytic framework used to evaluate the report included: omission, weighting and bias. The evaluation revealed a need to establish a formal methodology to standardize and make more objective the process of life cycle analysis. In order to facilitate the establishment of an effective environmental labeling program in the United States a less comprehensive or modified life cycle analysis is recommended.

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CHAPTER I

INTRODUCTION AND BACKGROUND

A. Introduction

Environmental labeling of consumer products has emerged high on the agenda of public concern in the United States and around the world. This reflects increased societal awareness of environmental issues which is being manifested in consumer willingness to act in an environmentally sound manner. However, consumers lack the information necessary to incorporate environmental considerations into purchasing decisions. Industry has responded by marketing products with environmental claims. However, these unregulated manufacturer claims are confusing and vague. In response, official environmental labeling schemes have been devised by a number of governments which identify environmentally sound products and encourage industry to commit itself to designing and producing such products (Environmental Data Services Ltd. 1988, i). Environmental labeling programs provide an independent bench-mark to guide consumers about the environmental consequences related to the products they are purchasing.

Unfortunately, distinctions between the environmental impacts of products are not very clear and environmental labeling is more complex then it initially appears. There is a general consensus that a true "environmentally sound" product does not exist and that every product has some negative impact on the environment in its lifetime either during manufacture, use or ultimate disposal (Hirsbak, Nelson, and Lindhqvist 1990, 3.1). Environmentally sound products are usually defined as products that cause less environmental impact then conventional competitive products. Therefore, any environmental labeling system is relative rather than absolute. In other words, an

environmental labeling system highlights those products which are considered to be less harmful to the environment than other competitive products rather then those having no detrimental effects.

The relative nature of environmental labeling creates the problem of how to evaluate and compare competitive products in order to get an acceptable and effective labeling program. Decisions required in this process involve trade offs and value judgments among environmental impacts. As a result, a product that may be acceptable according to the conclusions of one evaluation scheme may not be so in another. Therefore, in order to implement an environmental labeling system it is necessary to have a uniform method to evaluate products. This methodology must include criteria that define which characteristics are to be achieved for a product to be permitted to use the label.

This paper begins in chapter I with a background on the emergence and current status of environmental labeling. Chapter II surveys the existing environmental labeling programs throughout the world. Chapter III discusses the issues involved in conducting product evaluations and comparisons for environmental labeling systems. Chapter IV combines the insights from the previous chapters and uses the example of cloth and disposable diapers to illustrate the methodological problems and decisions that must be made when trying to assign an environmental label to a product. Finally, chapter V contains conclusions, policy suggestions and recommendations for further research.

B. New era of toxic substances management

As the final decade of the twentieth century opens, a new approach to the management of toxic substances is emerging. Previously, efforts to manage toxic substances had focused on waste streams rather than on the materials used by industry. In the 1970's, numerous unprecedented environmental laws were passed. These laws placed restrictions on the release of toxic pollutants into the air, water, land and work

place by setting acceptable emissions levels and requiring the treatment of pollutants once generated (National Toxics Campaign 1989, 1). Although successful in achieving substantial emissions control, these laws have significant flaws and the generation and use of toxic chemicals continue to adversely affect human health and the environment (Hansen 1990, 30). This end of the pipe approach has led to the annual production of 214 billion pounds of synthetic organic chemicals and petrochemicals and the release of more than 22 billion pounds of toxics to air, water and land annually (Lewis & Kaltofen 1989, 1). Controversy and opposition to the siting of waste disposal facilities has complicated this waste end approach to toxic substance management.

Present laws focus on controlling wastes already produced and focus on the end of the pipeline. The Office of Technology Assessment estimates that $70 billion is spent annually by industry to comply with current legislation, mostly on pollution control devices (OTA 1986, 3). Expensive pollution control devices do not solve the problem, and often only shift the pollution between environmental media (National Toxics Campaign 1989, 2). Additionally, costs and liabilities associated with waste handling, transportation, storage and disposal are high and continue to increase. Consequently, for economic as well as environmental reasons, government, industry, and environmental groups are beginning to consider pollution prevention as an alternative to traditional pollution control (Hansen 1989, 30).

The idea of reducing pollution is not a new one. The federal government has made efforts to reduce the use of toxics by passing Toxics Substances Control Act (TSCA) and the Resource Conservation Recovery Act (RCRA). TSCA granted the EPA broad power to gather information on chemicals, limit or ban their production and use, and require labeling of hazards. However, in its first seven years, EPA issued regulations for only four substances under TSCA (OTA 1986, 181). In the 1984 amendments to RCRA, Congress made a strong policy statement in support of reduction declaring, "It is to be the national policy of the United States that, wherever feasible, the generation of

hazardous waste is to be reduced or eliminated as expeditiously as possible". This has never been effectively implemented. Rather, the EPA has promoted "waste minimization" which the business community has interpreted as any reduction of hazardous waste produced by a firm instead of reducing all hazards associated with toxic substances use (National Toxics Campaign 1989,4).

Several states such as North Carolina and Minnesota, have established successful pollution prevention programs. These non-regulatory programs educate and motivate voluntary waste generators by helping them understand the economic and environmental benefits of waste reduction (Hansen 1989, 30). Individual companies, motivated by economic incentives to lower raw material and waste management costs, have also adopted pollution prevention policies. One of the best known and most successful is 3M's Pollution Prevention Pays program.

In the past five years, a new term "toxics use reduction", defined as:

> changes in the production process, products or raw materials that reduce, avoid, or eliminate the use of toxic or hazardous substances per unit of production without shifting those risks between workers, consumers or different parts of the environment.

has been proposed by the PIRG's and the National Toxics Campaign (National Toxics Campaign 1989, 3). Toxic use reduction can be interpreted broadly to include all methods which would reduce the use of toxic chemicals or more narrowly in reference to specific legislation. The first formal toxics use reduction legislation was passed in Oregon and then Massachusetts in 1989. Similar legislation has passed in ten other states since then (Tryens 1990a). Oregon's Toxic Use Reduction Act, which passed in July,1989, became the nation's first state law requiring companies using large amounts of toxic chemicals to analyze that use and develop detailed plans for reducing it. The Massachusetts Toxics Use Reduction Act is stronger, and sets goals of fifty percent reduction by 1997 and of using toxics use reduction to achieve stronger and more

coordinated enforcement of existing toxic substance laws and regulations. Although not labeled toxics use reduction, other states have adopted similar measures.

Beyond the specific legislation requiring industry to reduce, toxics use reduction can be achieved through other methods such as environmental labeling, product bans, and liability incentives. This paper focuses on environmental labeling as an instrument to reduce the use of toxic substances as part of an overall toxic use reduction program. Environmental labeling of consumer products is only one of the instruments which could be implemented to reduce the use and subsequent risks of toxic substances. It's proponents do not view it as an isolated solution but as one supplementary method with its inherent limitations and restrictions (Lindhqvist 1989a).

C. Stimulus for labeling: Green consumerism

As garbage washed up on beaches, oil tanker spills soiled pristine beaches and landfills reached capacity, Americans became more aware of the scope of environmental problems. One of the responses to this increased public awareness of environmental threats has been green consumerism. Green consumerism is a new term being used to describe consumers who are motivated to take into account the environmental consequences of the products they choose when making their purchases. Green consumers are trying to use their buying power to send a message to industry that they are concerned about the effect that the products they buy have on environment. It is the idea that consumer purchasing power can be used in conjunction with legislation and voluntary measures to stimulate the development of environmentally sound products that underlies the upsurge of international interest in environmental labeling systems (EDS 1988).

A July 1989 survey found that 77% of Americans said that a company's environmental reputation affects what they buy (Krikpatrick 1990, 50). A 1989 market research poll by the Michael Peters Group, an international product design firm, found

that 89% of Americans were concerned about the environmental impact of the products they purchased. Additionally, about 78% said they were willing to pay more for a product if the container were environmentally sound (Dadd & Carothers 1990, 8-9). Similarly, a poll by the Gallop organization for Ad Age Magazine found that 90% of women and 70% of men would be willing to pay more for products or packaging made safer for the environment (Dean 1990). In Europe, where green consumerism and environmental labeling are more established, the same attitude is prevalent. According to a study by the Austrian Chamber of Workers and Employees, 75% of all Austrians are willing to buy environmentally sound products, even if they cost up to 7% more than conventional products (Vogel 1989, 5). A gallop poll in Sweden showed 95% of Swedes are willing to choose "environmentally sound" alternatives when shopping and that 85% would accept somewhat higher prices for such products (Holm 1989, 42). In Germany, where an environmental labeling program has been in existence since 1978, a survey showed that 78.9% were familiar with the environmental label (Muller 1989, 52).

Studies suggest that, it is not necessary to have a majority opinion to influence manufacturers. It may take as few as one person in ten to change their buying habits for companies to stand up and take notice (Elkington, Hailes, and Makower 1990, 9) The power of the consumer to force the market on toxics issues was evidenced in last year's Alar scare. For 15 years environmental groups worked to convince the EPA to ban the use of the growth regulator Alar on apples, but it took a consumer revolt and extensive media coverage only a short time to get Alar off the market. Alarmed by reports of the hazards of Alar, consumers would not buy apples, apple sauce and apple juice. In response, grocers stopped buying products treated with Alar and put out signs reassuring shoppers that their apples were Alar free (Hannum 1990, 36). Provided with product specific information consumers used the market to influence toxics policy.

D. Green marketing

Industry has been quick to cash in on the change in public attitudes toward environmental concerns (Humphrey 1990). Retailers and manufacturers have sought ways to use claims of environmental benefits of products to sell goods and services to green consumers. Industry has changed products and packaging and promoted them with environmental marketing campaigns. Environmental marketing emerged first in Europe and now U.S. firms are beginning to follow. Corporate environmental marketing campaigns seek to persuade consumers that corporations care about the environment and are using environmentally sound technology in production and packaging (Hannum 1990, 36). It is very difficult however, for consumers to differentiate between superficial advertising campaigns and actual product improvement.

The first environmental marketing efforts have attempted to address the solid waste problem. Due to excessive packaging of products in the United States, changes in packaging provides ample opportunity for reductions in solid waste at relatively low cost. Currently, one third of U.S. garbage is new packaging including 2.5 million plastic bottles discarded every hour, as well as cardboard, foam and plastic which is used to package everything from hamburgers to hardware (Dold 1990, 49).

In November, 1989 Procter & Gamble (P & G) began test marketing a Downy fabric softener refill in a pint sized paper carton to be mixed with water in a used Downy bottle (Freeman 1989). In addition, in April, 1990 P & G announced that it will package gallon jugs of laundry detergent and cleaners in recycled plastic bottles containing 25% to 100% recycled content (Freeman 1990). Bob Viney, P & G associate advertising manager has said, "We are hearing a clear and consistent message from consumers that they want facts about what they can do to improve environmental quality without giving up convenience and quality. This is clearly a step in that direction" (Freeman 1990). P & G is already marketing similar products in Germany.

France and Japan (Koeppel 1989, 115). Colgate-Palmolive also is testing pouches of concentrated liquid detergent labeled "Protect our Planet" that allow consumers to refill rather then discard bulky plastic bottles (Kanner 1990, 19).

Retailers are also joining in on the green marketing bandwagon by making green product information more accessible. Wal-Mart, with an estimated $16 billion in annual sales, announced last August that it will highlight marketers that try to "improve their products to help prevent lasting environmental problems." Wal-Mart's goal is to provide incentives for manufacturers to produce merchandise and packaging that is better for the environment in manufacturing, use and disposal. Wal-Mart is highlighting those products with shelf signs. Soon after Wal-Mart's announcement, K Mart followed suit (Fisher and Graham 1989). These programs rely entirely on manufacturer information. There are no standards or testing procedures for these claims and like much self-proclaimed advertising may not be accurate. Manufactures and retailers report that early indicators of the success of environmental marketing programs are promising. Within a week of the introduction of its green line of goods, Canada's Loblaw corporation sold $5 million worth of phosphate-free laundry detergents, biodegradable diapers, bathroom tissue from recycled paper and unbleached coffee filters (Kanner 1990, 19).

It is too soon to calculate the the impact that green consumerism will have on the market or ultimately on the environment but, it is certain that the environment will be a major marketing issue of the 1990's. "This is not a small market niche of people who believe in the 'Greening of America'" says Ray Goldberg of the Harvard Business School, "it is becoming a major segment of the consuming public" (Dadd and Carothers 1990, 9). Morris Saffer, chairmen of Saffer Advertising in Toronto and chairman of the Retail/Advertising Conference, said, "in a very short time, environmental positioning will be an absolute part of consumers' everyday decision-making process" (Hannum 1990, 36).

As the advertising industry turns the environment into a marketing strategy, there is growing concern that consumer desires for green products will be exploited with unsubstantiated claims and confusing or misleading terminology. If these predictions prove true, it is likely that the only benefits of the green consumerism will be increased sales for manufactures and retailers, not improvement in the environment or public health. Outspoken critic of unregulated environmental marketing claims, Minnesota Attorney General Hubert H. Humphrey III said "the selling to the environment may make the cholesterol craze look like a Sunday school picnic" (Dadd and Carothers 1990, 9). Humphrey (1990) warns that:

> Some environmental claims are confusing and vague--consumers can't tell from reading the labels just how these products are better for the environment. Some claims are simply trivial, offering no environmental benefit of any consequence. And some claims are downright misleading and fraudulent.

