Engineering Guidelines

Environmental Packaging Design Guide

Preface

This book has been compiled by IBM's Competency Center for Packaging Engineering (CCPE). The information and recommendations contained in this manual have been compiled by IBM engineers, designers and IBM suppliers and represent their best judgment about the materials mentioned herein based upon their experience and knowledge. While we believe the information is accurate as used and applied at IBM locations involved and under the conditions described herein, IBM makes no representation or guarantee that the information or recommendations contained herein are accurate as they may be applied by others in their operations or that similar results will be obtained by others when the information or recommendations are used in their business operations.

Materials in this guidebook were originally presented at the 1990 CCPE Technical Exchange, a forum designed to promote the exchange of information and ideas amongst the Corporation's packaging engineers. The May 15th exchange was hosted by the CCPE in Mechanicsburg, Pennsylvania. The three-day session focused exclusively upon the environment and was attended by IBM representatives worldwide.

The creators of this guidebook gratefully acknowledge the following groups and organizations for providing information and materials used either directly or indirectly in the compilation of this book. In no way does the inclusion of a group or company in the following listing signify that the provider supports or condones the information as presented.

- American Paper Institute (API)
  New York, New York
- BASF Corporation
  Parsippany, New Jersey
- Connelly Containers, Incorporated
  Bala Cynwyd, Pennsylvania
- The Coalition of Northeastern Governors (CONEG)
  Source Reduction Taskforce
- The Department of Environmental Resources
  Harrisburg, Pennsylvania
- The Environmental Action Foundation
  Washington D. C.
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  Harrison, New York
- The National Polystyrene Recycling Company
  Washington D. C.
- The National Wooden Pallet and Container Association (NWPCA)
  Washington D. C.
- Official Board Markets "Yellow Sheet"
  Chicago, Illinois
- The Pollution Probe Foundation
  Toronto, Ontario
- Resource Recycling Update
  Portland, Oregon
- The Society of Plastics Industry (SPI)
  Washington D. C.
- Tuscarora Plastics
  Ncw Brighton, Pennsylvania
- The United States Environmental Protection Agency
  Washington D. C.
- Virginia Polytechnic Institute and State University
  Blacksburg, Virginia
- The Waste Recycling Council
  Washington D. C.

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1.0 Environmental Packaging Design Guide - Introduction

1.1 Document Control

This document was originated and is controlled by the IBM Competency Center for Packaging Engineering (CCPE) and is intended for the use of IBM Packaging Engineers, designers and our suppliers. Materials presented in this guidebook are based upon IBM business applications and may not be appropriate for all industries, groups and/or businesses.

This Guidebook is intended to be a dynamic and changing document and will be updated periodically. This documentation section will provide a history of all update activities by section and dates.

DATE:	SECTIONS AFFECTED:
05/15/90	Initial Release of IBM Environmental Packaging Design Guide
09/28/90	Revise for External Publication

1.2 Guidebook Abstract

The Guidebook is a working tool to assist Packaging Engineers in their development of packaging and distribution alternatives to ensure that environmental factors are considered for the entire life cycle of their package designs and processes.

The Guidebook outlines the recommendations of the CCPE and others on how best to make improvements in IBM's packaging and distribution processes, to address and minimize our impacts on the environment and to improve our systems controls.

1.3 Guidebook Purpose

The purpose of this Design Guide is to serve as a reference and working tool for IBM Packaging and Distribution Engineers, in their evaluations of packaging material & distribution process alternatives. This guidebook should help IBM improve its impacts on the environment by:

1. Eliminating prohibited expansion agents in packaging materials,
2. Eliminating heavy metals from all IBM packaging materials,
3. Minimizing toxic elements in packaging materials and in the byproducts of their manufacture,
4. Identifying and promoting the use of packages manufactured with recycled material content,
5. Promoting the use of packaging materials which are recyclable,
6. Identifying methods, processes and product & package designs to reduce the solid waste stream volume,
7. Demonstrating that IBM is an environmentally responsible company, and
8. Providing industry leadership in these environmental issues.

1.4 Guidebook Scope

IBM intends to address packaging-related environmental issues from a "cradle to grave" standpoint. This means that IBM will attempt to control and improve the packaging and distribution processes in all packaging related activities from purchasing of raw materials and components to the handling of the finished product and parts packaging by our customers.

1.5 Guidebook Introduction

This Guidebook is a working tool to assist IBM Packaging & Distribution Engineers in the identification & evaluation of different packaging and distribution alternatives to minimize negative effects on the environment from IBM's packaging materials or distribution processes.

The controls recommended for all IBM packaging designs to accomplish this are outlined with guidelines and specifications for their implementation. These recommendations pertain to all facets of the IBM's Packaging and Distribution activities including:

- Incoming parts and materials,
- Internal containers and material handling processes,
- Intraplant and interplant shipments,
- Products, supplies and replacement parts packages to customers.

Each section of this guide discusses a specific issue or concern and how it might best be addressed. (Example: Toxic Materials section identifies in what packaging materials and processes such items can exist and how to best eliminate or minimize them.)

To provide clear and uniform controls, IBM Engineering Specifications are supplied where possible. In other cases, checklists or guidelines are supplied. There are also some special sections in the Appendixes to aid in understanding the importance of these issues:

- Legislation Summaries.
- Definitions.
- Technical References and Literature.
  - CONEG Model Toxics Legislation
  - IoPP Packaging Reduction, Recycling & Disposal Guidelines
- Appropriate Internal and External Contacts.

1.6 IBM Corporate Environmental Policy

IBM Corporate Policy

Number 131 A
September 28, 1989

SUBJECT: Conservation and Recycling

It is IBM's policy to conserve energy and raw materials, to recycle commodities and to help protect the environment.

The oil crisis of the early 1970s forcefully demonstrated that with planning and imagination we were able to reduce our fuel and power consumption significantly. The solid waste disposal crisis now confronting the United States and other countries gives us additional challenge to reduce waste by making more efficient use of raw materials and recycled commodities. Recognizing the need for prudent energy use and global environmental protection, while maintaining safe and healthful workplaces, management must strive to keep its focus on both energy conservation and material recycling.

Therefore, I expect each operating unit to cooperate fully in conservation programs, giving high priority to energy efficient operation of our facilities and processes and to conservation of energy and raw materials in the design and manufacture of our products. You should also emphasize the use of recyclable packaging and components, the recycling of used commodities, and the purchase of recycled materials. Similarly, I expect managers at all levels to implement these policies by personal example--whether it be in simply turning off equipment or lights or in the prudent purchase, consumption, and recycling of supplies and materials.

This approach is good business practice and serves the broader purpose of helping to conserve the world's limited resources.

John F. Akers

Replaces Corporation Policy No. 131, dated September 9, 1974

1.7 IBM Corporate Environmental Position

1.7.1 IBM Goals

The following are the Recycling goals established by the EPA as well as IBM's internal goals for solid waste reduction:

1.	EPA - Recycling Proposed Targets	25%	1992
2.	IBM - USA Recycling Targeted Amount	50%	1992
	• Current Recycled Content	35%	1Q1990
	• Year End Expectation 6 Sites	50%	1990
	• All US Sites Committed	50%	1992
3.	IBM - CFC Elimination in Packaging	100%	YE1990
4.	IBM - Expand Recycling Targets to Field	50%	1992
5.	IBM - Expand Recycling Targets Worldwide	50%	1992

1.7.2 IBM Actions

In support of the aforementioned goals, IBM has implemented the following:

- Appointed Environmental Coordinators at each location.
- Developed close working relationships between CCPE, Corporate Environmental and Corporate Governmental Groups.
- Established plastic recycling sub-committee.
- Environmental section added to Specification for Supplier Packaging and Material Handling (GA21-9261-07).
- Implemented environmental packaging competition programs.
- Expanded IBM recycling goals to branch offices and field operations in USA.
- Expanded IBM environmental goals worldwide.
- Established Corporate Task Force to study reclamation of IBM packaging materials from our customers.
- Developed Environmental Engineering Specifications including:
  - Expanded Packaging Materials: Prohibited Expansion Agents. Specification 1041126 released on 01/16/90 in EC 537767 (Lexington).
  - Packaging Materials: Restricted Heavy Metals. Specification 589760 dated 06/18/90 in E/C 844576 (Rochester).
  - Recyclable Packaging Materials: Selection and Modification. Specification 589761 dated 09/06/90 in E/C 844576 (Rochester).

2.0 CFC Elimination

2.1 Introduction

2.1.1 Abstract

Fully halogenated chlorofluorocarbons (CFCs) are suspected of destroying the earth's protective stratospheric ozone layer. CFCs are sometimes used to manufacture foam cushioning materials. The use of packaging materials made with CFCs is also prohibited by law, in some areas (e.g., Ontario and Minnesota). IBM packages should not use foam cushions manufactured with CFCs.

2.1.2 Purpose

This guide discusses CFC problems and recommends procedures that will help to ensure IBM complies with existing, regional laws and totally eliminates the use of packaging material made with CFCs. In addition to meeting current, regional laws, IBM's objective is to totally eliminate CFC-made packaging materials used in all other countries, states, and provinces, by the end of 1990.

2.2 Ozone Depletion

Chlorofluorocarbons, or CFCs, are synthetic or man-made chemical compounds that contain chlorine, fluorine, and carbon atoms. Some of the more common forms of CFC include;

- $CC1_3F$ (often called CFC-11),
- $CC1_2F$ (CFC-12),
- $C_2Cl_3F_3$ (CFC-113),
- $C_2Cl_2F_4$ (CFC-114), and
- C_2CIF_5 (CFC-115).