Others fear that unregulated market claims will go berserk, the way manufacturers added tiny amounts of oat bran and claimed health benefits (Kanner 1990, 19). Finally, Joel Makower, co-author of The Green Consumer has said, " For better or for worse, I think we're on the verge of seeing 'green' and 'environmentally friendly' become as ubiquitous in the marketplace as 'natural' and 'light' are right now" (Kanner 1990, 19).

Several states are making efforts to control the problem of the lack of standards for terminology used in environmental marketing of products. The June issue of the EPA's Pollution Prevention News reports that Rhode Island, New York, Connecticut, and New Hampshire have passed legislation that will regulate the use of a recycling logo. These regulations define the minimum amount of secondary material that must be contained in a product to be labeled recycled. The regulations also define conditions under which a product can be labeled recyclable or reusable (Weddle 1990). In addition, a group of attorneys' general from California, Massachusetts, Missouri, New

York, Washington and Wisconsin are investigating environmental marketing claims (Humphrey 1990).

E. Environmental labeling

Bruce Weddle (1990), EPA Office of Solid Waste, reports that the,

> EPA believes that 'environmental choice' labeling has the potential to be a powerful mechanism for increasing consumer awareness of the environmental effects of their purchases, and for encouraging manufacturers to reduce the environmental impacts associated with their products.

The idea is that companies will design marketing strategies around the environmental label in order to increase market share, to reach new segments of the market and as a way to improve corporate image by demonstrating that they are concerned about the environmental consequences of their products. Environmental labeling could be an instrument in encouraging competition in a free market economy and potentially decrease pollution by the mechanism of supply and demand (Muller 1989, 58).

An example of the potential of environmental labeling is given by Fredrik Holm (1989, 46) of the Swedish Society for Conservation of Nature. In response to increased demands for unbleached paper products the Society made a decision that paper products made of pulp that caused outlets of chlorinated organic substances less than 1.5 kg. per ton of pulp could be labeled "environmentally sound". The pulp industry responded and within a few months produced paper products of all kinds that received the label. This led to a 40% decrease in chlorinated outlets in pulp industries in two years. Holm admits that this dramatic decrease is in a field where obvious results could be obtained, but it does give a measure of the potential impact of environmental labeling

The most significant problem for environmental labeling in the United States is that there are no nationally accepted standards, definitions or coding systems for determining what products are environmentally sound. Currently it is left to

individual consumers to gather information, evaluate claims, and set their own criteria. The greatest barrier to the growing green consumer movement is the lack of knowledge--where to get information and how to define a "green" product or company? (Hannum 1990, 37) Environmentally conscious consumers need guidance.

In response to interest in Earth Day 1990, many books on the role of the individual in preserving the environment were published. One such book, The Green Consumer by John Elkington, Julia Hailes and Joel Makower (1990) is based on the premise that by choosing carefully an individual can have a positive impact on the environment without significantly compromising ones way of life. The authors define an ideal green product as one which:

> Is not dangerous to the health of people or animals; does not cause damage to the environment during manufacture, use or disposal; does not consume a disproportionate amount of energy and other resources during manufacture, use or disposal; does not cause unnecessary waste due to either excessive packaging or to a short use useful life; does not involve unnecessary use of or cruelty to animals; and does not use materials derived from threatened species or environments (6).

This definition of a green product illustrates several of the fundamental questions that must be answered when attempting to choose products which are preferable for the environment. It would be very difficult if not impossible for any product to fulfill this broad list of criteria. Since few, if any, products will meet all requirements, tradeoffs and judgements will have to be made. Who should make these subjective decisions? Who should conduct and pay for the research? Since products will not meet all of the criteria, which ones are permissible to leave out? Is it acceptable to destroy an endangered species but not to use carcinogens? How do you compute an overall

evaluation of a product with so many criteria? How do you weight the individual importance of each criteria?

Other fundamental problems exist with trying to define a green product. For instance, there is disagreement whether it is preferable to promote and use a product that is only marginally less damaging to the environment or to wait until a perfect solution is developed. Furthermore, there is disagreement about whether some purportedly green products are truly less harmful to the environment (Elkington, et al. 1990, 7). In discussing what makes a product green, The Green Consumer summarizes,

> The result is a mixed bag of green products. There are some environmentally harmful products wrapped in green packaging. Some green products don't clearly state their greenness, while other products claiming to be green are not. To make matters worse, several of the corporations producing green products are among the world's biggest polluters. In short, it's a confusing world, with many shades of green.

Lindhqvist (1989a) suggests that unregulated use of a number of "environmentally friendly logos" is threatening to discredit not only the symbols themselves but at the same time may discourage and alienate the public towards taking environmental responsibility.

The controversy surrounding degradable plastics provides a clear example of the potential for consumer confusion, and marketing misinformation which can result from uncontrolled environmental marketing campaigns. Plastic products labeled degradable by manufacturers are among the consumer products that have been developed recently to meet the demand of green consumers. The market for biodegradable plastics has grown out of public concern over the shortage of landfill space for solid waste disposal in the United States. Public opinion surveys show overwhelming support for "biodegradable" waste materials (Statler 1990). These

products, including disposable diapers, grocery bags and six-pack connecters, claim to disintegrate harmlessly upon exposure to sunlight or burial in soil.

Denison and Wirka (1989) question the ability of degradable plastics to solve any of the real problems that plastics cause. Degradable plastics have been promoted to extend the life of landfills, however, Denison and Wirka report that even plastics which readily degrade in the laboratory are not likely to degrade in a reasonable length of time in a landfill. Counter to claims of "environmental friendliness" they report that degradable plastics pollute the environment in the same ways that ordinary plastic do and additionally add their own risks. Ordinary plastics are chemically rather inert and despite the many toxic additives, the chemicals remain embedded in the plastic in a landfill. Degradable plastics, if they do break down, will release toxic additives. The report also suggests that these breakdown products may themselves be toxic.

In the case of biodegradable plastic, a consumer may erroneously believe that by buying biodegradable plastic that they are helping solve the solid waste crisis. Furthermore by purchasing biodegradable plastic they are sending a message to the manufacturer that they want biodegradable products. If that consumer better understood the problem and the limitations of biodegradable products they may choose a different method to help the solid waste crisis. Without some education program, consumers can be strongly influenced by marketing campaigns that are not based on sound scientific evidence.

In response to this controversy the Federal Trade Commission's consumer protection bureau announced in late 1989 that it is investigating environmental advertising claims made by marketers that promote degradability aspects of their products (Lawrence 1990). This investigation coincides with a probe by the attorneys general of seven states of whether claims of degradability constitute deceptive advertising (Humphrey 1990). Mobil announced in April that is would no longer tout its Hefty trash bags as degradable because of "mounting confusion" over what the label

means, shortly after the announcement of the investigation and Dow Chemical has removed labels from its Handi-Wrap plastic wrap (Here today, still here tomorrow 1990).

The current status of environmental labeling in the United States is confusing to the consumer. Without any standards or legal guidelines, the consumer can easily be confused or mislead by product labels. Individual industries are labeling their own products but are not required to follow any standards, criteria or guidelines. Independent organizations are proposing to award environmental labels to products they consider environmentally friendly. Retailers are using manufacturer information to promote their products. The consumer is left to evaluate which products to purchase often in the face of conflicting information. However, the information that consumers need to act effectively is difficult to acquire. Consumers intending to reduce their negative impact on the environment may ultimately be making the problem worse based on inadequate information.

F. Historical rationale and experiences in labeling

Historically our society has given emphasis to information provisions to educate its citizens so that they can participate intelligently in both public and private decisions. Efforts to inform the public range from public education, public libraries, and a free press to laws including the Freedom of Information Act (Riley 1979). In order to make decisions that accurately reflect personal preferences, individuals must have accurate information about both the risks and benefits associated with that decision. Labeling is one form of information provision that is widely used.

The United States Congress recognized the importance of labeling as a source of consumer information in the Fair Packaging and Labeling Act of 1966. Section two states:

> Informed consumers are essential to the fair and efficient functioning of a free market economy. Packages and their labels should enable consumers to obtain accurate information as to the

> quality of the contents and should facilitate value comparisons. Therefore, it is hereby declared to be the policy of Congress to assist consumers and manufacturers in reaching these goals in the marketing of consumer goods (Miller 1978, 3).

The Act imposed some packaging standards and provided for voluntary industry adoption of uniform packaging designations. This provided increased power to the buyer in the marketplace (Hadden 1986).

In Read the Label, Susan Hadden (1986) states that in the United States we rely extensively on information provisions to control risks to health, safety and the environment. This is partly due to the fact that information provisions are relatively mild form of regulation, and Hadden adds that this is linked to the historic inclination to limit the power of government in the United States. Information provisions, Hadden states, are conservative of social resources and liberal of individual freedom. Individuals need to have enough information in order to choose whether to accept risks in return for expected benefits. Hadden describes the labeling of risks as widely accepted by the regulated industries because most products have some label and the provision of additional information costs little more than it takes to create it.

Markets are likely to respond to the demands of a relatively small number of informed consumers, hence the proportion of consumers who actually use the information is not necessary a good measure of its value. Firms will compete for the informed minority and may make changes that benefit all consumers. For example, nutritional information is not used by a large fraction of consumers, but in competing for consumers who do read labels, many companies have fortified their products. This resulted in improved nutritional quality of their products, at least as measured by the information on the label (Beales 1980, 244).

Not only do only a limited portion of consumers use information provisions but they only used a portion of what they are given. Although consumers potentially have

a wide variety of information available to them on product and brand alternatives, they tend to acquire and make use of only a portion of the information available and make use of only a fraction of that information (Miller 1978, 1-5). While consumers are exposed to information from many sources, either inadvertently or as a result of active information search, not all consumers have the same opportunity for information exposure or propensity toward information search. There is evidence of a segment of consumers who actively search for and use product/market information. The "information seekers" serve as an information elite and police the market for less active consumers. It is these "information seekers" who as suggested above can push the market to meet their demands. "Information seekers" look for and use the information on labels and tend to be younger, better educated, higher income and are more likely to use and benefit from label information then are older and minority consumers. In contrast, "information avoiders" rely on brand name or price to make decisions. The vast majority are found in between these extremes (Miller 1978, 1-5). To be successful an environmental labeling program will have to target the "information seekers".

By participating in a voluntary labeling program, such as an environmental labeling program, a manufacturer encounters costs and limitations. Direct costs of labeling programs are generally low since the information is often already known. There may be substantial testing costs and some cost in redesigning existing labels. The actual costs printing the new label are trivial since most labels must be printed anyway. Label information may reduce the manufacturers flexibility in responding to changes in the relative costs of inputs. Secondly, additional information may reduce the probability that consumers read note and act upon other information on the label. The more information on the label, the less likely is the average consumer to read it all. This however can be minimized by appropriate label design and marketing (Beales 1980, 244).

One specific type of consumer product information, seals and certifications of approval, are analogous to environmental labels. Such a label is a word or symbol indicating that a product meets a certain minimum standard quality level. In the United States, seals of approval, such as those given by Good Housekeeping and Parents' Magazine, are essentially a phenomenon of the private sector (Miller 1978, 14). Underwriters' Laboratories (UL) is the major quality certification organization in the U.S, tests materials as being safe for product groups.

Thomas L. Parkinson (1975), in a paper on the role of seals and certifications of approval in consumer decision making, describes them as private aids designed to give the buyer some dependable third-party assurance to the quality of the product that they are buying. Parkinson cites the results of numerous studies as generally supporting the belief that seals and certifications play a significant role in consumer decision making. He points out that not all seals and certifications on products are from third party organizations and some are maintained by retailers and manufacturers who are directly involved in the production and sale of these products. This distinction however, is not always clear to all consumers.

Parkinson's study investigated the role of these symbols as informational sources in the consumer decision making process. Parkinson concludes that seals and certifications significantly influence consumer choice behavior, however, consumers as a whole attribute more meaning to the symbols then is justified by the seal granting programs. Parkinson suggests that this is related to some extent to a misunderstanding of the meaning of the seal and that greater government control and consumer education is needed to correct this problem.

A prerequisite for labeling systems is the development of standard methods of measuring performance(SMMP) or criteria (Miller 1980, 57). The major problems involved with this are not technical infeasibility but difficulty in getting a consensus. Determining appropriate or satisfactory measures for the certification is particularly

difficult with voluntary participants. Miller reports that the literature suggests that industry support in the development of SMMP's and in the design and implementation of the informative labeling programs is important if the program is mandatory, but critical if the program is voluntary. Finally, it has been suggested that whether or not consumers use the label information, that they feel reassured that someone is "checking out the system (Miller 1978, 67).

The next chapters will examine what governments are doing to to respond to green consumerism, green marketing and the problems and issues raised by environmental labeling. The main response that has developed in Europe and is now emerging in the United States is federal environmental labeling programs. These programs will be discussed in the next chapter.