These materials are used as plastic foam expansion agents, refrigerants, solvents, and sterilants. When these materials are used in open-air environments, they will slowly migrate into the earth's upper atmosphere. Once in the upper atmosphere, they can be

widely disbursed around the world. This means CFCs used in one region will have a global or world-wide distribution, in just a few years. Once in the upper atmosphere, the CFC molecules are exposed to intense ultra-violet solar radiation. This energy from the sun is strong enough to break-down the CFC molecules. When CFC break-down occurs, chlorine is released and is able to chemically break-down ozone or 0_3 molecules that are naturally present in the upper atmosphere.

Ozone in the upper atmosphere acts as a protective shield and prevents too much harmful ultra-violet solar radiation from penetrating thru to lower atmospheric levels. Too much ultra-violet radiation can cause problems to people and plants. Potential harmful effects include higher risks of skin cancer, eye cataracts, and agricultural crop damage.

2.3 CFC Use in Packaging

CFCs are sometimes used as expansion or blowing agents for manufacturing foam cushioning materials. In addition, CFCs may be used elsewhere in the foam manufacturing process as mold releases and as cleaning solvents. All CFC uses should be eliminated from the foam cushions purchased or made by IBM.

2.3.1 Elimination Specification

IBM Engineering Specification 1041126 (E/C 537767) should be used to help prevent CFC-made foam from being purchased or used by IBM. The specification is included in “Appendix G. IBM Engineering Specification - Prohibited Expansion Agents” on page 99. It should be used when specifying or purchasing foam cushioning materials. The document can be referenced on engineering drawings and on IBM purchase orders for packaging materials. The specification also can be used as an additional technical reference for information about CFC problems and uses in packaging.

3.0 Toxic Material Reduction

3.1 Introduction

It is difficult for us in the packaging community to view packaging materials as being life threatening. It is not too difficult to see packaging as being a problem in landfills . . . it fills them up. But that fact certainly doesn't present a hazard. Besides, there is a lot of effort going on today to source reduce, reuse and recycle. And in addition, there is incineration which can turn a lot of solid waste into a little ash.

Packaging is very functional. It protects products. You can label it and print information on it. Professional looking colors and graphics can convey a message to the customer concerning the quality of the product inside. Packaging during its useful life doesn't present much of an environmental hazard. In fact, some packaging is designed to protect the environment from the contents of the package.

The concern, which is being focused on packaging, is that it does represent a toxic threat to the environment at the "front-end" and "back-end." At the front-end, many of the chemicals used in the production and processing of packaging materials are highly toxic. resulting in hazardous wastes, toxic air emissions, and discharge of toxic effluents into waterways. At the back-end, once the lifetimes of packages are over, toxic elements can again be introduced into the environment, even through "proper" disposal of the materials in landfills or incinerators.

Much attention is centered today on environmental contamination by dioxins and heavy metals. Dioxins do not occur naturally, they are created, and once created, do not biodegrade readily. Heavy metals do exist naturally, they are elements. Industrial processes convert them into particles which arc much more environmentally mobile than the natural form. Although packaging is not the major contributor of these toxic agents to the solid waste stream, their removal from packaging could make solid waste management safer and serve to alleviate public concerns about solid waste management treatment facilities.

Packaging materials used by IBM do not represent any more or less of an environmental hazard than do those of any other industry. However, IBM has in place a policy statement addressing the current solid waste crisis. It is in support of that policy that this information on packaging related toxic wastes is presented.

3.2 Dioxins

3.2.1 Introduction

Since the early 1980's environmental dioxin has become an issue of increasing concern to environmentalists, government agencies, and to various industries within the United States. Dioxin, which is a carcinogen, a teratogen, and a mutagen, is present in the environment at very low levels as a by-product of combustion in municipal incinerators, forest fires, automobile exhausts, and certain industrial processes. Kraft pulping mills produce two percent of the yearly estimated production of dioxins from all sources.

Recent studies by the EPA, API, and NCASI indicate that about 300 different chlorinated compounds called organochlorines, which include dioxins and furans, occur in pulp mill bleachery eflluent. These studies further concluded that the source of these toxic discharges is the bleaching plant, that portion of the mill that converts brown pulp to white (Figure 1). Chlorine gas used in the first stage of the bleaching process forms the organochlorines.

Once formed, the organochlorines are introduced into the ecosystem through various channels which include:

- Pulp mill effluent discharges into streams
- Incineration of pulp mill sludge
- Landfill of pulp mill sludge
- Use of pulp mill sludge to improve crop soils (sludge farming)
- Disposal (incineration and/or landfill) of the bleached paper product

3.2.2 Industry Activities

As a result of increasing concern over the ecological effects of organochlorines, many paper companies are implementing site specific process modifications at their mills which have demonstrated significant reductions in the generation of these compounds. These process alterations include:

- Reduction of pulp lignin prior to bleaching through extended delignification (cooking)
- Elimination of non-chlorinated dioxin in pulp washing defoamers
- Reduced use of chlorine gas in the bleaching process by:
    a. The use of peroxide in early stages of multi-stage bleaching processes
    b. The use of less chlorine gas through substitution of chlorine dioxide

Additionally, NCASI is undertaking studies to identify elements of the production process which appear to be involved in the formation of dioxin.

3.2.3 Legislation/ Regulation

Water discharges permits for pulp mills typically only place limitation on three properties of the effluent: biological oxygen demand (BOD) which measures organic and easily degradable compounds, total suspended solids (TSS) which measures the amount of fibers and other wood particles discharged, and pH which measures acidity. None of these measures chemicals that are present in the effluent, and they ignore the persistent organochlorines that are a by-product of bleaching.

Though most U.S. mills employ biological treatment ponds or aerated lagoons to treat effluent before discharge, these facilities are generally ineffective against organochlorines because they resist biological breakdown. Dioxin-containing sludge from the settling ponds is not regulated as a hazardous waste.

The EPA has agreed to coordinate an interagency federal effort to assess the human-health risks of dioxin in paper. Unless EPA finds that paper's dioxin contamination "presents no unreasonable risks to the public," the agency must announce by April 1990 that it intends to propose regulations limiting dioxin in paper, or that it plans to refer the problem to a more appropriate regulatory agency, such as FDA.

The EPA will also investigate technologies that could reduce dioxin in pulp bleaching.

3.2.4 Recommendations

The linkage between the manufacture, use, and disposal of bleached paper products and the presence of some portion of the toxic organochlorines found in the environment has been established by authoritative investigation. It follows that a reduced demand for bleached paper products will correspondingly reduce the potential for ecological contamination by these compounds.

In addition to the concerns associated with organochlorine generation, it must also be understood that bleached paper is manufactured from virgin fibre. This circumstance creates further demand on our forest resources and reduces opportunity for the use of recycled fibre.

In packaging design development, consideration should be given to eliminating or reducing the requirement for bleached corrugated liner and paperboard, in the following order:

- Specify unbleached "natural" material, or
- Specify white coated unbleached material (Figure 2), or
- Specify mottled white liner (which achieves an 80% reduction in bleached fiber), or
- Specify bleached materials having a reduced "whiteness" requirement, or
- Specify white coated mottled white or semi-bleached material

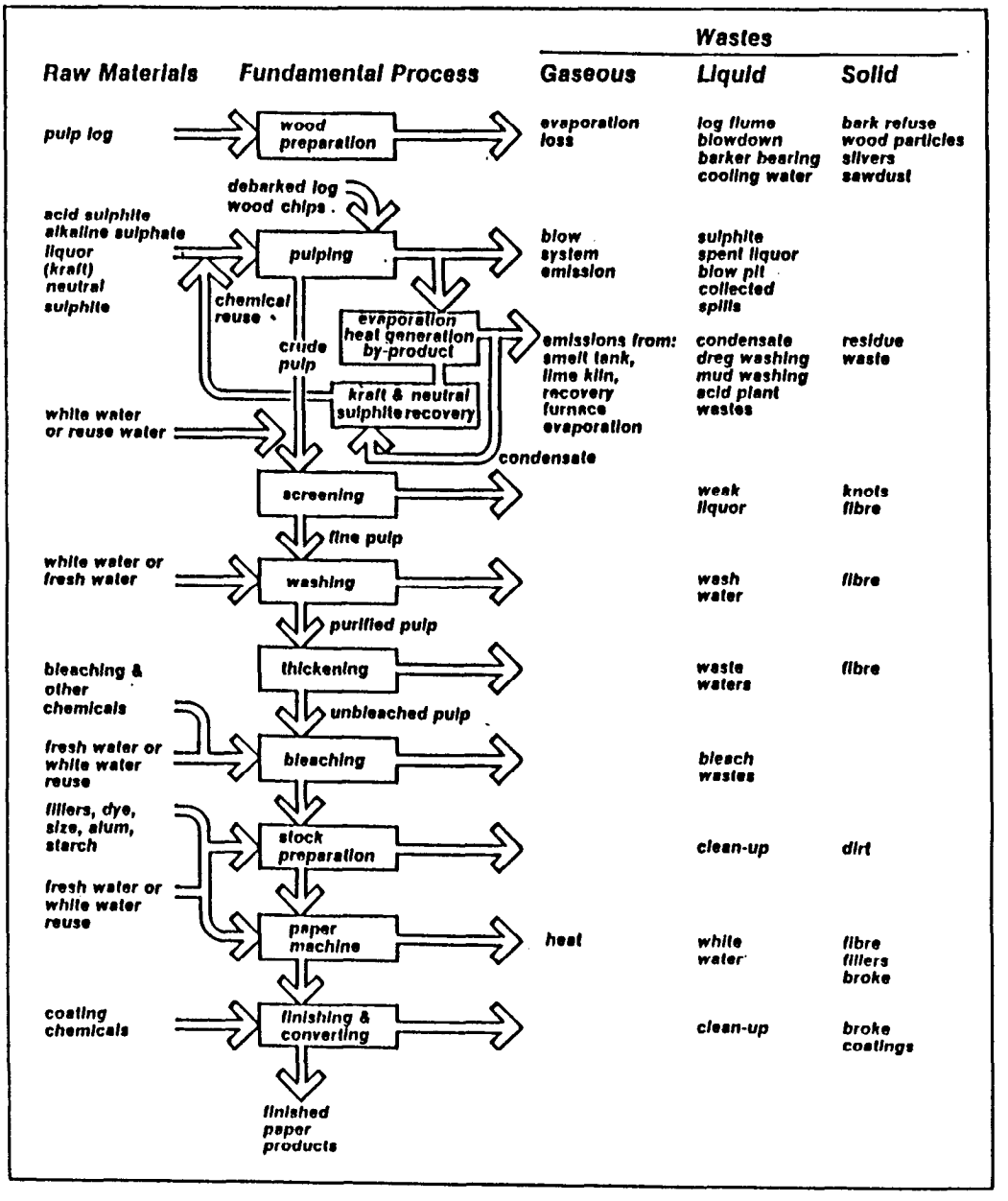
The specification for the use of coated packaging should stipulate that the coating material meet the requirements of 21 CFR, 176.170. This is the Food and Drug Administration section of the Code of Federal Regulations.

3.2.5 Figures

3.2.5.1 Dioxins - Figure 1

The Pulp and Paper Process

Source: Environment Canada (Water Pollution Control Directorate), *The Basic Technology of the Pulp and Paper Industry and its Waste Reduction Activities*, May 1973.



3.2.5.2 Dioxins - Figure 2

Corrugated Coatings Manufacturers

(Partial Listing)

- Michelman Inc.
  Cincinnatti, OH (5 13) 793-7766

- International Coatings Co.
  Cerritos, CA (213) 926-0747

- Eastman Chemical Products
  Kingsport, TN (615) 229-2000

3.3 Toxins in Corrugated

3.3.1 Introduction

The regulatory structure resulting from California's Proposition 65 requires manufacturers of corrugated boxes to provide warnings if any of their products contain chemicals that have been listed by the State as causing cancer or reproductive hazards. Manufacturers are exempt from the warning requirement if the risks posed to the users of the products are not "significant." California has released no-significant-risk levels, or insignificant risk doses, for several chemicals that could appear in containerboard or other materials used to make corrugated boxes.

This information is presented here for awareness purposes only. At this juncture there are no specific considerations or recommendations which relate to IBM's use of corrugated packaging.

3.3.2 Industry Activities

Recently, the Fibre Box Association conducted a risk assessment study relative to California's Proposition 65. The following discussion, as well as the Figure 1 tables are excerpted from the Executive Summary of their report.

> "Potentially, people using the corrugated boxes could be exposed by any of the major routes of exposure: inhalation (of chemicals vaporizing from the box materials), ingestion (of chemicals migrating into food from corrugated containers in which the food is packed directly), and dermal absorption (of chemicals migrating from linerboard in contact with skin). This report addresses inhalation exposures to formaldehyde gas and 1,4-dioxane that might vaporize from corrugated boxes, ingestion exposures to lead, arsenic, and epichlorohydrin that might migrate from boxes into food, and dermal exposures to arsenic, cadmium, chromium, epichlorohydrin, and lead from handling corrugated boxes in a warehousing setting. These substances were selected systematically from a longer list of listed substances potentially appearing in corrugated boxes.
>
> One substance listed by California, formaldehyde, occurs as an unavoidable residue in some resins used to make water-proof (WP) and water-resistant (WR) corrugation glues and another, 1,4-dioxane, occurs in some box joint glues that contain 1,1,1 -trichloroethane as a solvent. Both substances may evaporate from corrugated stock in a user's facility and be inhaled. A warehouse environment provides a reasonable worst case for user exposure. Measurements of its evaporation rate from corrugated board along with reasonable assumptions about ventilation rates, duration of exposure, and use of WP/WR resins have been used to estimate exposure to formaldehyde. Exposures to 1,4-dioxane have been generated by analogy, using the physical properties of formaldehyde and 1,4-dioxane.
>
> The model that estimates the migration of chemicals from corrugated boxes into food products takes into account the amount of corrugated material used in various sectors of the food industry, the proportion of that used for direct packaging of food, the amount of food so packaged, and the amounts of various food groups eaten by average people in the United States. The migration rate from box to food is estimated from equilibrium migration relationships measured by the National Council of the Paper Industry for Air and Stream Improvement (NCASI). According to the California Health and Welfare Agency, cadmium and hexavalent

chromium are not considered to be carcinogens by the oral (ingestion) route of exposure, and exposures need not be estimated for them by these methods.

For dermal contacts, the report uses a two-step model of migration from paper and absorption through skin to relate critical concentrations to the insignificant risk doses. In the first step of the dermal exposure model, a chemical migrates out of the paper into a layer of sweat and skin oils the surface of the skin, under the influence of the concentration gradient relative to chemical equilibrium. In the second step, the chemical migrates through the skin, again under the influence of the concentration gradient between the sweat layer and the interior of the body, assumed to remain at near-zero concentration. The rate-limiting barrier for this step is the stratum corneum, the non-living and passive outermost layer of skin.

Bleached or mottled white outside linerboard may contain TCDD in the tens of parts per trillion. Risk assessments by NCASI concluded that such levels do not pose a significant risk to humans. Thus, this report does not address TCDD in detail.

The chemical and physical properties of interest have been measured by NCASI and by other investigators. The parameters of the exposure scenarios have been developed by NCASI or by ENVIRON specifically for use here.

The results of the application of the models with the available data show that critical concentrations can vary greatly, principally because of the variation in the insignificant risk doses among the chemicals or the differences in the exposure scenarios. The tables (Figure 1) summarize the critical concentrations for the chemicals and exposure routes considered in this report and, for comparison, the concentrations typically found in boxes. The critical concentrations are criteria for determining the need to warn, not the predicted concentrations in actual products. They were estimated for a “typical” manufacturing, distribution, and use pattern for corrugated boxes. To determine the need to warn, a manufacturer needs to consider the concentrations of these chemicals that actually appear in its products and compare them with these criteria.”

3.3.3 Legislation/Regulation

The Safe Drinking Water and Toxic Enforcement Act (Proposition 65) of the state of California is undergoing continued development, alteration, and review. There appears to be little possibility of enactment in the near future.

3.3.4 Recommendations

Relative to this subject, there are no specific recommendations or limitations to IBM’s use of corrugated packaging materials. Current studies indicate that corrugated packaging materials already conform to existing or proposed limitations.

3.3.4.1 Figure 1 - Toxins in Corrugated

Critical Concentrations for Exposure to Selected Substances in Corrugated Boxes

The following table lists critical concentrations of chemicals in corrugated boxes that could limit human exposure to the no-significant-risk levels specified by the state of California under its Safe Drinking Water and Toxic Enforcement Act ("Proposition 65"). If a corrugated products company can maintain the concentrations of the chemicals in its products below these critical concentrations, no warning should be required under California Proposition 65.

Substance	Critical Concentration (ppm): Dermal	Ingestion	Inhalation	Limiting
Arsenic	64,000	280	--	280
Cadmium	6,400	--	--	6,400
Chromium (a)	6	--	--	6
1,4-Dioxane		10.0% (b)	10.0% (b)	
Epichlorohydrin	40	13	--	13
Formaldehyde	--	--	0.5% (c)	0.5% (c)
Lead	1,700	20	--	20

Where:
a = Hexavalent
b = In box joint glues
c = As free formaldehyde in WP/WR glue resins

Typical Concentrations in Corrugated Box Materials

Substance	Concentration in Corrugated Board (ppm)	Concentration in Corrugator Glue Resins	Concentration in Box Joint Glue
Arsenic	0.1		
Cadmium	0.03-0.12		
Chromium (hexavalent)	0.025		
1,4-Dioxane			0.4%
Epichlorohydrin	0.56		
Formaldehyde		0.1-1.0%	
Lead	0.05 - 0.15		

3.4 Heavy Metals in Inks

3.4.1 Introduction

Inks have three component parts: pigments, which yield color, resins, which act as carriers of the pigment and permit it to attach to an object; and solvents, which dissolve resins and make the ink workable.

Carbon black, the work-horse of the pigment series, is produced exclusively from petrochemicals, as are the solvents and other organic pigments.

Non-organic based components include (heavy metal) pigments such as lead, mercury, cadmium, cobalt, chromium and nickel (Figure 1).

Toxicologists are finding growing evidence to substantiate their long-felt malaise regarding the health effects of exposure to many of the pigments currently in use. Some of the pigments identified to date that pose potential hazards include carbon black, lead chromate, molybdate, cadmium, benzidenes, mercury sulfide, phthalocyanide and toluidines. The task of systematically identifying potentially hazardous pigments is enormous and still in its incipient stages.

The problem being faced is in the generation and disposal of wastes associated with ink borne heavy metals. These materials are often used in packaging; once the packaging is incinerated, the resulting inorganic ash contains heavy-metal oxides or sulfates. Such incinerator ash requires special and costly disposal.

3.4.2 Industry Activities

As scientific research verifies serious health problems with select ink components, ink formulators tend to substitute constituents that are believed to be less hazardous. In the absence of a comprehensive screening process to establish which chemicals currently available on the chemical market are safe, it is probable that ink makers will have to accommodate continual substitution of certain ink components as advances in toxicological testing document new health problems.