CHAPTER II

EXISTING ENVIRONMENTAL LABELING PROGRAMS

Environmental labeling programs or eco-labels are primarily government sponsored seals of approval which under a voluntary system are applied to qualified products to inform consumers about the environmental impacts of those products. Currently, federal eco-labeling programs exist in in West Germany, Canada, and Japan. Several other countries as well as the European Economic Community are preparing plans for labeling programs (Carswell, Langel and Borrison 1989, 2-3). These programs emphasize positive rather then negative impacts of the products on the environment. The products that meet the requirements of the program are awarded a label to indicate that the product is in some way aligned with the goals of preserving the environment.

The existing and proposed programs share similar goals and procedures. In general their goals include:

- helping consumers make environmentally-conscious purchases;
- encouraging product manufacturers and sellers to develop environmentally acceptable products and manufacturing processes, and;
- increasing environmental awareness in general (Carswell et al. 1989, 3)

The existing programs also have a common structure. These labeling programs are administered by a government organization and/or an independent advisory board comprised of representatives of government, industry, consumer, environmental and technical interest groups. This body decides which product groups should be eligible to be evaluated for the official label, defines which environmental criteria they must meet, and judges specific products to qualify for the label. Manufacturers voluntarily

apply to use the label, and if approved pay a fee to cover administrative and in some cases testing costs and to pay for campaigns to educate the public about the significance of the label(Carswell et al. 1989,3; EDS 1988, iii). There is generally a time limit on the use of the label and a process for renewal.

Additionally, most of the programs are initiated by selecting products which are simple to evaluate and offer clear advantage over competitive products based on environmental impact. Many of these products contain recycled material or are reusable. As a result, much of the emphasis of the early phases of environmental labeling programs addressed solid waste issues rather then use of toxic or hazardous materials.

A. West Germany

The first official environmental labeling scheme was established in West Germany in 1978. Known as the Blue Angel, the program provides the only experience so far of the impacts which environmental labeling can have on consumer purchases and on manufacturers' product design and marketing strategies. In addition, the Blue Angel is significant because other countries have drawn heavily on the German experience in devising their systems (EDS 1988, 10).

According to a paper by Edda Muller (1989) on Environmental Labeling in the Federal Republic of Germany, the Blue Angel program's goals are:

- to reduce environmental pollution in problematic areas using the best available technology;
- to provide information to consumers; and
- to create an economic incentive to produce environmentally sound technologies (51).

Muller describes the Blue Angel labeling program as one part of an overall product oriented environmental protection program in West Germany. Other measures included warnings, bans, financial incentives, promotion of research and development and consumer education.

Currently 3100 products in 60 different product categories are certified to carry the Blue Angel logo and 200 proposals for new labels are received from manufacturers each year (Muller 1989, 52). Figure 1 contains a list of the product categories. According to Muller label may be given for products which:

> In comparison to other products serving the same purpose, under thorough investigation, taking into account all aspects of environmental protection (including the economical use of raw materials) are, as a whole, characterized by a particularly high degree of environmental soundness, without their practical value being significantly reduced thereby and their safety impaired (53).

Many of Germany's product categories are based on the use of recycled materials to make the product. The categories include: building materials from recycled glass, plant pots from recycled materials and recycled cardboard. Other categories include packaging materials such as returnable glass bottles and reusable industrial packaging. Non-recycling categories include asbestos-free brake lining for cars, re-treaded tires, products operated by solar energy and low noise lawn mowers.

The Blue Angel label logo is made up of the Environment Sign of the United Nations with the special environmental advantage of the product indicated in the outer circle of the logo. For example, one label reads, "Helps reduce waste" (Carswell et al. 1989, 7). Figure 2 contains an example of a Blue Angel logo. The Blue Angel logo was originally worded: "Environmentally friendly because..." followed by a reason such as recycled paper content. However, environmentalists pressured program officials to remove the "environmentally friendly" tag saying that no product is truly friendly to the environment. The wording was therefore simplified to highlight the environmental advantage (Watson 1989, 19). The label is only granted for three years in order to allow for standards to be raised.

Figure 1: Blue Angel Product Categories

RAL UZ 1	retreaded tires
RAL UZ 2	returnable glass bottles
RAL UZ 3	spray cans without fluorocarbons in the areas of cosmetics (incl. hair-spray), indoor and furniture sprays and sprays for every-day-use-purposes (till 31.12.1989)
RAL UZ 3 (new)	low waste hairsprays, deodorants and shaving foams (from 01.01.90)
RAL UZ 4	glass collection bin campaign
RAL UZ 5	sanitary crepe paper made from recycled paper
RAL UZ 6	low-noise lawn mowers
RAL UZ 9	low-emission oil-atomizing burners
RAL UZ 10	asbestos-free floor coverings
RAL UZ 11	asbestos-free brake linings
RAL UZ 12 a	low-pollutant coatings
RAL UZ 12 b	powder coatings
RAL UZ 13	salt-free, neutralizing spreading material
RAL UZ 14	recycled paper
RAL UZ 15	recyclable printed material
RAL UZ 16	zinc-air-batteries
RAL UZ 17	potting containers made from recycled materials
RAL UZ 18	corrosion protection coatings low in lead and chromates
RAL UZ 19	durable, low-noise car mufflers
RAL UZ 20	asbestos-free clutch linings
RAL UZ 21	sound-proofed glass collection bins for noise sensitive areas
RAL UZ 23	waste water-poor car wash plants
RAL UZ 24	environmentally compatib pipe cleanser
RAL UZ 25	reusable capsules for cream machines and soda siphons
RAL UZ 26	reusable drop box for food
RAL UZ 27	reusable packings for transportation
RAL UZ 28	reusable trys and similar industrial packings
RAL UZ 29	waste water neutral cold cleanser
RAL UZ 30	products made from recycled plastics and rubber
RAL UZ 31	motor vehicles with exhaust gas treatment
RAL UZ 32	water-saving toilet flush tanks
RAL UZ 33	electronically operated shower batteries
RAL UZ 34	pesticide-free pest control for indoor use
RAL UZ 35	wall paper made from recycled paper
RAL UZ 36	construction materials made from recycled paper
RAL UZ 37	PCB-free cooling and insulation liquids for electrical appliances
RAL UZ 38	low-formaldehyde products from wooden materials (for indoor use)
RAL UZ 39	low-emission gas burners
RAL UZ 40	low-emission combined water heating and cycling-water heaters
RAL UZ 41	low-emission burner-boiler units with gas burner (with fan)
RAL UZ 42	low-noise moped
RAL UZ 43	water-saving flow restrictors
RAL UZ 44	water-saving pressurized flushers
RAL UZ 45	soil meliorators and soil agents made from compost materials
RAL UZ 46	low-emission energy-saving oil burner-boiler units
RAL UZ 47	solar-power operated products and mechanical watches
RAL UZ 48	readily biodegradable lubricants for motor-raw chains
RAL UZ 49	construction materials made mainly of recycled glass
RAL UZ 50	lithium batteries free of mercury and cadmium
RAL UZ 51	"environmental ticket (for public transport)
RAL UZ 52	highly insulating multi-layer window glass
RAL UZ 53	low-noise construction machines (compressors, power aggregates, wheel loaders, excavators, excavator loaders)
RAL UZ 54	low-noise garden chaff cutters for compost materials
RAL UZ 55	reusable, refillable typewriting ribbon cassettes and toner cartridges
RAL UZ 56	recycled cardboard
RAL UZ 57	thermal processes (using hot air) to combat xylophagous insects

Reprinted from FEA fact sheet.

Figure 2: Environmental Labeling Program Logos

Canada - EcoLogo

West Germany - Blue Angel

Japan - EcoMark

The process of authorization of product categories, criteria and products involves three groups: the Environmental Labeling Jury (EL) made up of representatives of science, industry, consumer and labor organizations; an independent standards setting organization, the German Institute for Quality Assurance and Labeling (RAL); and the Federal Environmental Agency (FEA). The process is described in an FEA fact sheet and is as follows.

Step 1: -the FEA collects and reviews applications;

-FEA forwards these to the EL, which twice a year makes a pre-selection of product groups warranting closer scrutiny;

-RAL organizes expert hearings for the preparation of the final decision by the EL;

-EL decides on product groups that may be given the label

-public announcement of the decision

Step 2: -submission of applications to RAL by interested manufacturers;

-case by case study by RAL and FEA and the Federal State in which the manufacturer is located;

-testing against relevant criteria by Consumer Quality Test Organization, Stiftung Warentest.

-signing of a contract for the use of the label between RAL and manufacturer.

A product category is a group of products such as diapers or paint, and within the product categories are the specific products. The choice of product groups and criteria are discussed by Muller and are summarized below. In order to be selected the product group must fulfill the following requirements. The contribution to reducing pollution must be substantial. The products must be currently on the market and there must be a need to promote the product group. This means that there must not be an environmentally sound product on the market that already has a large market share. The environmental impact of the product must not be shifted between media. Usability

and safety must be guaranteed. Testing must be possible. Finally, all competitive products must be included in the group as not to interfere with competition.

Once the product group is selected, the Blue Angel program narrows the requirements down to individual criteria because of difficulty in evaluating the environmental merit of a product over the products life cycle (Carswell, et al 1989, 9). According to Muller (1989, 56) these can be narrowed down to individual aspects and phases of production because:

- one particular aspect, noise for example, may not be relevant for the group of products concerned;
- products in the group may defy differentiation with regard to their environmental properties and;
- lack of available information on the product or process.

In practice the Blue Angel reduces the analysis of products within product groups to a single criteria.

A report by Environmental Data Services (EDS) illustrates the single criteria approach. Within the acrylic paint product category, the Blue Angel program awarded the label to acrylic paint that had a maximum organic solvent content of 10%. Other aspects of the impact of these paints on the environment were not considered. In the battery industry, the zinc-air batteries with low mercury content received the Blue Angel because they provided an alternative to mercury oxide batteries for use in hearing aids. The mercury content was limited to 60 mg/Ah. Only the mercury content is considered in comparing zinc-air batteries (1988, 14)

The primary criticism of the Blue Angel program is this single criteria approach to choosing products within product groups. A report prepared for the EPA on environmental labeling by Applied Decision Analysis (ADA) cites criticism by manufacturers and consumers of the single criteria approach as being narrow-minded (Carswell, et al 1989, 9). In fact, some manufacturers have chosen not to use the logo although qualified, because of disagreement with the logo's criteria. Additionally, some

manufacturers feel that their products in other categories without the logo many be perceived as inferior (Carswell et al 1989, 9).

The EDS report states that there appears to be a general consensus to a number shortcomings to the Blue Angel Program. First, the program fails to assure the consumer that labeled products are of satisfactory quality or adequate performance. Secondly, some contend that the program does not set the qualifying criteria high enough or and revise them often enough. The report cites that as a result consumers cannot differentiate between products varying significantly in environmental characteristics. Finally, critics suggest that products with equivalent or superior environmental performances are left out due to the single criteria approach. Using the acrylic paint example, only paint containing organic materials are included in the product category because paint without organics is not entirely competitive for all uses. This results in paint containing organics receiving a Blue Angel while paint without organics do not. This is because these two types of paints are not considered to be in the same product category.

The ADA report cites evidence that the Blue Angel has succeeded in encouraging manufacturers to develop ways to reduce pollution, and to consider their products' effects on the environment when making design and manufacturing decisions. The study describes paper manufacturers as being significantly affected by consumer demand for recycled paper bearing the Blue Angel logo. Until recently, paper products were required to contain 51% waste paper to qualify for the Blue Angel and the standard has been strengthened to 100% (Watson 1989, 19). The German government is the only source of quantitative evidence of the impact on the Blue Angel program. They report a cumulative reduction of 40,000 tonnes of solvents from household paints entering the waste stream (Carswell et al. 1989, 10).

B. Canada

The authorities in Canada and Japan closely studied the German experience and have attempted to overcome some of the shortcomings of the Blue Angel (EDS 1988, 30). Canada's official environmental labeling program, Environmental Choice, was announced in June, 1988. The programs logo is a maple leaf formed by three doves symbolizing the three major partners - government, industry and consumers - working in a spirit of harmony towards a common goal (EDS 1988, 30). See Figure 2. The logo is accompanied by an explanatory statement specific to the product such as "over 50% re-refined oil" and is printed in both English and French (Carswell et al. 1989, 12). The Canadian program was initially called "Environmentally Friendly Products Program" but like the German program the name was changed in response to controversy and it was agreed that "nearly nothing is friendly to the environment" (Hirsbak et al. 1989, C6).

Still in the start up phase, Environmental Choice has already approved three product categories and with eleven more in the approval process. Categories for which guidelines are already approved are re-refined lubricating oil, construction material made from wood-based cellulose fiber, and products made from recycled plastic. Those for which guidelines are under review are zinc batteries, vegetable oils for consumer/industrial use, products from recycled rubber, low-pollution water and solvent based inks, fine paper from recycled paper, sanitary paper from recycled paper, miscellaneous products from recycled paper, newsprint from recycled paper, home ventilation using heat recovery and cloth diapers (Ego Logo 1989). In the short term the program is mainly concerned with selecting products which are environmentally benign, have a compelling reason to be selected and have a high market profile (Carswell, et al. 1989, 13).