In September 1989, the Coalition of Northeastern Governors (CONEG) Source Reduction Task Force issued their final report containing recommendations related to the issue of source reduction of packaging. The following is an excerpt from their Preferred Packaging Guidelines.

> “The guidelines are also based on the overriding tenet that materials used in packaging are not to include toxic agents, such as lead, cadmium and mercury, that can create problems in disposal (land or incineration) or recycling systems; and furthermore, that industry will strive to reduce any remaining, incidental amounts of heavy metals from packaging by a date certain to be recommended by the Northeast Source Reduction Council. Although packaging is not the major contributor of these toxic agents in the solid waste stream, removal of these toxic substances from packaging could make solid waste management safer and serve to allay some of the public’s more significant concerns about solid waste treatment facilities.
>
> While toxic materials in packaging (e.g., heavy metals such as cadmium and lead) pose no inherent danger to the consumer when the package is purchased or used, it does present a concern in the solid waste management system. These materials frequently are used as plastics additives and coloring agents. Packaging materials

that come into contact with food, for example, must be shown to be safe prior to their use and are strictly regulated by the U.S. Food and Drug Administration and the U.S. Department of Agriculture. However, sometimes toxic constituents may be formed or released by reactions of packaging materials when exposed to certain conditions. As the discarded package is subjected to treatment in the disposal system -- incinerated in resource recovery facilities or buried in landfills, for example -- toxic components may be released into the air (stack emissions) or onto the land and potentially into groundwater (leachate from land disposal of package or incinerator ash, etc.)."

In December 1989, the CONEG Source Reduction Council drafted model state legislation, for introduction by the Northeast states in the 1990 legislative session, that will result in the sale and/or use in the Northeast of packaging from which toxic agents such as lead, cadmium and mercury have been reduced to the maximum extent feasible. The thrust of this proposed legislation is that the sum of the concentration levels of lead, cadmium, mercury or hexavalent chromium present in any package or packaging component shall not exceed the following:

- 600 parts per million by weight (0.06%) effective two (2) years after enactment of the statute;
- 250 parts per million by weight (0.025%) effective three (3) years after enactment of the statute; and .
- 100 parts per million by weight (0.01%) effective four (4) years after enactment of the statute.

The proposal is currently being reviewed by appropriate industry and regulatory agencies for comment.

3.4.3 Legislation/Regulation

On June 1, 1989, in response to the current concern over waste generation and disposal, Senate Bill S. 1112 was introduced as an amendment to the Solid Waste Disposal Act. The bill, entitled the "Municipal Solid Waste Source Reduction and Recycling Act of 1989," establishes a national policy for dealing with municipal solid waste.

Embodied in the bill is significant language for pigment, ink, and packaging manufacturers and users. The bill is concerned with"... the constituents of any product or article, the disposal or incineration of such product or article, including the management of ash from incineration of such product or article (that) may present a threat to human health or the environment ...". Additionally, the bill specifically addresses lead, mercury, cadmium, and other heavy metals in pigments and inks, with respect to establishing regulations on their use in products. One part of the bill contains an outright ban on cadmium based pigments for packaging purposes.

In addition, several states are developing legislative proposals containing the heavy metal limitations in packaging as recommended by CONEG.

It is apparent that the continued use of metal-containing pigments for packaging printing ink and other applications will come under close regulatory scrutiny in the 1990's.

3.4.4 Recommendations

In view of expected federal and state regulation of heavy metals content in packaging materials, there is some impetus for IBM to take steps in anticipation of these restrictions. Additionally, IBM's corporate policy in regard to making positive contributions to the abatement of our solid waste crisis necessitates that opportunities to do that be acted upon.

IBM has established an IBM Engineering Specification which requires that all packaging materials and packaging components used in IBM product and supplies packaging contain no more than 100 parts per million by weight (0.01%) as the sum of concentration of incidental levels of lead, cadmium, mercury, and hexavalent chromium. This document, assigned part number 5897660, has been included in "Appendix F. IBM Engineering Specification - Restricted Heavy Metals" on page 91.

3.4.5 Figures

Figure 1: (Partial List)
Heavy Metals in Pigments

Name:	Uses:
Aluminum	Metallics
Antimony	
(1) (2) Arsenic	
Barium	Red
(1) (2) Cadmium	
Chromium	Yellow
Cobalt	Blue
(3) Copper	Blue, Green, Metallics
(1) (2) Lead	Opaque
Lithium	
Manganese	
(2) (3) Mercury	
Molybdenum	Orange
Nickel	
Selenium	
Silver	
Titanium	Whites, Opaque
(3) Zinc	Metallics, Blue

Where: (1) = Carcinogen
(2) = Neurotoxin
(3) = Toxic to Aquatic Life

3.5 Toxins in Plastics

3.5.1 Introduction

The single largest use of plastics today, taking up a fourth of all plastics produced or 12 billion pounds of plastics a year, is packaging. Packaging is a huge industry. The $55.8 billion of packaging in 1985 amounted to 4 percent of the value of all finished goods sold in the United States. Plastics (Figure 1) are the third largest segment of that industry, exceeded only by paperboard and metals.

Two potential areas of pollution in the plastics processing industry are air pollution during processing, and solid plastic waste generated on-site. In general, the plastics processing industry does not use large amounts of water, nor does it generate large amounts of wastewater. Hence, water pollution problems are relatively small.

Air pollution problems presented by the plastics processing industry consist primarily of removing processing chemicals such as solvents, softeners and plasticizers from plant exhaust air streams. During molding and forming, most plastics are relatively inert. But there are threats at this stage as well; from toxic additives, from hazardous chemicals used in processing, and from heating up the polymer (which may allow toxic elements to volatilize). .

Ingredients in plastic production have dangerous properties for those who work with them or live near plastic factories. In 1986, EPA ranked the 20 chemicals whose production generates the most hazardous waste. Five of the top six were chemicals commonly used by the plastics industry: Propylene (#l), phenol (#3), ethylene (#4), polystyrene (#5) and benzene (#6). In 1980, 44 percent of propylene, 73 percent of phenol, 61 percent of ethylene and 72 percent of styrene produced were consumed by the plastics industry.

The plastics industry is a strong supporter of incineration, arguing that because plastics are made from petrochemicals, they release much more energy than other municipal wastes, thereby helping the entire waste stream to burn more efficiently. Plastic wastes become a potential disposal problem when certain plastics are incinerated. Once the plastic product has completed its useful life, it is referred to as post-consumer waste.

Controversy exists regarding the effect of incineration of plastics on the environment. Although a significant portion of domestic waste contains relatively harmless plastics such as polyethylene, the incineration of other components of garbage may contribute to air pollution and ash disposal problems.

When a high percentage of certain plastics is incinerated, the burning process may yield potentially toxic gases. For example, the burning of PVC generates hydrogen chloride gas. The incineration of urethanes produces hydrogen cyanide. Imperfect burning of plastics produces soot. Specially designed incinerators have to be used when the plastic content is high to protect the equipment against corrosive damage from combustion products, such as hydrogen chloride, ammonia, sulphur oxides and nitrogen oxides.

Of particular concern is the fact that many additives used to process and color plastics products contain toxic heavy metals such as lead, cadmium and nickel (Figure 2). Because these heavy metals do not combust, they have been found in both air emissions and ash from municipal solid waste incinerators.

3.5.2 Industry Activities

In anticipation of proposed or impending legislation designed to regulate heavy metal content in packaging, several major plastics manufacturers as well as certain of their prominent customers have already placed limitations on these elements. These limitations primarily affect the pigments used in coloring plastics, and go beyond the current limitation levels established by the Food and Drug Administration for food packaging.

Inorganic pigments containing heavy metals are being replaced by organic pigments. To achieve certain color and finish standards it is sometimes necessary to use additional organic material, which can result in an increased cost. However, the value of this step in reducing the heavy metal constituents of the solid waste stream is significant and warranted.

3.5.3 Legislation/Regulation

For many years, FDA regulations have limited the content of certain heavy metals in food packaging to about six hundred parts per million (0.06%). This regulation was concerned primarily with the danger of these elements being absorbed by the food prior to consumption, and not with the present issues found in solid waste management.

Model legislation, developed by the Coalition of Northeastern Governors (CONEG) proposes strict limitation on certain heavy metals content in all packaging and is directed at minimizing these toxic elements introduced into the waste stream by packaging disposal. These recommendations in the form of proposed legislative bills are presently being introduced in several states, and are receiving support from both business groups and environmentalists. (See “Appendix E. Source Reduction Council of CONEG” on page 88.)

The CONEG recommendations are outlined in detail in the section of this guidebook discussing heavy metals in Inks.

3.5.4 Recommendations

It is recommended that all IBM locations utilize Engineering Specification 5897661 which defines acceptable limits for heavy metals content in IBM packaging materials. This recommendation is discussed further in the section of this guidebook dealing with Heavy Metals in Inks.

3.5.5 Figures

3.5.5.1 Toxins in Plastics - Figure 1

Plastics in Packaging

Type	Major Uses	%
LDPE	Film, Bags, Bottles	33
HDPE	Film, Bags, Bottles	31
PS	Foam, Lids	11
PP	Lids	9
PET	Bottles	7
PVC	Film	5
Other	Coatings	4

3.5.5.2 Toxins in Plastics - Figure 2

Chemicals and Additives in Plastics

Flame Retardants

Purpose

Flame retardants are added to plastics to yield products that will ignite and burn with greater difficulty than untreated plastics. Current research efforts include minimizing the toxic smoke and gas associated with the burning of plastics, particularly as it relates to unexpected fires in buildings.