Canada's process for defining product categories, establishing guidelines and approving products is modeled after the the Blue Angel program (Carswell et.al.,1989).

Three main groups are involved: the Canadian Standards Association (CSA), a non-profit independent testing and standards writing association; Environment Canada, the government agency sponsoring the program; and the Environmental Choice Board, a panel of experts from various fields (Carswell et al. 1989, 13). Manufactures pay an annual licensing fee to use the logo on the approved product which is based on annual sales and ranges from $1500 to $5000 and also pays a one time testing fee which varies by category (Watson 1989, 19). These fees are higher than the Blue Angel program because the program is intended to be self-sustaining in two years (Carswell et al. 1989).

Learning from the criticism of the Blue Angel, the Environmental Choice program uses a cradle to grave approach to determine product criteria. The objectives of the program clearly state that the products must be environmentally sound in their production, use and disposal. The EDS report states that a matrix system is being developed for product assessment in which points will be awarded for environmental acceptability at each stage of its life cycle. Different stages may receive a different weighting in the final score depending on the product type. Products will have to achieve an acceptable overall score to qualify for the label. The ADA report however, states that the implementation of this approach has been somewhat ad hoc and has not been used explicitly.

C. Japan

The Eco-mark program in Japan was announced in 1988 along with a White Paper declaring a new direction in domestic environmental policy-pollution prevention. The paper stated that pollution prevention should be considered in every stage of production, use and disposal of products and that consumers would be educated to help them realize that environmental problems are their concern and responsibility (Carswell et al. 1989, 14). The program was formally launched with a mass media campaign in February, 1989 and is similar to the Canadian and German programs.

The Japanese program uses a logo made up of a letter "e" made out of a pair of hands encircling the earth. The phase "gentle to the earth is written above the symbol and a brief product specific reason such as "Protects the ozone layer" (Carswell et al. 1989, 14). See figure 2. The Eco-mark program is coordinated by the Eco-mark office at the Environmental Agency (Hirsbak et al. 1990, C3). Products must meet the following requirements for Eco-mark approval:

- minimal or no pollution in use;
- improvement of the environment in use;
- minimal or no pollution at disposal; and
- other contribution to environmental conservation.

In addition, products which qualify for the label must have been manufactured with adequate attention to the following:

- preventative measures are taken against environmental pollution in the manufacturing stage;
- processing is not difficult at disposal;
- energy or resources can be conserved with the use of the product;
- compliance with laws, standards, and regulations pertaining to quality and safety; and
- price not extraordinarily higher then comparable products (Tamura 1990, 3).

A report by the Danish Technological Institute (DTI) suggests that the procedures for the Eco-mark program are simpler then the German and Canadian programs and seem to offer less opportunity for public involvement (Hirsbak et al. 1989, C4). The report also suggests that the program lacks clarity about ground rules for validation of manufacturers' claims, possibility because the product groups initially selected are unsophisticated and will not require extensive testing. The Eco-mark program has begun with products which may quickly receive the label to keep up public interest and momentum.

A committee in the Eco-mark office sets standards for approval of products and approves products for certification. The label granted is a renewable license for two years and costs a fee depending on the retail price. Any product that is marketed in Japan, domestic or foreign, is eligible for the Eco-mark. In the first year, 300 products were approved for the label, with new products being added twice a year. The first list of products includes: non-CFC aerosols, kitchen strainers, used oil cooking bags, home composters, recycled paper products, cans with stay-on tabs, returnable bottles, and cloth diapers (Tamura 1990, 9).

D. Sweden

A proposal for a slightly different program was introduced in Sweden in 1989 by Thomas Lindhqvist. The Environmental Product Declaration (EPD) is a voluntary mechanism for discouraging the use of toxics. The EPD is based on the concept that manufactures have the unique knowledge of the characteristics of their products, and therefore they have the ability and social responsibility to change the products to minimize environmental impacts. According to Lindhqvist, the success of EPD assumes that if a manufacturer had to declare some the environmental properties of his products, that they would develop products with an improved environmental profile. Further if the manufacturer has the responsibility to know how its products should be taken care of when discarded, it follows that this knowledge be transmitted to all parties dealing with the product including wholesalers, retailers, consumers and waste handlers. Lindhqvist believes that this could be done with a written EPD.

Lindhqvist describes an EPD that would provide consumers the information they need to make environmentally sound purchases and provide incentive to industry to reduce their use of toxic substances. This would strengthen goodwill of the company and meet consumer demand. It differs from the eco-labeling concept in that it is much more extensive in informational content and is available only on request of the consumer. A shortened version of the EPD may be included on the label of a product

including a message on how to request additional information. It would be applicable to a wider range of products then existing eco-labeling programs currently are. EPD is seen as a much stronger tool than eco-labeling to encourage source reduction at the manufacturing level.

The EPD is a written statement of all properties of a product which during the use and final treatment of the product are important from an environmental point of view. It should consider both potentially harmful substances and those known to be environmentally hazardous.

A complete EPD requires the manufacturer to document the following:

1) a list of all environmentally relevant substances (elements and compounds) which are present in he product.

2) an account of all stages in the production process which are of importance.

3) an account of the final treatment of the product and more specifically:

a-the possibilities to reuse or recycle the product and its packaging, including existing organization and economic solutions for collection

b-the behavior in a waste incineration facility

c-the behavior in a landfill

d-the behavior in a waste composting facility

More complex products should be supplemented with:

4) a dismantling/scrap declaration

5) a repair declaration.

Governmental authorities, as described by Lindhqvist, in Sweden would have responsibility to issue guidelines for the EPD and would likely be developed in cooperation with industrial trade organizations. Several major Swedish companies are already preparing EPDs for their products and they have expressed an interested in obtaining guidelines for content and form of both a complete EPD and a condensed version for printing on their products. Final government decision has not yet been made on EPD yet in Sweden.

E. Other European Programs

At least eight other countries are exploring the concept of eco-labeling and may be soon implementing programs. These include: Norway, Sweden, Holland, France, Denmark, Finland, Austria, Switzerland, and the United Kingdom. The idea of an international environmental label is also being discussed as are smaller cooperative efforts. Considerable interest has focused on proposal for an European environmental label after the removal of internal trade barriers in the European Community scheduled for 1992 (Watson 1989, 21). The DTI paper proposes such as program. These programs are all in the developmental or planning stage and are not yet operational. Much of the discussion and research for these programs focuses on how to set criteria for a labeling system. According the the EDS (1988) report the two main trends of thought are first, to follow the German example by using a single environmental criteria or to peruse a cradle to grave (life cycle) assessment.

F. United States

In the United States there has been no federal environmental program established yet but private and state programs have been initiated. Two independent private organization have recently announced programs to establish environmental labeling programs. In addition, the EPA has drafted legislation to establish a federal program and several states have pending bills. The federal legislation is currently at the Office of Management and Budget (Mohin 1990b).

The Green Cross Certification Company is a not-for-profit organization working in cooperation with four retail supermarket chains.. The program will award both a recycling seal of approval and an environmental seal of approval. The first recycling seal was awarded in July to the Kraft paper grocery bag made of 38-40% recycled paper content. The Green Cross program is also developing an environmental performance ranking system to base decisions for the environmental seal. According to Stan

Rhodes, President of Green Cross, they do not expect any major product to receive a seal for a long time due to strict criteria (Brown 1990).

The Green Seal program, announced in April, 1990, is being lead by Earth Day 1990 chair Dennis Hayes. Green Seal will begin establishing standards this summer. According to Norman Dean (1990), Green Seal executive director, a primary objective of the program will be "assessing the environmental impacts of consumer products through their entire life cycle."

Another type of labeling program that has developed in the U.S. is California's Proposition 65. Unlike the other programs discussed here, this is a negative labeling, or warning labeling program that highlights the dangerous aspects of products. The Safe Drinking Water and Toxics Enforcement Act, a citizens initiative, was passed by a substantial majority of voters in November 1986 in response to criticism that federal laws for controlling toxics were not working (Russell 1989, 36). The major purpose of the act is to restrict discharges of carcinogens and reproductive toxins to drinking water sources and to require businesses to require warnings to people who they expose to such chemicals. It emphasizes preventing human health risks rather then protecting the environment (Carswell et al. 1989, 19). The Act addresses the state's responsibility, industries obligations and the publics right to know about and to control the release of hazardous substances. According to a report by the California Senate Office Research (Jennings 1989, 2) the major provisions require:

- the publication of a list of carcinogenic and reproductive toxicants and make additions at least annually;
- the prohibition of discharges of listed chemicals that might enter sources of drinking water;
- the issuance of warnings regarding public exposure to listed chemicals;
- the imposition of civil penalties of $2500 per day per violation of these requirements;
- the state to increase criminal penalties for violations of the Hazardous Waste Law to as much as $25,000 per day and three years in jail;

- specified government employees to report information received on certain illegal discharges to local Board of Supervisors and to the local health officer; and,

- the state to allow citizens to initiate suits and collect a portion of fines for violations of this Act.

The provision for warnings is of specific interest for environmental labeling. Proposition 65 puts the burden on business to provide "clear and reasonable" warnings to those exposed to designated chemicals in consumer products, the work place or the environment. The regulations outline various methods to satisfy the warning requirement including labels, advertisements and use of an 800 toll free number for customers to call. The regulations however, do not prioritize methods by their effectiveness allowing businesses to choose the least obtrusive method. The California Superior Court however, ruled in July 1989 that offering an 800 number is not in compliance with Proposition 65 because it "does not provide clear and reasonable warnings" since it fails to provide warnings before exposure. This action has allowed environmental and consumer groups to take action against manufacturers who fail to provide a warning about dangerous chemicals in their products.

Suit was filed by a coalition of labor and environmental groups against Liquid Paper "white out" products which contain trichlorethylene (TCE). The manufacturer of Liquid Paper, not only relied on the toll free number to inform customers but it also did not inform consumers about the availability of its versions of the product which do not contain TCE. The company agreed to reformulate Liquid Paper without the carcinogen, and offers a trade-in program. The Liquid paper settlement is an example of the potential of Proposition 65 for toxics use reduction. The threat of lawsuits may encourage industry, when possible, to manufacture products without or using less dangerous chemicals (Sierra Club 1989, 11).

Russell (1989) suggests that the outcome of Prop 65 could shape commerce across the country, changing the way major products are sold, packaged, and labeled. Susan

Hadden, suggests that it is unclear how Proposition 65 will affect consumer behavior, "Everything we know about labeling and providing people with information say the way Prop. 65 is working right now is not likely to be successful" said Hadden. She adds, "when people seen the same works over and over they just blank them out." Hadden believes that the law's most positive effect is that it may "put pressure on industry to consider how much it needs to include those hazardous ingredients" (Russell 1989, 44).

A review of the literature on international environmental labeling programs has revealed patterns in the existing and proposed systems. Many of the programs utilize a similar system for the evaluation and comparison of products. Generally, product categories are selected and then products are selected to receive the label are chosen from within those categories.

CHAPTER III

ISSUES IN PRODUCT EVALUATION AND COMPARISON

Governments, institutions and individuals throughout the world are separately investigating and implementing environmental labeling programs yet a general process is shared by most all of them. This chapter will lay out the process used by many of the programs and discusses issues of product evaluation and comparison in detail. This will include a discussion of product categories, approaches to product criteria and possible criteria.

The process for selection of products for an environmental label is normally a two step process. The first step is the the development of product categories. The categories are defined in such a way that it ensures all competitive products that fulfill the same purpose are included and that there is a clear understanding of which products belong to the product category (Hirsbak et al. 1990, v). Step one will be discussed only briefly and will be given less attention then the second step. This is because most of the controversy and problems of environmental labeling programs have focused on the selection of criteria. The second step is the selection of criteria and evaluation of the products within the categories. Those products selected in the second step are awarded the label.

A. Product Category Selection

A product category is a set of products for which a common selection of criteria are defined. The DTI report states that the practical implications of fulfilling the same purpose will have to be pragmatic and relate to the goals of the program. The report states that the more significant the desired changes in the pattern of consumption are, the less homogeneous the product group will be (Hirsbak et al. 1990, v). Using bicycles

and cars as an example, if it is the goal of the program to encourage people to purchase bicycles rather then cars as a means of transportation, then it would be appropriate for them to be in the same category. However, if the goal of the program is to reduce gasoline consumption, then it would be more appropriate to include only cars in the category and evaluate them by gas mileage. Furthermore, while both the bicycle and the car serve to transport individuals over distances, it is questionable if an environmental label would influence the choice between two products with such different features. The product groups should therefore not be too broad or they will not present real alternatives to consumers. Plastic beverage containers and aluminum cans on the other hand, do serve the same purpose, are competitive and offer viable alternatives. Therefore, bicycles and cars would not be in the same product category while plastic containers and aluminum cans would be. Step one also assumes relatively equal efficacy in function.

The process of product category selection has proceeded in a straight forward manner for most existing programs. The Blue Angel program however, has been criticized for being too narrow in product category selection. As discussed in the previous chapter, by limiting the paint category to only those containing organic components, the program excluded paint without organics. This resulted in promoting a paint with a greater environmental impact, that with organic content, being awarded the Blue Angel.

B. Approaches to Product Evaluation

In order to implement an environmental labeling system it is necessary to adopt selection criteria (step two of the process). These criteria define the characteristics to be achieved for a product to be permitted to use the label. It is this aspect of environmental labeling that is perhaps the most difficult and controversial (Carswell et al. 1990, 3,4). Despite ten years of experience of the Blue Angel program and a great deal of effort by other countries, most programs are still grappling with their product

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impacts be considered? Other considerations include whether the criteria are intended to be technology forcing and help drive the development of new technology or only meet current expectations? If all the products in one category meet the criteria, should they all be awarded a label? How should improvement be rewarded once a product has received the label (Carswell et al. 1989, 56)?

The cradle to grave or life cycle approach is often cited as the most appropriate approach to evaluate products (Hirsbak et al. 1990; Larnimaa 1990; Jensen,1989). In order to be practical, most existing and proposed labeling systems recommend only an initial life cycle evaluation of the product group followed by selection of several criteria upon which to base decisions. Such a process has been proposed by the Danish Institute of Technology (DTI) for an European Community Environmental label.

The DTI proposal for an European Community Environmental Label also raises several issues concerning problems with life cycle analysis specifically related to the manufacturing process. For example, a manufacturer may change suppliers of raw materials, energy, and components depending on the market situation. How is it accounted for when one supplier uses state of the art technology while another produces significant air emissions, for example? Additionally, one manufacturer many use several different production facilities. This may result in products of the same type and same brand being manufactured at plants with very different environmental standards and impacts. A life cycle analysis of one of the facility would not be representative of the actual consumer product in every case.

The DTI report also raises concerns over local conditions. The environmental impact will in many cases depend on how the product is treated and upon the surrounding circumstances. A product such as pesticides, used correctly may have minimal environmental impact, but if used incorrectly could have a significant impact. Additionally, existing water treatment systems and pollution control equipment will influence the environmental impact of manufacturing, use and disposal. For

example, a product disposed of in an inadequate landfill has the potential to contaminate groundwater, but the same product in a contained landfill will have less impact. Furthermore, actual waste treatment systems and the pollution control standards may vary from region to region. Recycling opportunities also vary from region to region. For example, a product made of recyclable plastic can not be recycled if there is no local infrastructure for plastic recycling.

Some other unresolved issues exist and were discussed by Christine Ervin in a speech at the Clean Technologies conference in June 1990. Ervin raises the following questions. Is it necessary to include a risk analysis on each chemical, process and product? How can the uncertainty of risk analysis be factored in? Should all risks be included or only unregulated ones? How are weights assigned to each pollutant or effect? Ervin asserts that if no weight is given, it is assumed that all are equally weighted. Ranking or weighting systems however, can be very complex. Ervin is working on a project at EPA developing a methodology to evaluate the public health consequences throughout the life cycle of products and to provide this information to consumers (Mohin, 1990a)

C. Possible Criteria

The following is a list of possible criteria that could be used to evaluate a product in a life cycle analysis. This list is not intended to be complete, but rather to exemplify the large variety of factors that could be considered in evaluating and comparing products. Those criteria that are considered important for any product will vary considerably as a result of individual values. Their relative importance will also vary. It is difficult, for example, to compare within a category such as air emissions and even more difficult to make comparisons between very different criteria such as reusability and worker safety. Similarly, while solid waste might be of primary concern in one community, water conservation may be more important in another. Possible criteria are presented in figure 3.

Figure 3: Critieria for Life Cycle Analysis

raw material consumption: natural resources, water
use of renewable/non-renewable resources
energy consumption
toxic substance use
air emissions
waste water emissions
solid waste generation: post-consumer, in process
waste reduction/pollution prevention in product/process
hazardous waste generation
hazardous waste disposal methods
nuisances: noise, odor
worker safety
product safety
potential health effects of products
ecosystem effects: endangered species threat, habitat destruction
recycled material content: of product, packaging
refillable
reusable
resalable
compostable
degradable (photo, bio)recyclability: of product, of packaging
ease/availability of recycling of product/packaging
life-span of use
efficiency of production process
ozone layer effects
threat to groundwater
acid rain contribution

In order for an environmental labeling program to be successful it must resolve many of the issues raised in this chapter. The more explicit the decisions regarding theses issues are, the more credibility the program will have with both manufacturers and consumers.

CHAPTER IV

ANALYSIS OF DIAPER PRODUCT CATEGORY

This chapter uses an existing analysis for a specific product category--diapers--to illustrate the generic problems in using a life cycle approach to make decisions in an environmental labeling program. This analysis was designed to respond to a need to exemplify the problems in establishing criteria with the practical problems of real products (Hirsbak et al. 1989).

A. Methodology for Analysis of Diaper Product Category

After reviewing the literature, I devised an analytical framework for this analysis using the following categories: omission, weighting and bias. The omission category evaluates the life cycle analysis for criteria and data that were not included and how this would potentially influence the outcome of the analysis. The weighting category is defined as the systematic or implied emphasis given to components of the analysis. This category is used to evaluate how weighting systems were used and how they impact on the outcome of the analysis. The third category, bias, is defined as partiality to one of the products in the product categroy. Bias will be considered in both presentation and data selection.

The diaper product category is used to illustrate and understand the difficulties in attempting to select a product as environmentally preferred to another. The analysis assumes that the diaper product category has already been chosen. In other words, step one discussed in chapter III is assumed to have been completed. This is not significant because the diaper product category is easily defined.

The diaper product category provides a good case study to illustrate product comparison issues. Within the diaper category there are two readily available cost

effective alternatives that currently exist: cloth and disposable diapers. The products unquestionably fulfill the same purpose while producing significantly different environmental impacts. Furthermore, several studies have been conducted comparing disposable diapers (single use) to reusable cloth diapers. This analysis will utilize this existing data to compare the diaper alternatives to illustrate the difficulties in conducting product comparisons for environmental labeling programs. Specifically, a life cycle analysis by Arthur D. Little Inc. will be used as a case study.

B. Diaper Background

In the 1950's nearly all diapers used in North America and Europe were made of reusable cotton fabric. However during the past few decades, cotton diapers have been almost entirely replaced by disposable, single-use diapers. In 1987, 90% of all diapers purchased in the United States were disposable with sales totalling an estimated 17 to 18 million. While cotton diapers accounted for 10% of the market they accounted for 20% of diaper changes (Lehrburger 1989, 9). The discrepancy in diaper changes and market share is due to the reuse of cotton diapers.

Recent awareness of the decreasing availability of landfill space and the increasing cost of municipal solid waste disposal has caused all disposable products to come under increased scrutiny. Disposable diapers in particular have received considerable attention due to the fact that with the exception of newspapers and beverage containers, disposable diapers are the single consumer product that contributes most to the solid waste stream (Wirka & Tryens 1989, 1). In fact, approximately 2% of the municipal solid waste stream is made up of disposable diapers, of which 92% ends up in landfills (Lehrburger 1989, 29).

This concern over solid waste disposal has prompted many parents and institutions to switch to cotton diapers in the recent past. In July, the University of North Carolina Hospitals switched to cloth diapers and will receive 3,000 cloth diapers a week from a diaper service. As a result, diaper services are growing. Jeff Johnston,

the president of the National Association of Diaper Services, said,"We are up 35 % from last year as an industry average" (Holusha 1990). In addition, 20 states have considered proposals that range from taxes to bans of disposable diapers to encourage the use of reusable diapers (Salter 1990).

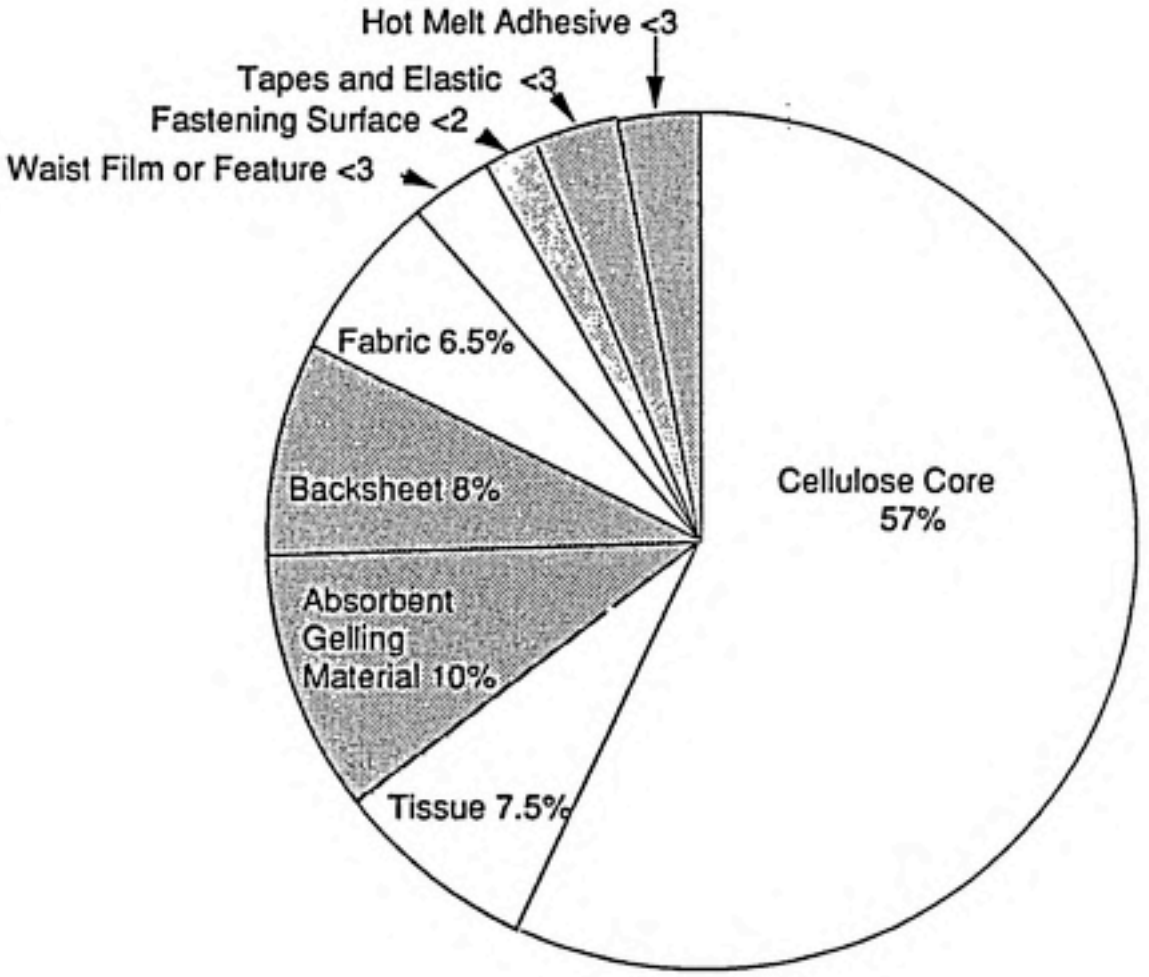
In response to this controversy both the cotton diaper and the disposable diaper industries have conducted studies, and embarked in media campaigns to gain and/or defend their markets. It is these studies that provide the data used in this analysis. This, if the European experience was adopted, would be the data used if diapers were being considered for an environmental label.

Disposable or single-use diapers are used once and discarded into the municipal solid waste stream. While the materials used vary in composition between different diaper styles and manufacturers, generalizations can be made. In general, disposable diapers are manufactured using pulp, absorbant gelling material, tissue, polyethylene film, polypropylene nonwoven material, tapes, elastics and adhesives (ADL 1990, II-14). Sandwiched between an outer layer of waterproof plastic and a water-repellant liner is a thick layer of absorbant material made from wood pulp (cellulose). The cellulose is embedded with superabsorbant crystals made of a poly-acrylate polymer which is held in place by tissue like paper (Lehrburger 1989, 12). Additionally there is a waist film or decorative feature, fastening surface and tape, elastic and adhesive. Disposable diapers are packaged in either polyethylene bags (75%) or fibreboard boxes (75%) (ADL 1990, II-14). Figure 4 illustrates the percentages of each component by weight in the typical disposable diaper

Cloth or reusable diapers are, as their name implies, used, washed and used over and over again. Reusable diapers are almost exclusively made of cotton with the majority being imported from China. (ADL 1990). Cloth diapers are either washed at home or picked-up and washed by a diaper service. Most cloth diapers are used with

Figure 4: Disposable Diaper Components

(reprinted from ADL study)



reusable diaper covers or pants. Cloth diapers are purchased and delivered by services in polyethylene bags.

C. The Arthur D. Little Study

In March of 1990, Arthur D. Little (ADL) completed a report "Disposable versus Reusable Diapers: Health, Environmental, and Economic Comparisons." The report was commissioned by the Procter and Gamble Company which accounts for about half of the $3.6 billion a year disposable diaper market. The ADL study evaluated the relative merits of the diapering alternatives on a life cycle basis from "the point of raw material production through post-consumer waste disposal".