Typical Compounds:

- Aluminum trihydrate (ATH)
- Organic phosphates
- Antimony oxides
- Organic halogen compounds
- Boron compounds

Heat Stabilizers

Purpose

Heat stabilizers are used to ensure product durability. Heat stabilizers are important additions to heat-sensitive polymers that undergo relatively high temperatures to soften them during fabricating operations.

Typical Compounds:

- Liquid organotin compounds and tin mercaptides
- Barium/cadmium concentrates
- Barium/zinc/lead additives

Lubricants

Purpose

The principle function of lubricants is to decrease the viscosity of the resin melt and to control resin-to-melt friction during plastics processing. These additives also lower the die swell of extrudates and promote surface gloss.

Typical Compounds:

- Metallic stearates
- Waxes, fatty acids and mineral oil
- Silicones
- Molybdenum salts
- Polyfluorocarbons

Plasticizers

Purpose

Plasticizers are added to polymers such as PVC to make them soft and flexible. Plasticizers are also used to improve melt processibility and toughness of rigid plastics such as cellulose esters and ethers, and in a variety of specialized applications.

Typical Compounds:

- Phthalates
- Adipates
- Phosphates
- Epoxy
- Polyesters

Antioxidants

Purpose

Antioxidant additives are required in the stabilization of ABS, polypropylene, polyethylene and polystyrene plastics. These additives may be free radical scavengers (primary oxidants) or peroxide decomposers (secondary antioxidants).

Typical Compounds:

- Primary antioxidants such as butylated hydroxytoluene (BHT)
- Secondary antioxidants such as dilauryl thiodipropionate and tris phosphite
- Phosphite/phenolic blends

Ultraviolet Stabilizers

Purpose

UV (ultraviolet) stabilizers function to prevent degradation of plastics by UV radiation such as occurs in sunlight. Many organic UV stabilizers tend to migrate to the polymer surface.

Typical Compounds:

- Hindered amine stabilizers
- Zinc oxide and nickel complexes
- Benzophenones and benzotriazoles
- Carbon black
- Phosphite co-stabilizers

Blowing Agents

Purpose

Blowing agents are used in the production of cellular plastics such as foamed insulation, and plastic film, sheet and pipe obtained by extrusion.

Typical Compounds:

- Fluorocarbons
- Chemical blowing agents (CBA) such as azodicarbonamide and sulfone hydrazide
- High temperature blowing agents (HTBA)

Colorants

Purpose

Color is added to achieve the desired color of the final product. Color‘ may be compounded into the resin and sold as such. In other instances, the end-user blends the appropriate amount of dry color powder with resin and produces the final colorpart. Currently, color is frequently added as pellet concentrates or direct-feed liquids to minimize occupational exposure to colorants.

Typical Compounds:

- Titanium dioxide
- Carbon black
- Inorganic colorants such as iron oxides, cadmium, chromium, lead, nickel and molybdate
- Organic colorants such as phthalocyanines, nigrosines and others

Fillers and Reinforcements

Purpose

Fillers are added to plastics to reduce the quantity of high cost plastics required in the final product. Reinforcing fillers such as fiberglass and graphite give additional strength to the plastic product.

Typical Compounds:

- Non-reinforcing fillers include calcium carbonate, silicas, clay, talc, carbon black and fly ash
- Reinforcing fillers include fiberglass, graphite and cellulose

Organic Peroxides

Purpose

Organic peroxides are used as curing and cross-linking agents for polymers such as unsaturated polyesters and polyolefins. Their purpose is to initiate cross-linking, and in doing so decompose. These peroxides are not present as such in the finished product unless in minor residual amounts.

Typical Compounds:

- Benzoyl peroxides
- Methyl ethyl ketone peroxides
- Peresters and dialkyl
- Peroxides

Impact Modifiers

Purpose

Impact modifiers may be added to plastics to enable plastic products to withstand stronger impacts and still remain intact. For example, rubbery polymers are added to PVC and other thermoplastics to produce products with improved impact resistance.

Typical Compounds:

- Styrene-butadiene polymers
- Chlorinated polyethylenes
- Ethylene vinyl acetate copolymers
- Calcium carbonate

Antistatic Agents

Purpose

The use of antistatic agents in plastics is a growing need in electronics, computer and aerospace applications where electrostatic damage can result in costly defects. The increasing miniaturization of electronics components, for example makes them even more susceptible to static electric charges.

Typical Compounds:

- Internal antistats
- Ethoxylated alkylamines
- Metal flakes such as aluminum
- Surface modifiers including silanes and titanates

3.6 Summary

Because the material contained in this guidebook section treats the topic of Toxic Materials Reduction in a rather abstract format, it is appropriate that the conclusion to this section should relate this information to IBM packaging practice.

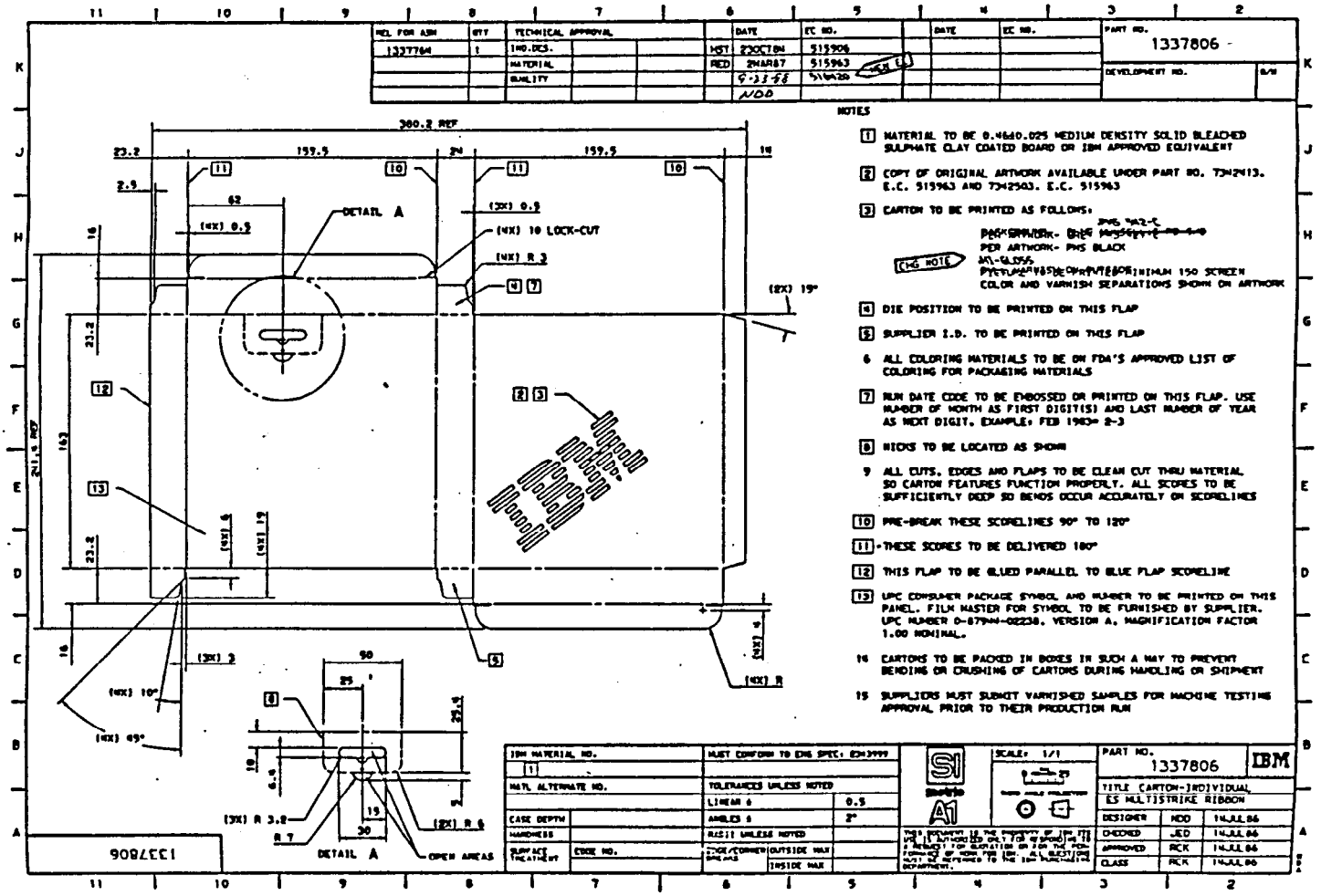
Figure 1 shows an IBM specification for part number 1337806, a carton designed for IBM ribbons. Examination of this specification indicates several items which, in view of what is presently known about solid waste concerns, are not environmentally sound.

- Note 1 - The use of bleached paper has generated dioxin during the manufacturing process.
- Note 1 - The use of bleached paper requires virgin fiber and a corresponding natural resource depletion.
- Notes 3 & 6 - The FDA limits certain heavy metals content to 600 PPM. Current assessments by government, industry, and the scientific community indicate this limit should be lowered to 100 PPM.
- Note 3 - The use of varnish will result in air pollution during the manufacture. Varnishes contain such volatile solvents as methanol, toluene, ketones, etc., and often thinners such as naphtha.
- Note 12 - The glue used, if not organic, waterbased, may not be conducive to repulping (recycling).
- Because of the use of clay coating and varnish finishes, the container is not desirable for recycling.

This container is a “pretty package”, professional looking, and attractive to a customer, but not particularly attractive to someone concerned with solid waste issues.