The ADL report concluded "that the specific human health, environmental and economic advantages of disposable diapers would appear to outweigh the more limited advantages of the reusable diapering materials". This conclusion is largely based on reported health and economic advantages of disposable diapers. Specifically, the report cited better protection against diaper dermatitis, and decreased potential spread of infection in day care settings. The ADL study reports these to be achieved at a lower cost then reusable diapers. The report also concluded that neither diaper option is clearly superior in the environmental criteria. The primary difference cited by ADL is that disposable diapers cause most of their environmental impacts before and after the life of the product, while the impacts from reusable diapers occur during the life of the product. Figures 5 and 6 illustrate the life cycles of the two diapering alternatives considered in the ADL analysis.

The above conclusions were based on the following data. These data are a summary of the ADL report and not an independent analysis of the data by this author. Figure 7 details the ADL data on the environmental impacts of diaper usage.

- Disposable Diapers consume about 7 times the raw materials of cloth diapers and result in the generation of over 90 times the post-consumer waste.
- Reusable diaper use generates 50 percent more process solid waste then disposable diapers.

- Reusable diaper use consumers over 3 times more non-renewable energy resources and just over 4 times more renewable energy resources.
- Reusable diaper use consumes 6.1 times more water and releases nearly 10 times higher levels of total water pollutants.
- Reusable diaper use results in the emission of over 9 times higher levels of total air pollution.

Other studies have been conducted on the diapering alternatives within the diaper product category. Unfortunately, none are a life cycle analysis and therefore cannot be directly compared with the ADL study. No single one of these studies represents a definitive analysis but the data taken from these will be used as a basis for comparison with the ADL study.

In December 1988, Carl Lehrburger published "Diapers in the Waste Stream: A Review of Waste Management and Public Policy Issues." This study, funded by the National Association of Diaper Services, evaluated the role of diapers in the solid waste stream. Unlike the ADL study, this analysis did not use a life cycle approach. The Lehrburger study focused on several criteria specifically related to solid waste. The multi-criteria approach used by Lehrburger falls midway on the spectrum of approaches to product evaluation between the single criteria approach and a life cycle analysis. This approach is used in some of the existing and proposed labeling systems.

The Lehrburger study concludes that the "use of reusable cotton diapers should be encouraged over single-use diapers because it reduces solid waste and relies on reusable fabric." Lehrburger bases this decision primarily on the reliance on landfills to dispose of used disposable diapers which he considers the least desirable method of waste management. Additionally, he cites the preferable disposal of feces in the sewage waste system from cloth diapers, rather then the solid waste system as with disposable diapers. This is due to potential comingling of untreated sewage and solid waste potentially posing a health concern for sanitation workers. Finally, Lehrburger cites cloth diapers as offering a long term cost savings.

Figure 5: Disposable Diaper Life Cycle from ADL Study

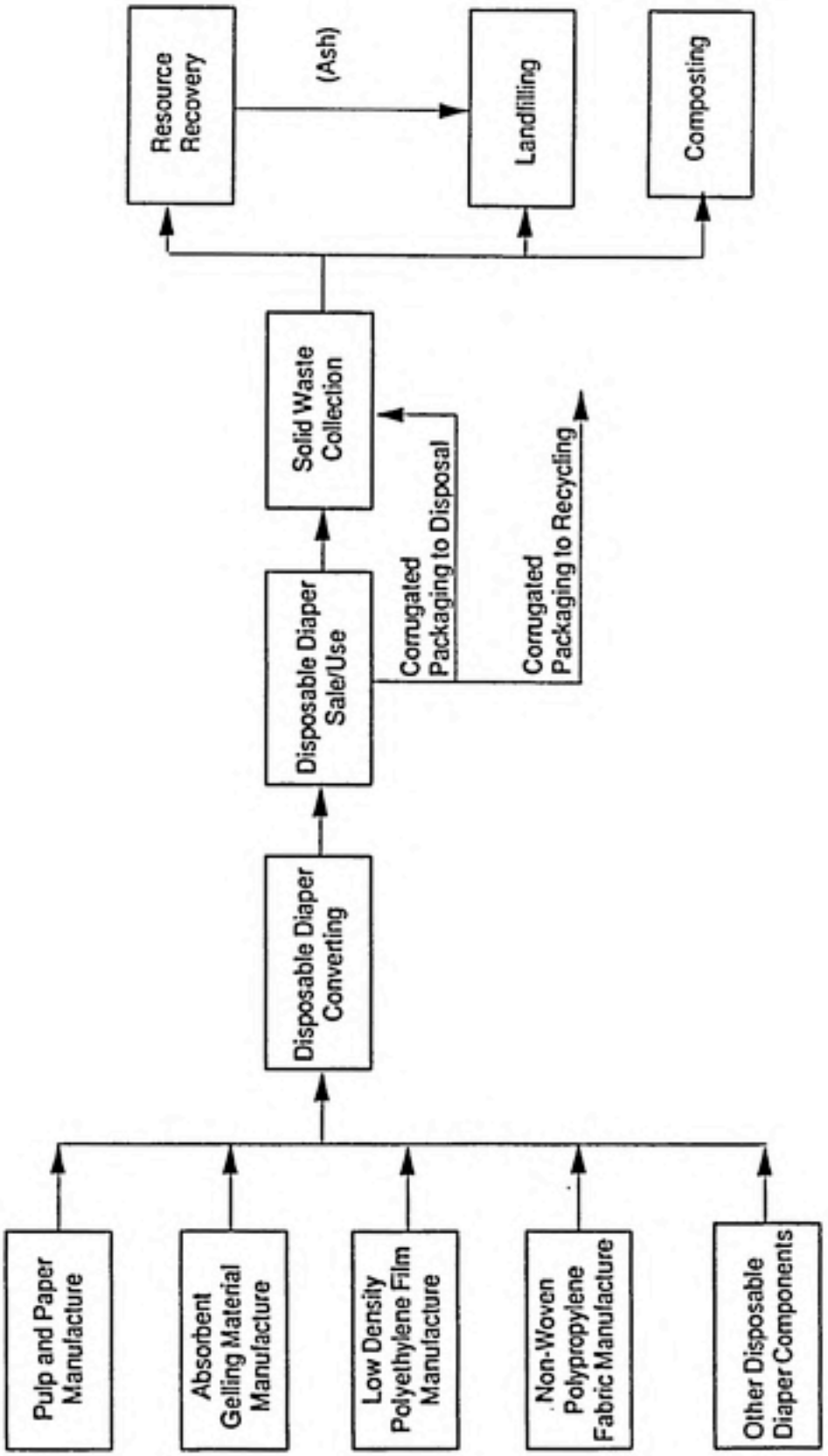


Figure 6: Reusable Diaper Life Cycle from ADL Study

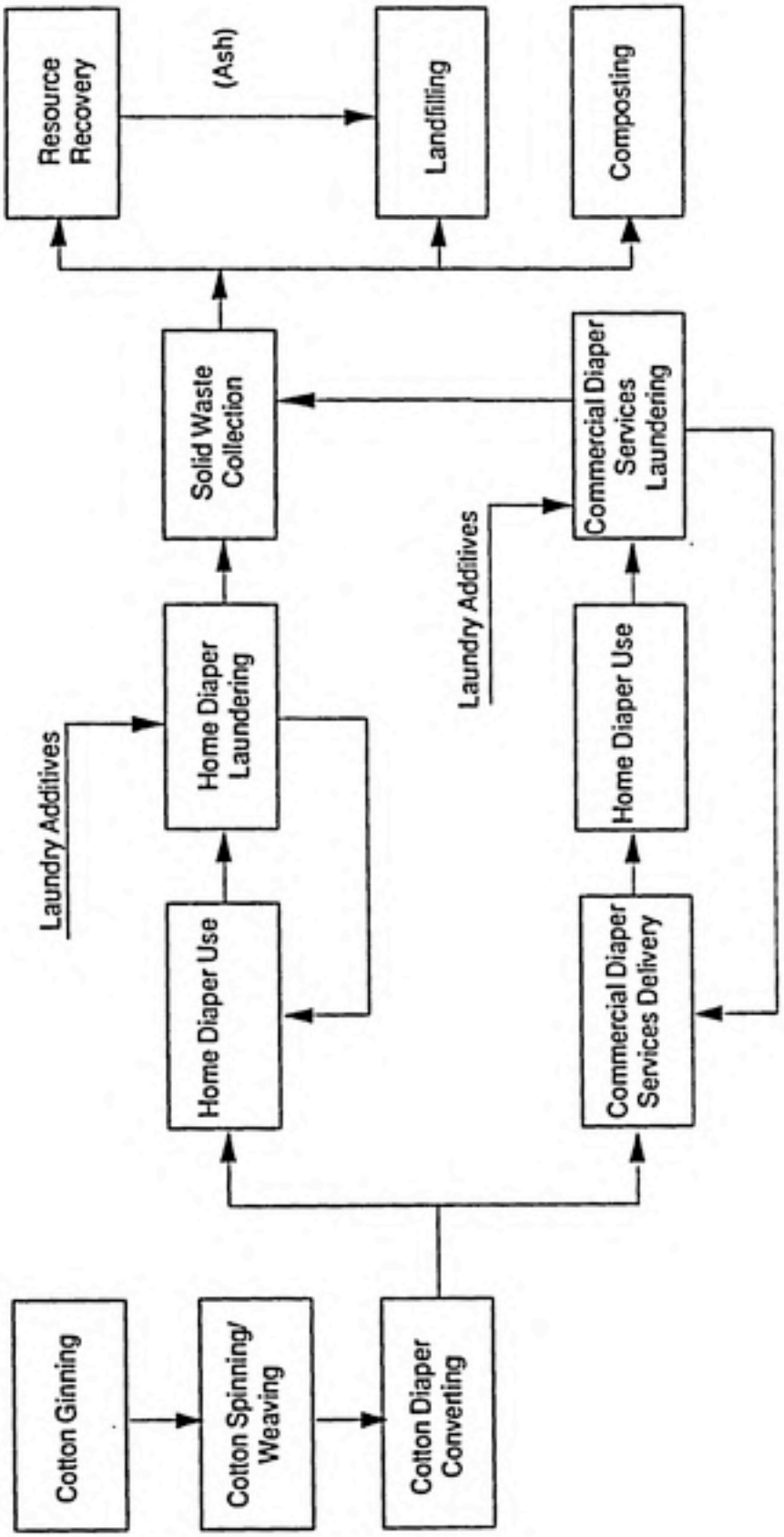


Figure 7: Environmental Impacts of Diaper Usage from ADL Study

	Reusable Diapers[b]	Disposable Diapers
Raw Materials Consumption		
• Renewable Resources	0.4 pounds	21.6 pounds
• Non-Renewable Resources	3.2 pounds	3.7 pounds
Water Consumption	1,195 pounds (144 gallons)	196 pounds (23.6 gallons)
Energy		
• Renewable Sources	14,890 Btu	3,720 Btu
• Non-Renewable Sources	64,000 Btu	19,570 Btu
Total	78,890 Btu	23,290 Btu
Atmospheric Emissions		
• Particulate Matter	0.26 pounds	0.003 pounds
• Nitrogen Oxides	0.15 pounds	0.006 pounds
• Sulfur Oxides	0.32 pounds	0.007 pounds
• Carbon Monoxide	0.03 pounds	0.008 pounds
• Chlorine/Chlorine Dioxide	--	0.001 pounds
• Chloride	--	negligible
• Hydrocarbons	0.10 pounds	0.068 pounds
Total	0.86 pounds	.093 pounds
Waste Water Effluents		
• Total Suspended Solids	0.013 pounds	0.007 pounds
• Chemical Oxygen Demand	0.004 pounds	negligible
• Biological Oxygen Demand	0.012 pounds	0.003 pounds
• Hydrocarbons	--	0.002 pounds
• Phosphorus	0.005 pounds	--
• Nitrogen	0.083 pounds	--
Total	0.117 pounds	0.012 pounds
Process Solid Waste	3.13 pounds	2.02 pounds
Post-Consumer Waste	0.24 pounds	22.18 pounds

[a] Based on the average weekly diapering requirements per child and considering current post-consumer waste disposal practices.

[b] Considers the approximate use of home laundering and diaper services for 90 percent and 10 percent of the respective diaper changes. Lehrberger (1988) and Arthur D. Little estimates.

The Lehrburger study and several other sources of information were used to evaluate the Arthur D. Little Study. A survey by Weiss and Associates Marketing Research on diaper rash is used in the bias category. A paper by Jeffrey Tryens (1990) is used in the analysis of bias in data selection.

D. Omission in Arthur D. Little Study

A life cycle analysis of a product, as the names implies, should include all aspects of the products life cycle from raw materials to disposal. In practice however, some boundaries need to be drawn and decisions need to be made regarding how comprehensive each step of the analysis will be. In other words, the parameters for the analysis of each step in the life cycle must be chosen. Two types of omission can occur in a life cycle analysis. The first is omission of criteria and the second is omission of data.