It is inevitable that packaging designers will need to give increased consideration to the environmental consequences of their designs. The investigation of the toxic aspect of packaging disposal is relatively new and is being expanded through the use of more accurate testing equipment and dedicated scientific research. The challenge to the IBM packaging community is to understand the issues and to consider protection of the environment as an on-going job responsibility.

3.6.1 Figures - Summary



4.0 Recycling

4.1 Introduction

4.1.1 Abstract

IBM uses a comprehensive waste management system to reduce the impact of our waste materials on the solid waste stream. This integrated system attacks our solid waste problem with a multitude of solutions; It emphasizes reducing and recycling before considering alternatives for waste disposal.

This section will focus upon the use of recyclable packaging materials (capable of being processed for subsequent use) as well as applications for recycled (already reclaimed from a waste product) material. It is designed to:

- provide tools that increase the likelihood of recycling packagings
- provide information on secondary applications for (packaging) materials which would otherwise be landfilled or incinerated,
- establish goals for the content of recycled material to be included in the finished package.

4.1.2 Objective

To be a truly environmentally-conscious manufacturer, one must surpass mentalities that only endorse the use **of** recyclable materials. A comprehensive strategy finds **applications for** recycled materials including engineering specifications that reference recommended recycled content and secondary applications for materials which have previously functioned as a product package.

Used in proper quantities and/or strategic applications, recycled material can offer the manufacturer several advantages over using virgin materials including:

- Avoidance of disposal costs
- Little or no compromise in performance.
- Economic advantage in material cost
- Reduction in the unnecessary depletion of natural resources
- Environmentally sound
- Compliance with legislation

4.1.3 Scope

This Chapter attempts to identify means by which contributions to municipal solid waste can be reduced through recycling.

Recycling is more than re-processing of waste materials. It is a technology that involves collection, separation, preparation (e.g. baling), sale to intermediate or final users, processing and eventual reuse and resale of the material.

Recycling may reduce the volume of solid waste material in two ways:

1. By redirecting materials otherwise sent to a landfill,
2. by reducing the amount of waste material generated from manufacturing processes which utilize raw materials.

4.1.4 Purpose

Reasons for recycling include:

Limited landfill space The disposal of waste is becoming a major issue as landfills become scarce and those that are not yet at capacity, limit the type and amount of wastes which are accepted. Environmental concerns including groundwater contamination, the generation of poisonous methane gas, and the siting of future landfill locations further restrict the availability of this once-common practice.

Cost savings Landfilling of solid waste is becoming an increasingly-expensive alternative for eliminating waste. As landfill costs climb, people search for ways to reduce their volume of solid waste requiring disposal. Recycling has been identified as a cost-efficient alternative to landfilling.

Generate Revenue Though perhaps best viewed as a cost avoidance, an active recycling program has the potential to generate revenue. Aluminum and steel recycling programs serve as examples. A similar return may one day be attainable for some industrial packagings including those made of paper and plastic.

Energy Conservation Natural Resources are limited. Recyclable packagings are constructed of renewable resources. Not only does recycling allow us to reclaim our original resource, it also limits the amount of energy required for material reprocessing. Aluminum cans can be produced from recycled material at a fraction of the cost (about 5%) of producing an identical one from ore.

Environmental concerns Recycling is an environmentally-superior alternative to landfill, incineration or litter. The recycling process redirects landfill material and it reduces the production of undesirable by-products created during the processing of virgin material.

Legislation State and local officials repeatedly demean packaging for its affect on solid waste. Recycling is mandated in some proposals, while degradability is required by others.

4.2 Legislation

Environmental activists and legislators have proposed "solutions" to our solid waste problems by imposing taxes, bans, deposit laws, mandated material alternatives, recycled contribution requirements, and surcharges on products whose packaging is less-than desirable.

Proposals which could impact IBM's current business practice include those that require our packaging materials be:

1. manufactured from degradable materials (e.g. photodegradable, biodegradable)
2. manufactured using a prespecified content of recycled material
3. constructed of a single (non-laminate) material
4. manufactured from materials which are recyclable (in some applications).

As more environmental legislation is proposed, compliance becomes increasingly difficult. Some laws have objectives which are mutually exclusive and others are based upon fundamentals experts disagree upon including:

- the length of time required for materials to degrade (litter)
- what degradable materials should ultimately yield (e.g. oxygen and water),
- what conditions must be present for degradation (versus the conditions that are present in modern-day landfills)
- the value of additives designed to speed or enhance material degradation if the material will instead be incinerated or recycled.

The impact of these proposals is more easily understood by reviewing specific proposals that regulate or restrict the use of packaging materials or methods. A partial list has been included in "Appendix A. Packaging/Environmental Legislation" on page 73.

4.3 Recycling and the Economy

The demand for recycled materials fluctuates with the economy. In periods of economic growth, the demand for recycled products is much greater than the readily available supply. The U.S. housing industry, which is very sensitive to economic trends, uses a significant portion of recycled paper in building components including roofing shingles, fiberboard or wallboard, siding, flooring, tar paper, and insulation.

Another major purchaser of recycled papers is the foreign market, whose fluctuations are subject to worldwide economic trends. In future years, it is believed the demand for recycled paper will grow despite recession trends. This is primarily due to the insufficient quantity and poor quality provided by overseas markets where forest sources are limited.

4.3.1 Supply and Demand

Dealers discourage stockpiling during a period of oversupply. When the world economy is in a period of recession, the consumption of waste material declines, and additional collection is unwarranted. The growing popularity of mandatory collection of recyclables in the U. S. may also result in the oversupply of waste material as proposed legislation requires only collection, and not recycling.

4.4 Outlets for Recycled Materials

Most packaging materials are recyclable. Their recyclability, however, is dependant upon the existence of an outlet for the secondary material. An outlet for recycled material can be estimated by reviewing costs associated with its:

- collection
- separation (from heterogeneous mixtures or waste)
- cleaning (if required)
- reprocessing
- transportation
- administrative costs (including sales)

The resultant costs must be competitive with the cost to manufacture similar products from virgin material. This is most easily demonstrated using an example:

The costs involved in reclaiming aluminum from a previously used can compare quite favorably to costs associated with manufacturing aluminum from ore as energy consumption is reduced by about 95%. The differential provides the material recycler with the opportunity to build additional efficiencies into the reclamation channels. Efficient reclamation channels mean reduced collection costs (the single greatest expense for material recyclers). Recyclables with a high value provide ample margin to further optimize reclamation channels.

4.4.1 Intermediate Outlets

Intermediate outlets are represented by scrap dealers or brokers. They accumulate materials, process them to market specifications, and ship them to final outlets.

4.4.2 Final Outlets

Final outlets are facilities where materials are converted into new products. They are the final phase of the recycling circle.

“Appendix B. Outlets for Recyclable Materials” on page 76 references publications that provide contacts for both intermediate and final outlets for recyclable polymeric materials.

4.5 Collection Systems

IBM packaging materials enter two distinct wastestreams; The first is the commercial or residential wastestream. This wastestream originates at a customer location where new products, parts or supplies are unpacked and consumed. IBM packaging materials also enter the industrial wastestream initiated at IBM manufacturing locations. This wastestream is comprised of the materials used to package fragile components used in the manufacturing of IBM products. Two distinct collection methods are required for the reclamation of these materials.

4.5.1 Post-Consumer Collection Systems

After IBM products are shipped and installed, customers are often confronted with the disposal of unwanted packaging materials. IBM industrial packagings may be collected using the various reclamation channels established for consumer packagings including aluminum cans, glass jars and bottles, and, most recently, molded plastic packagings (e.g. ketchup bottles). A variety of methods are used to collect materials for recycling including curbside collection, drop-off, and buy-back collection centers.

4.5.1.1 Curbside Collection

This method requires consumers to sort waste into two or more separate containers--one that contains waste, the other(s) to hold recyclable material. Recycled container(s) are commonly provided for newspaper, glass, aluminum and bi-metal cans, corrugated cartons, and selected plastic containers. If a single container is used for recyclables, an intermediate processing facility will further separate materials by type.

4.5.1.2 Multi-Material Collection Centers

A multi-material collection center is a stationary site where residents bring their recyclable material. In some instances, residents are paid for materials they collect, in others they simply drop off materials, and proceeds are used to cover program operating expense.

This collection method may offer an outlet to IBM customers for their unwanted packagings. They must first, however, be provided some incentive for their participation.

4.5.1.3 Single Material Buy-Back or Collection Centers

Single material buy-back or collection centers resemble vending machines except that they operate in reverse (in the instance of buy-back). This method is most often used for aluminum can, glass bottle/jar, or newsprint collection.

4.5.1.4 Establish Collection Network

To be truly effective, IBM may be required to develop another system for the collection of its recyclable packagings from its widespread customer base. Alternative collection center proposals include:

1. IBM Branch offices (regional collection center)
2. IBM manufacturing locations (regional, product set or material-based)
3. Central collection locations (by either product set or material type)
4. Vendored collection and recycling

4.5.2 Post-Commercial Collection Systems

This wastestream originates at IBM manufacturing locations where work-in-process packagings are discarded as value is added to components and they become products or shippable machine units.

IBM Solid Waste Coordinators have been given the task of minimizing solid waste disposal through a number of channels, including recycling. Information provided in “Products Made from Recycled Plastics” on page 42, and the Appendixes may be used by Packaging and Solid Waste teams to establish new outlets for their recyclables.

4.6 Cellulosic (Paper) Materials

4.6.1 History

The history of paper recycling is over 300 years old (1690) when cotton and linen rags were used as the raw material for paper. Economic and technological growth coupled with sparse supplies of source material brought about the introduction of paper produced from wood fiber.

Today, recycling is not only a part of papermaking's heritage, it is a vital component to the industry's growth and prosperity. Currently, over 30% of all paper and paperboard consumed in this country is collected and utilized as either raw material to make recycled products or as an export to countries overseas. That amount is projected to increase to 40% by the year 1995.

4.6.2 Outlets for Recycled Fiber

4.6.2.1 Domestic Outlets

IBM Packaging Engineers are encouraged to work closely with site solid waste coordinators to establish local outlets for their paper and corrugated wastes. Local corrugators or corrugated carton manufacturers may be useful in providing potential outlets for your recycled paper and corrugated products.

A useful reference is The Official Board Markets or "Yellow Sheet." The Yellow Sheet is a newsletter that is published weekly and contains information such as paper and paperboard prices and industry developments, news and events. Subscription inquiries may be directed to Official Board Markets at (218) 723-9308.

Another reference is being developed by the papermaking industry, in conjunction with API. This national database called "Matchmaker," is designed to match communities or businesses with constant wastepaper streams to waste paper mills or brokers who are interested in purchasing these materials.

4.6.2.2 International Outlets

The U. S. provides the greatest supply of waste paper to compensate overseas markets for inadequate supply or poor source quality (short fiber length). U. S. exports of waste paper have been increasing dramatically: In 1970, 406,000 tons of waste paper were exported. In 1986, that sum increased to 3,749,000 tons. The U. S. has established a network of wastepaper brokers to capitalize on the overseas market.

4.6.3 Sources of Recycled Fiber

Paper Stock Standards and Practices Circular PS-86, published by the Paper stock Institute of America lists 49 different grades of waste paper plus another 31 specialty grades.

The most popular sources of recycled fiber are:

Newspaper	Old newspapers are the main source of waste paper collected from homes. In 1988, about 33% of the newspapers produced

were reclaimed for the purpose of recycling. A large portion of this recycled fiber is used in the subsequent production newspaper. The average recycled fiber content of all U. S. produced newspaper was estimated at 8% in 1988. That number is projected to grow to 40% by the year 2000.

Mixed Paper Mixed papers are generally collected from office buildings and industrial plants. The mixed paper classification includes paper known as high grade waste paper.

High Grade Waste Paper High Grade Waste Paper is represented by folding cartons, envelopes, bags, business forms, ledgers, printed materials, tabulating cards (key punch), computer printouts. These materials will usually yield a greater price since higher grade materials can be produced from the stock.

Old Corrugated Cartons Old Corrugated Cartons represent the largest single source of waste paper collected for purpose of recycling. Nationwide about 42% of old corrugated containers are being collected. In some metropolitan areas, it is estimated that over 60% of old corrugated containers are reclaimed.

Large supermarkets typically bale old corrugated containers and sell it directly to recycling mills. Smaller ones are usually not compensated for their waste, but their participation provides them with a savings of expense otherwise incurred by landfilling these materials.

4.6.4 Paper Recycling Process

Recyclable papers are mixed with water (about 80%) in a beater or hydrapulper to separate the fibers via mechanical action and form a fiber/water slurry. This process is similar to that observed in a large kitchen blender. The slurry is passed through a series of screens and centrifugal cleaners to remove non-fibrous contaminants such as glass, metal or plastic.

After the waste paper is repulped, it is formed into paper or paperboard using either Cylinder or Fourdrinier machinery. Either method dries the fiber (from 800% water to 20% water) in preparation for pressing and drying. Final drying is done using a series of steam-heated dryers where moisture content is typically reduced to less than 5%. Paper is then wound into rolls for shipment to its user.

4.6.5 Performance of Recycled Paper Products

It is a popular misconception that the inclusion of recycled fiber is undesirable for any cellulosic product. While it is true that recycling can reduce the performance of some paper products, that reduction can be minimized by adopting these principles:

- the source of recycled fiber is of premium-grade (long fiber length)
- the source of recycled fiber is free of contaminants
- use previously recycled fiber in moderation
- when designing packagings that contain recycled fiber, use the recycled fiber in strategic areas of multi-component material (e.g. corrugated mediums).

Properly done, well-engineered applications for recycled fiber can produce both tangible and intangible advantages for its user.

4.6.5.1 Fiber Length

Recycling of paper products shortens the length of each paper fiber. As fiber length is reduced, so too are the number of bonding points between fibers; As the bonds are reduced, strength is reduced. Theoretically, however, paper products may be recycled an infinite number of times. The shorter fibers may continue to be used in less structural applications including office or tissue papers.

4.6.5.2 Contaminants

The quality of recycled paper and paperboard depends substantially upon the quality of the waste paper available to the recycling mill. The most frequently found contaminants are water insoluble adhesives, plastic film, plastic foam, rubber bands, metals, glass, asphalt, string and carbon paper. Plastic coated, laminated, and wet-strength papers also cause production problems.

All discarded waste paper cannot be recycled. The waste paper that is commingled with food waste becomes contaminated with odor and bacteria. In this instance, separation and collection are not economical.

Scrap or waste from container fabricating is a highly desirable source of recycled fiber because of its long fiber length and minimized exposure to non-cellulosic contaminants.

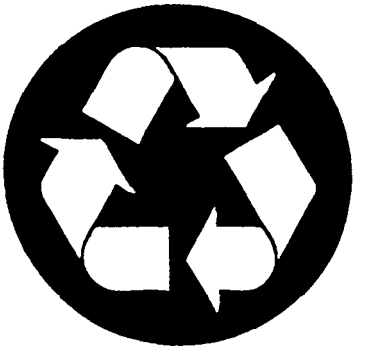
4.6.6 Recycling Aids for Cellulosic Materials

Incorporation of the following will assist in further developing an outlet for your recyclable fiber:

- Use water-based inks or FDA/USDA approved,
- Use tape and starch glues in place of staples and hot melt adhesives
- Avoid plastics or non-cellulosic materials; Design packages that are constructed of components that may be removed or separated prior to paper recycling (e.g. avoid free-rise foam-in-place),
- Avoid coatings or impregnating of corrugated,
- Minimize use of bleached kraft/oyster white board
- Avoid cartons with urea-formaldehyde

4.6.6.1 The Recycling Symbol

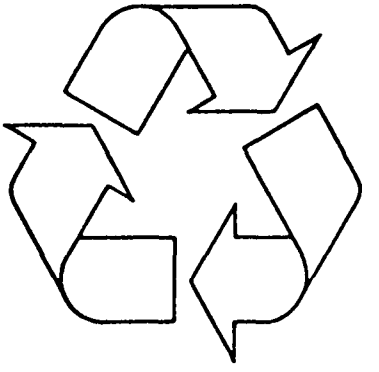
The American Paper Institute (API) is promoting the use of the recycling symbol to inform users that cartons or other cellulosic materials bearing it, are manufactured using recycled material. The recycling symbol may be printed with or without text-- “Packaging Material Made from Recycled Fibers” or “This Product Packaged in Recycled Paperboard.”



The recycling symbol should be applied to all IBM package materials that contain any amount of recycled material (e.g. fiber). Refer to “Appendix H. IBM Engineering Specification - Recyclable Packaging Materials” on page 111 for additional information including placement.

4.6.6.2 The Recyclable Symbol

The recyclable symbol appears similar to the recycling symbol, however it does not have the circle in the background. The API has promoted the use of the recyclable symbol on all paper products that can reasonably be expected to be recycled.



Artwork for the recyclable symbol is available in the IBM Design Guide - Basic Packaging Graphic Standards. It should be printed on all corrugated containers.

4.6.7 Paper Products Manufactured from Recycled Fiber

All cellulosic papers may be manufactured with some contribution of recycled fiber. However, the performance requirements of the second (or next) generation product will dictate the quantity of recycled fiber used as an ingredient.

Products manufactured from waste paper include:

1. Paper, including newsprint, printing and writing paper, tissue, and kraft
2. Paperboard such as unbleached kraft, semi-chemical, bleached paperboard
3. Other materials including building products, molded products (e.g. egg cartons), or cushioning.

4.7 Corrugated

Most manufacturers of corrugated board utilize some recycled fiber when combining papers to form corrugated board. It is estimated that only two or three manufacturers produce corrugated from virgin materials exclusively. The API (American Paper Institute) defines virgin material as material comprised of at least 80 percent new fiber (75% for hardwoods).

4.7.1 Recycling Specification

IBM Engineering Specification 5897661 (E/C 844576) should be used to promote the use of materials which are recyclable and/or recycled. In addition to environmental concerns, consideration is given to material and container performance. The specification has been reprinted in its entirety and included in “Appendix II. IBM Engineering Specification - Recyclable Packaging Materials” on page 111.

The specification should be referenced on engineering drawings and on IBM purchase orders for cellulosic packaging materials which do not require specialized materials or certain performance requirements (i.e. Cobb Test ratings). The document can also be used as an additional technical reference for information about recycling and considerations affecting performance.

4.7.2 Guidelines for Recycled Fiber Content

By using recycled fiber in quantities that exceed the referenced minimum quantities below, packagers may capitalize upon advantages in “Purpose” on page 29. Recommendations have also been provided for the largest quantity of recycled fiber that should supplement virgin material. These recommendations are based upon the maximum permissible content of recycled fiber that will not seriously degrade the performance of the combined board.