1. Omission of criteria

The list of possible criteria in figure 3 illustrates the various impacts on the environment that could be considered in a life cycle analysis. It is not necessary however, for a comprehensive life cycle analysis to include every criteria. The list of criteria included in the analysis could be shortened in two ways. Criteria may be eliminated from the analysis on the basis of objective and subjective decisions.

The list of criteria considered in the analysis will be shortened as a result of a series of objective decisions. First, not every criteria will be applicable to every product category and will therefore not need to be considered in the analysis. For example, recycled material might not be available or applicable to any of the products within the product category and accordingly need not be considered. Next, within a product category, all of the products may have the same impact or no impact in some of the criteria. These may not need to be considered in the analysis leaving only the criteria that differentiate the products to be evaluated. Using the recycled content criteria example again, the products within the category may all use the same

percentage of recycled material. In this case it may not be necessary to included recycled content in the analysis. Similarly if neither product produced hazardous waste then it would not need to be considered. Other criteria may drop out due to a lack of quantitative measurement techniques. For example, it may not be possible to measure the impact of a product on an endangered ecosystem or to measure non-point source pollution. This process of elimination may leave most of the life cycle still to be considered or cut the list of criteria down to only a few or one. In the diaper product category, most of the criteria would still remain since the two diapering alternatives are significantly different.

More important then the criteria eliminated by objective decisions are those omitted by subjective decisions. These will vary according to the person or organization performing the analysis and involve value judgements. Since there is no formal methodology for conducting a life cycle analysis, the researchers must make decisions on what to include. For example, a decision must be made about whether worker safety or habitat destruction should be included as criteria. Without a formal procedure, these decisions are usually based on values. Unless explicitly stated in the analysis, the omitted criteria have the potential to significantly influence the outcome of the analysis and the ultimate decisions in an environmental labeling program. The omission of certain criteria or data may favor some products within the product category over others.

Although the ADL study used a life cycle approach, it did narrow the analysis to a set of criteria. The following were used in the environmental analysis: consumption of raw materials, water consumption, consumption of energy, air emissions, waste water effluents, process solid wastes, hazardous waste and waste oils, and post consumer wastes. The analysis also considered health impact criteria which included the effects of fecal and urine contents on: users, family members and close contacts, persons who handle diapers at work, and people who live near uncontrolled landfills. In addition,

the report considered economic criteria including: selling price, laundering cost, disposal costs.

The ADL study did not include several criteria that may have influenced the outcome of the analysis. These include: worker safety, odor, recyclability, reusability, recycled material content, habitat destruction, potential groundwater contamination, life span of product, product safety and source reduction. See figure 8. It is not the intent of this author to offer a new analysis using the missing criteria but to illustrate their omission and the potential impact on the outcome of the analysis.

First, the ADL study did not include worker safety. Risks to workers in the manufacture of cotton diapers are significantly different than those in a disposable diaper manufacturing process. The life cycles of both diapering alternatives are illustrated in figures 5 and 6. The manufacturing of cloth diapers includes cotton ginning, spinning, and weaving. Disposable diapers require the manufacture of pulp and paper , absorbent gelling material, low density polyethylene film, non-woven polypropylene fabric and other components. Both processes present risks to workers but the complexity of the disposable diaper manufacturing process and the number of chemicals involved would potentially pose higher risks to workers.

The ADL study does not consider odor as a criteria. For disposable diapers, odor from air or water emissions would be a factor in the pulp and manufacturing processes, chemical manufacturing and in areas surrounding landfills. For reusable diapers, odor would be a factor as a result of wastewater from sewage treatment of feces.

The only solid waste related criteria included in the ADL study were post-consumer and in-process solid waste generation. This results in omission of reusability of the product, recyclability, recycled material content, source reduction and life span

Figure 8: Omission of Data and Criteria in ADL Diaper Study

Criteria Omitted	Effect on Results of Diaper Analysis	
	Disposable	Reusable
Worker Safety	-	-
Odor	-	-
Recyclability	-	+
Reusability	-	+
Recycled Material Content	0	0
Habitat Destruction	-	-
Potential Groundwater Contamination	-	0
Life Span of Product	-	+
Product Safety	-	-
Source Reduction	+	0
Data Omitted		
Primary Packaging	-	-
Adhesives	-	0
Elastic	-	0
Tape	-	0
Fastening Surface	-	0
Waist Features	-	0
Fertilizer/Herbicides	-	-
Wastewater Criteria	-	-
Energy for Transportation	-	-
Raw Materials for Manufacturing Bleach, Detergent and Softener	0	-

Key: "-" = negative impact; "+" = positive impact; "0" = no impact

of product. These omissions are particularly significant in an age of diminishing resources and limited waste disposal facilities. Inclusion of these criteria would significantly favor the cotton diaper alternative. While ADL did describe efforts at source reduction for disposable diapers, it was not considered in the analysis. It would favor disposable diapers. Cotton diapers are reusable up to 200 times, have a longer life span and those used by diaper services are recycled as industrial rags (Lehrburger 1988, 13). Procter and Gamble and the Seattle Solid Waste Utility is currently undertaking a three month pilot diaper recycling project. The recycled material will be made into computer paper, cardboard and stationary (Williams 1990). The project is still experimental.

Another criteria not included is the potential threats to groundwater from landfill leachate. Disposal of disposable diapers and their contents in landfills will contribute to leachate and groundwater contamination if the landfill is not contained. New landfills are being built with liners and leachate control systems to prevent groundwater contamination but most operating landfills are not outfitted with modern safety features. According to the EPA only 15% of the nations 6,000 municipal landfills have liners and less then one-third have a system for monitoring groundwater (Lehrburger 1988, 29).

Other criteria not included are habitat destruction and product safety. Habitat destruction is a very difficult impact to quantify but may be significantly effect the analysis of both cotton and disposable diapers. The pulp and paper manufacturing process demands forest products and will involve habitat destruction. Similarly, the high demands of energy to wash cotton diapers would have a similar effect from coal or or oil production. Currently, no studies have been conducted on comparative product safety. Potential safety concerns may regard the contact of infant skin to the chemicals in disposable diapers (Tryens 1990a).

2. Omission of data

The second type of omission that can occur is of data. Omission of data frequently is the result of assumptions that limit the scope of the analysis of criteria. For example, statements that set cut off points for inclusion or exclude parts of the life cycle. Similar to the omission of criteria discussed above, the omission of data can profoundly influence the results of the analysis and of the environmental labeling program based on that analysis.

In the ADL study, omission of data occurred within several criteria. See figure 8. The ADL report makes a broad assumption which limits the breadth of the study causing the omission of significant data. The study states that "the analysis considers all diapering components comprising over 5% of the diaper weight, including packaging and auxiliary materials." This assumption specifically impacts the analysis of disposable diaper manufacturing in two ways. First it limits the analysis by weight and secondly by only including components of the final product For disposable diapers the study does include the evaluation of raw materials and manufacturing of: pulp, tissue, absorbant gelling material, polyethylene back sheet, polypropylene fabric and secondary packaging. The study therefore excludes the following from the analysis of disposable diapers: primary packaging, hot-melt adhesives, elastic, tape, fastening surface, and waist features. These components may represent less then 5% by weight but potentially present significant environmental impacts. This assumption favors disposable diapers since it eliminates several steps from the complex of manufacturing process.

A second assumption bounds the analysis regarding raw materials. "Raw materials are considered to be those materials that are intended to become part of the final output and do not include the materials consumed during the growing and extraction of raw materials." This excludes fertilizers, insecticides and herbicides used to grow cotton as well as those used to produce trees for pulp. Raw materials used to

manufacture bleach, detergents, and softeners used in the laundry of cloth diapers are also excluded.

Within the specific category of waste water emissions data omissions also occur. The analysis considered total suspended solids (TSS), chemical oxygen demand (COD), biological oxygen demand (BOD), hydrocarbons, nitrogen and phosphorous. The analysis did not include heat, turbidity, toxicity, color or odor. If these factors were considered the ten fold higher level of water pollution reported by ADL for reusable diapers may be lower. The issue of the weighting of these factors will be considered in the next section.

The ADL study limited the energy consumption criteria to include only "energy during use and disposal and not during mineral extraction processing or distribution". This excluded energy use from the importation of cloth diapers from china, transportation of logs to the mill for pulp production and trucking . In addition this statement excluded the environmental impacts of extraction of raw materials to supply energy during the entire life cycle of both diapering alternatives. This would increase the impact of reusable diapers due to the high energy demand.

E. Weighting in Arthur D. Little Study

When more than one criteria is used to evaluate and compare products, a system must be used to combine the data and draw a conclusion. In a life cycle analysis, a weighting system is necessary in order to make a final judgement about the various life cycle's impacts. Various weighting systems could be used which are based on toxicity, environmental fate, or carcinogenicity. A method has been developed at Clark University using hazard descriptors to compare risks (Hohenemser et al, 1986).

Weighting occurs within criteria as well as between criteria. For example, a weighting system must be applied to the parameters within the air emissions category to produce a total figure. Between criteria, a weighting system is need to combine all the criteria to get a final result. Differences in the type of environmental impact of

the different criteria and use of different units to measure them make any weighting system problematic. Any weighting system has the potential to bias the results of the analysis.

The ADL report does not apply any explicit weighting system either within or between criteria. The study states, "the goal of this analysis is to provide a general guideline to compare resource and environmental impacts of diapering alternatives and does not attempt to place an absolute value on these impacts". However, as mentioned in chapter IV, if no explicit weighting system is established ,equal weighting is assumed. The relative impacts of the criteria and the final conclusion is therefore not quantified. This has several implications on the outcome of the study.

First, the lack of a systematic weighting has impact within the criteria. For example, the waste water effluent criteria considers six pollutants (see figure 9). These pollutants are presented with individual figures and totaled arithmetically. This total assumes that each of the pollutants are equally important and are therefore given equal weight. TSS is assumed to be as important as nitrogen and BOD the same as COD. This is inappropriate since each parameter has different significance. For example, BOD measures only the short term impact through oxygen depletion while COD measures the addition of both biodegradable and non-biodegradable material thus reflecting short and long term impact.

This lack of prioritization of the data is significant since it is the total figures that are used as the results from which the conclusion for the study are drawn. Comparison of the impacts for the waste waster criteria are based on the totals of the parameters within the criteria and not on the subtotals. Within the waste water effluents criteria, ADL uses the the total figures of 0.117 pounds per week for reusable diapers and 0.012 pounds for disposable diapers to make the comparison in the results. It does not consider each parameter separately. The same situation occurs with the air emissions criteria.

Figure 9: Waste Water Effluent Criteria and Results from ADL Study

Pollutant	Reusable Diapers(1)			Disposable Diapers			
	Cloth	Laundry	Total	Pulp	PP & LDPE	AGM	Total
TSS	0.001	0.012	0.013	0.007	neg.		0.007
COD	0.001	0.003	0.004		neg.		neg.
BOD	0.0003	0.012	0.012	0.003	neg.		0.003
Hydrocarbons						0.002	0.002
Phosphorus		0.005	0.005				
Nitrogen		0.083	0.083				
Total	0.002	0.115	0.117	0.010	neg.	0.002	0.012

1. Assumes 90% of cloth diaper users home launder and 10% of cloth diaper users employ a commercial laundering service

The second type of weighting that can influence the conclusions in the life cycle analysis is between criteria. In the ADL study it is unclear how the individual criteria are combined to reach the conclusion that " advantages of disposable diapers would appear to outweigh the more limited advantages of the reusable diapering materials" It can only be assumed that in the ADL study the criteria are all considered equally. It is possible that some other system was used but not explicitly stated.

If all the criteria were considered equally then it would means that air emissions are considered the same as waste water and solid waste, etc. A different type of weighting system could take into account relative differences in the importance of different criteria. For example, solid waste may be considered to be twice as important as air emissions. Using the ADL data, this would make the disposable have a much larger environmental impact. Similarly, energy use might be considered to be five times more important and make cotton diapers have a larger impact.

E. Bias in Arthur D. Little Study

The success of an environmental labeling system depends on consumer confidence. Consumers must trust that those products which receive the label are truly environmentally preferable to other products within the product category. Additionally, unless the labeled products have a significant lower environmental impact, then the labeling program will only be a marketing scheme and not an environmental policy. Bias in the evaluation and comparison of product categories has the potential to adversely effect both the integrity and effectiveness of an environmental labeling program. Bias can occur both in selection of data and in the presentation of the analysis.

The ADL report has received considerable attention and generated controversy since it was released in March, 1990. Much of the controversy has focused on the selection of data for the analysis. The National Center for Policy Alternatives (NPCA),

who has been involved in policy options regarding diapers, prepared a response to the ADL study. The NPCA response states that:

> ADL often does not use independent data, but relies on information gathered by its client (Procter and Gamble) and others with financial or other interest in promoting disposables. In addition, the data is selected to reflect unfavorably on cloth and positively on disposables. Specifically, ADL overestimates the number of cotton diapers per change, the number of cotton diapers used per week and the percent of at-home vs. diaper service use. This leads to overestimations in energy costs, water usage, atmospheric emissions and water pollution from cotton diapers. In addition, ADL miscalculates the expenses of the laundering equipment in developing the life-cycle cost of cotton diapers, apparently ignoring the fact that the home equipment is mostly used for general laundry, not diaper cleaning(Tryens 1990b).

Specifically, the ADL study relies on a figure of 1.9 diapers per change, for reusable diapers compared to 1.0 for disposables. ADL bases the 1.9 figure on the practice of using two cloth diapers per change to prevent leakage for almost every diaper change. Tryens suggests that a figure of 1.4 is more accurate. In fact, Tryens cites a 1977 ADL study for the American Paper Institute that used the 1.4 figure. According to Ann Beaudry, consultant to the National Association of Diaper Services, "people don't routinely double-diaper." Beaudry added, "we have a lot of questions about the assumptions in the Little Study"(Holusha, 1990). Also critical of the 1.9 assumption, Jackie Prince of the Environmental Defense Fund, said "If that is the best that P & G can do, it will be difficult to use this kind of study to make public policy" (Holusha, 1990). If the study used the lower figure, the impact of reusable diapers would be decreased in all criteria. This is exemplified by a sensitivity analysis included

in the ADL study which determined that reducing the 1.9 figure to 1.8 diapers per change reduces weekly use by 5% and costs by 5% for users of diaper services. See figure 10.

Figure 10: Bias in Data Selection in ADL Diaper Study

Description of Data	ADL Figure	Revised Figure
Number of Diapers per Change	1.9	1.4
Number of Diapers per Week	85	70
Percent Employing Diaper Service	10%	25%
Number of Uses in Life Span	90	50-200
Gallons of Water in Pre-rinse	60	30

Above refers to cloth diapers.

The ADL study used an estimate of 85 diapers per week for the number of diapers used by clients of professional diaper services. Tryens cites a survey of the member of the National Association of Diaper Services reporting a weekly average of 70 diapers per week. If the figures suggested by Tryens were used, the results of the analysis for each criteria would also be changed.

One of the most significant bias issues raised by Tryens is the percentage of cotton diapers used at home and those washed by diaper services. The ADL study is based on 10% of cotton diapers being washed by diaper services and 90% being washed at home. Tryens cites a market research study by Dundee Mills, Inc., a U.S. diaper manufacturer, that approximately 25 % of cloth diaper changes were from a diaper service. In addition an article in Consumer Reports in August 1987, cites 25% of new

parents using a diaper service. This is significant since according to ADL the equipment used by diaper services as more efficient in water and energy use

The ADL report states, disposable diapers are generally less costly on a life cycle basis then their reusable counterparts". However, the NCPA response contains a recalculation of the life cycle costs by Carl Lehrburger and Economic Data Resources. See Figure 11. These results reflects several adjustments to the ADL data. First, the 1.9 diaper per change figure is replaced with 1.4. Secondly, the numbers are upgraded by a factor of 10.24% to account for annual escalation in waste collection and disposal costs. Finally, the price for purchase of disposables was changed from $9.45 to $10.30 to account for a misstatement in the report. Using these figures, all the reusable options, except when domestic labor is calculated at $6.00/hour, are less expensive then disposables.

Figure 11: Adjusted Life Cycle Cost Figures from Tryens(1990b)

	Type of Diaper			
	Disposable	Reusable	Reusable	Reusable
Labor Cost*	$0.00	$3.35	$6.00	$0.00
ADL Diapering Life Cycle Cost Analysis-Average Cost Per Child Per Week				
Life cycle cost	**$10.31**	**$12.75**	**$16.92**	**$7.47**
Reconstructed ADL Costs by Carl Lehrburger and Economic Data Resources, Boulder, CO				
Life cycle cost	**$11.25**	**$8.75**	**$11.82**	**$4.85**

*Value attributed to domestic labor

Another assumption used by the ADL study is a figure of 90 life cycles for cloth diapers before they can no longer be used as diapers. Lehrburger reports that a typical cloth diaper washed at home may be used 50 to 100 times and a diaper serve diaper used have 200 life cycles. In addition, Lehrburger notes that nearly 100% of diapers from diaper services are recycled into rags and that most home washed diapers are also usually used as rags. This figure is increasingly important if the percentage of diapers washed by professional diaper services is 25% rather then 10%.

The ADL study bases its estimates of water usage and waste water on a figure of 60 gallons used per week as a pre-rinse for reusable diapers. This figure is inflated for two reasons. First, many reusable diaper users do not use a pre-wash at all. When a pre-rinse is used, Tryens (1990b) suggests this figure should be 30 gallons. According to Tryens this is a highly sensitive figure, therefore changing it will significantly influence the analysis.

In evaluating the health impact of the diapering alternatives, the ADL report states that "disposable diapers that incorporate absorbent gelling materials offer better protection from dermatitis than do other brands of disposable diapers or home laundered reusable diapers. However, a study by Weiss and Associates Marketing Research report that "paper diaper users experience a higher occurrence of diaper rash then do those who use cloth diapers exclusively. These two statements do not directly contradict each other due to the slightly different user groups, it illustrates the potential for bias is in data selection.

The style and format of presentation of any report has the potential to influence how the reader interprets the results. In the context of an environmental labeling program it is very important that the information used to make the decisions about which products receive the label is straight forward and unbiased. The information should present the results in an uncluttered manner to let the data speak for itself.

The second form of bias evaluated in the ADL study is bias in presentation. Although the ADL report is intended to be an independent analysis, the Procter and Gamble sponsorship clearly influences the presentation. The report reads more like advertising propaganda for disposable diapers then a third-party analysis of the diaper product category.

The ADL study presents information in the report that is not directly relevant to any of the criteria considered in the life cycle analysis or to the impacts of the product. First, the report devotes several pages of text and figures to describing the increase of women in the work force. For example, one figure illustrates the percentage of wives in the labor force with one or more children under the age of three from 1975 to 1988. Another figure illustrates the female labor force as a percentage of female population age sixteen and over from 1960 to 1988. Yet another full page chart shows the percentage of women in the labor force that had a child within the last year form 1976 to 1987. These figures along with a discussion of decreasing discretionary time, the changing mobility of the child and the increase of single or divorced mothers are used to make a case for disposable diapers. The ADL sums up a section titled "societal forces" that the "so called 'disposable society' did not just happen, it was created in response to some significant needs". This is not relevant to the analysis.

A similar section on the changes in child care providers promotes the "convenience" of disposable diapers. Lehrburger and others describe this convenience as "perceived" since it may not be any easier to use disposable diapers then cloth diapers when using a diaper service. The report describes the "containment effectiveness of disposable diapers specifically reduces the demands of their (care givers) time". The ADL report continues that "cloth diapers are more difficult to handle, pins are dangerous, and children who are diapered in cloth more frequently require a complete change of bedding." Following this promotion of disposable diapers, the report states that more then 60% of diapering age children are cared for by people

who are not related and that is is difficult to find care givers who will provide the level attention to the task of changing soiled cloth diapers. Later in the report they describe the process of home laundering cloth diapers as an "unpleasant task". Finally the report conclude the care giver section with the following:

> Speaking generally, the implication of the changing status of women in the labor force is that they have less time to spend as care givers and feel stressed because of it. They have embraced the convenience offered by such technological advances as the microwave oven and the disposable diaper because those technologies shorten the time required to conduct the necessary tasks and simultaneously allow them to maintain an acceptable level of quality.

These value based statements do not belong in the analysis.

The ADL study discussed here as a sample of a life cycle analysis was subject to the problems of any life cycle analysis. The problems of omission, weighting, and bias are potential concerns in an analysis of another product category. The lessons learned for the ADL attempt at a life cycle analysis can be used to perform a less flawed analysis of another product category.

CHAPTER V

SUMMARY AND CONCLUSIONS

A. Summary

Environmental labeling of consumer products has emerged as a player in a new era of toxic substances management which puts emphasis on pollution prevention. The growing green consumer movement in the United States and abroad is seeking environmentally sound products and packaging. However, the unregulated environmental labeling campaigns being used by manufacturers and retailers in the United States are confusing to the consumer and are not likely to promote significant changes by industry. As discussed in chapter I, these marketing claims are not required to meet any standards or guidelines and may be misleading or even fraudulent. Proponents of an independent environmental labeling program however, claim it has the potential to guide consumers, influence corporate policy and decrease environmental pollution. Labeling, like other information provisions, is a widely accepted form of controlling risks in this country and may serve to supplement environmental regulations.

In response to interest in pollution prevention, green consumerism, green marketing and unregulated labeling, government run environmental labeling programs have been established in West Germany, Canada and Japan. Several other nations, the European Economic Community and the Unites States are studying and proposing programs as well. In general these voluntary programs discussed in chapter II, evaluate products for inclusion in the program. If the product meets the criteria, it is awarded a label signifying it has less environmental impact relative to competitive products. Two notable programs, the Swedish Environmental Product Declaration and

California's Proposition 65, use a different system. The EPD requires more comprehensive analysis by the manufacturer and provides more information to the consumer. Proposition 65 highlights the negative aspects of the product.

Chapter III describes the process of evaluating products which is used in may of the existing and proposed environmental labeling programs. The process of awarding a label to an environmentally preferred product is not simple and many issues remain unresolved. At present there is no formal methodology for evaluating and comparing products for inclusion in an environmental labeling program. The possible approaches range from a single criteria to a life cycle analysis. From this spectrum of approaches, the methodology considered to be the most appropriate by many in the field is life cycle analysis. Life cycle analysis however, is inherently difficult to perform and involves many subjective decisions. These decisions concern which criteria to include and how comprehensive each step of the analysis should be.

The Arthur D. Little Study of the diaper product category was evaluated using the analytic framework discussed in chapter IV. The categories: omission, weighting, and bias, illustrated the generic methodological problems in performing a life cycle analysis in the context of an environmental labeling program. The analysis revealed that several criteria and data were omitted from the ADL life cycle analysis. In fact, one of the principal authors of the ADL study, Anthony Montrone, said that the researchers decided to exclude issues like pesticide runoff and habitat destruction. "It was basically a decision of how many unknowns to include", he said (Holusha 1990). These subjective decisions concerning which criteria were included and omitted may have influenced the outcome of the study.

The analysis also revealed that the ADL study did not use any systematic weighting system. It was therefore assumed that all the criteria and data were weighted equally. This equal weighting is not appropriate since the criteria are not of equivalent importance. Similarly, the data considered within the criteria are not all

equally relevant. A system that considered these differences would have more effectively reflected the actual environmental impact of the individual criteria and data.

The analytic category, bias, revealed partiality in data selection and presentation. The data selected for the evaluation of reusable diapers was significantly biased to highlight the negative impacts of that diapering option. If the data were re-calculated using the data in figure 10, the results of this analysis would be significantly altered. It is likely that the conclusions of the study would be shifted to favor reusable diapers. While bias in presentation does not directly effect the numeric results of the analysis it does effect the readers perception of the conclusions. If this study was being used in an environmental labeling system, it might influence the decision of which diapering alternative should receive the label.

Which of the diapering alternatives is more environmentally sound? I will not attempt to make that decision. It is interesting to note that both the Canadian and Japanese programs have awarded their label to cloth diapers. It is not clear exactly what approach they used to choose within the diaper product category. Looking at the available United States data with its flaws it would be very difficult to choose which should be awarded the label using a life cycle analysis.

In general, the conclusions and policy recommendations that follow reflect the difficultly in using life cycle analysis in the context of an environmental labeling program.

B. Conclusions

The future of environmental labeling in the United States in unclear. It is most likely that an environmental labeling program similar to the Canadian Eco-logo or German Blue-Angel program will be established. At this time however, it is uncertain whether it will be one of the fledgling Green Seal or Green Cross programs or a governmental program run at the state or federal level. Additionally it is not certain

which approach to product evaluation and comparison will be adopted. Some form of life cycle analysis would be most appropriate.

Using the framework devised for the analysis of diaper products the following conclusions could be drawn. First there needs to be a set of guidelines or a formal methodology to guide decisions about which criteria to include in the analysis. Such a system would make the process more objective. This system would also have to include guidelines for what data should be considered within each criteria. This system could list the criteria that must be considered in any life cycle analysis and also list which parameters must be considered in those criteria. For example, the list might include waste water emissions as one of the criteria and it would then include a list of the parameters to be used to measure the impact of the waste water. This sort of systematic methodology would limit omission of criteria to only objective decisions. For example, recycled content may be excluded if it was not applicable to the product category.

Secondly, there needs to be an explicit weighting system. This must consider the relative impacts and importance of each criteria and apply a weight accordingly. This system must include those criteria that are based on several parameters such as air emissions or toxic substances use.

Finally, bias must be controlled to the fullest extent possible. This may require a full discussion of the sources of the data and possible a review of the data by a panel of experts. Bias may not be completely eliminated but it needs to be openly discussed. Bias in data presentation can be controlled by a requring model for the evaluation of the products.

From the analysis of the ADL study, I propose that a comprehensive life cycle analysis is not practical in the context of an environmental labeling program. A full life cycle analysis would include all aspects of every phase of the product life as well as energy use and raw material extraction. However, the large number of criteria would be diffuclut to use systematically. Furthermore, the completion of an adequate life