Board type	Total Recycled Fiber (% weight): Minimum	Recommended Maximum
Singlewall	30%	50%
Doublewall	40%	70%
Triplewall	40%	70%

4.7.3 Selective Placement of Recycled Fiber

In general, high performance corrugated board can be produced with a high content of recycled fiber provided that fiber is used in strategic locations. Recycled materials are best placed in the corrugated mediums and the inside liners of multiwall board (e.g. doublewall or triplewall). These non-critical components may be manufactured from up to 100% recycled fiber without seriously affecting performance. Recycled content of the

corrugated's facings, however, will have a more dramatic impact on the performance of the combined board. Performance can best be achieved by using fiber with a recycled content of less than 40% on the outside facings or liners of corrugated board.

The inclusion of recycled fiber may serve to reduce the combined board's bursting strength, but it has little impact on container compressive strength.

4.7.4 Integrated Companies

Though it is a goal of the environmental-conscious customer, it is sometimes difficult to have a carton manufacturer meet customer demands for an aggressive or disproportionately large content of recycled fiber. This is particularly true if the carton manufacturer is a subsidiary of a larger wood products or integrated company-- one that markets everything from forests and wood products, to papers and corrugated board. Because of their broad natural resource base, these manufacturers have difficulty being competitive in recycled markets.

4.8 Wooden materials

At this writing, wooden packagings including shipping pallets, are reused (or refurbished and reused). Successful reuse operations minimize the need for recycling programs. Pallet reuse programs are described in "Pallet Reutilization" on page 56.

Should pallets and other wooden materials be of such condition that reuse (or refurbish and reuse) is not feasible, alternatives to landfill should be investigated. One such alternative is the shredding of these materials. Shredded wooden material has been successfully used as poultry litter, livestock bedding or fuel.

Pallet grinding operations currently exist in Illinois, Florida and Virginia. For additional information contact:

Marshall S. White
Virginia Polytechnic Institute
Blacksburg, Virginia 24061

4.9 Polymeric (Plastic) Materials

4.9.1 Reclamation

The recycling of post-consumer plastics is complicated by the great number of resin types and their incompatibility with one another. Most polymers do not mix, bond or adhere well to one another. Mixing of resin types can result in a product that has inferior physical properties including strength and durability.

4.9.1.1 Scrap (Pre-Consumer) Reclamation

Plastic processors are in the best position to recycle plastics because they are assured of a source that is relatively clean, homogeneous and continuous.

4.9.1.2 Post Consumer Reclamation

Postconsumer recycling of plastic materials is just beginning to occur in the United States. It is inhibited by:

- the need to separate plastics by resin type,
- contamination,
- high collection costs due to low material density,
- insufficient and variable volume source for recyclable material.
- the use of heterogeneous resins in a single package

4.9.2 Commingled Plastics

Plastic material that have not been separated by resin type is referred to as "commingled." Plastic recyclers receive the greatest amount for their waste material when it has been separated into its various plastic components (resins). When separation is deemed too costly, the mixture can be processed in its commingled state in one of two ways:

1. Commingled plastics may be used for waste-to-energy incineration.

   The most popular market for commingled plastics is waste-to-energy incineration as plastic materials contain a large BTU or fuel value.

2. Commingled plastics may be further processed in rudimentary applications where the second generation product is noncritical in nature.

   For molding applications, commingling between plastics is permitted only amongst specific polymers. For example, polyethylene and polypropylene can safely be substituted for one another in amounts as great as 15%. Polystyrene, conversely, is a very sensitive polymer and almost no commingling can be permitted.

   Secondary applications for commingled plastics are discussed in "Products Made from Recycled Plastics" on page 42.

4.9.3 Plastics Separated by Resin Type

In comparison to the commingled variety, plastic materials that have been separated by resin type (e.g. Polyethylene) represent a much greater resource; One which can be recovered through recycling. With proper quality controls, recycled post-consumer plastics perform as well as virgin plastics in non-critical applications.

4.9.4 Degradable Materials

Some plastics manufacturers are complying with legislation offering materials that are degradable. Degradable materials are ones that break down by natural causes usually by one of two mechanisms: microorganisms or bacteria in the case of biodegradable materials, or the use of the sun's ultraviolet rays to assist the reduction of photodegradable materials.

Carbonyol additives are commonly encountered in photodegradable materials. Corn starch or vegetable oil are sometimes added to materials to enhance their biodegradability. Both additive types represent a misuse of resources unless used in conjunction with the proper disposal methodology. For example, it is simply a waste of money to incinerate your premium-priced biodegradable packaging materials.

It should be noted that the use of biodegradable or photodegradable materials inhibits recycling. It complicates resin separation by adding additional materials to our wastestream and if they are introduced to a recycling operation, they may compromise the quality of future products manufactured from the resin.

4.9.5 Plastic Recycling Process

Plastic recycling typically combines food service and industrial materials of the same resin type and mechanically reduces material size into small pieces called fluff. These are then heated, and extruded, forming solid pellets. The recycled plastic resin is typically shipped to a molder who manufactures durable products. These secondary products are discussed in “Products Made from Recycled Plastics” on page 42.

4.9.6 Plastic Recycling Aids

Currently, there is not an established market for post consumer plastics; Especially for industrial-type packagings. Post consumer reclamation is plagued by inefficient collection and distribution methods (primarily poor density) and contamination and separation of resins.

To increase the effectiveness of plastic reclamation, the Plastic Bottle Institute, a division of the Society of Plastics Industry (SPI), has developed a voluntary coding system that identifies plastic bottles by their material or resin type. Prior to implementation of this program, recyclers were burdened with the cumbersome and time-consuming chore of separating material by resin. The bottle coding program simplifies the resin sortation and allows recyclers to employ unskilled labor.

4.9.6.1 SPI Plastic Bottle Coding System

The container coding system to provides a uniform system for identifying plastic resin that meets the needs of the recycling industry, as defined by recyclers and collectors. The system has been designed to be easy to read, and easy to differentiate from existing marks utilized by container (primarily bottle) manufacturers. It is simple and intended to avoid confusion, extensive workforce training, and potential mis-sorting. It is critical that the coding system be implemented on a global basis because the use of different coding systems (by companies or states) would create major problems when mixing some resin types. Use of this central system assures we derive the highest possible economic value from recycled materials.

SPI’s Bottle institute developed a coding system that identifies the seven most commonly used plastic materials. The code is a three-sided triangular arrow with a number in the center and letters underneath. The numbers inside and the letters indicate the resin type. Following is a list of the seven codes developed by the bottle industry:

1 PETE - Polyethylene terephthalate (PET)

2 HDPE - High density polyethylene

3 V - Vinyl/polyvinyl chloride (PVC)

4 LDPE - Low density polyethylene

5 PP - Polypropylene

6 PS - Polystyrene

7 OTHER - all other resins and multi-layered materials.

4.9.7 Expanded Plastic (Foam) Materials

Historically, plastic foam manufacturers have utilized defective parts, trimmings and other in-house scrap to supplement virgin resin when manufacturing foamed materials. Because there are no contaminants and minimal collection costs associated with this source, manufacturers are eager to supplement their virgin resin with the recycled foam. The cost to add the recycled material is small due to the reduced requirement for resources, energy, and the cost avoidance of landfill.

While plant scrap materials have been processed for many years, the recycling of plastic products after they have been used by consumers is a relatively new process.

4.9.8 Reclamation of Expanded Plastics

In comparison to structural foam or plastic, packaging waste suffers from one additional reclamation burden in that it is blown or expanded to perform it useful function. This process reduces the density of the plastic; A process that must be reversed for efficient material collection. Packagings may be densified by either using heat or grinding dependent upon the particular resin.

A directory to recycling equipment including grinders, crushers and balers has been referenced in “Appendix D. Recycling Equipment” on page 87.

4.9.8.1 Extension of the Bottle Coding System

Recently, industrial plastic manufacturers have adopted the use of a resin identification system based upon that established by the bottle coding system. This system is similarly designed to reduce collection costs associated with sortation of expanded plastics and uses identical designations for each resin type.

It is advised that IBM Engineering drawings reference the resin coding system on its molded cushion drawings and purchase specifications make a similar notation. Use of the resin coding system demonstrates our commitment to reduce the impact of our products (and their packages) on the environment.

The resin identifier is most easily placed on a molded part with a permanent embossing of the appropriate designation in the part mold. The embossing should be requested at the time of tool development. If necessary, the resin identifier may be added to existing tools or molds at a later date at a cost of less than $1,000. Each time a cushion is molded, the resin identifier (e.g. 6 for EPS) will be permanently displayed on the molded part. This method is now being employed by Tuscarora Plastics on parts manufactured of Polystyrene and Polyethylene. Molded Polypropylene can be marked as well.

An alternative method uses the ejection pins to mark the plastic piece with the resin identifier. Because the pins are not an integral part of the mold, sites may request the molder select the appropriately marked pin whenever new parts are molded. Use of this process adds no expense to tool development or the piece price of molded cushion parts.

It costs only the time required to specify it on the Purchase Order or Engineering Specification.

A similar method may enhance the recyclability of all our molded plastic parts (e.g. plastic machine covers).

Fabricated parts can identify resin type using hot wire imprinting.

This plan is detailed below:

4 LDPE - Expanded polyethylene

5 PP - Expanded polypropylene

6 PS - Expanded polystyrene

7 Other - Copolymers, specialty resins and multi-layered materials.

4.9.9 Engineering Specifications for Plastics

Recommendations:

1. Include the recycling symbol on molded and fabricated parts.
2. Modify Engineering or purchase specifications so as to encourage the use of recycled materials in packaging.
3. Virgin resin can be supplemented with a small amount of recycled material to produce a greater yield of molded part. At present, however, technology limits processes to:

   - recycled contribution of less than 5%
   - contribution to larger molded parts or extruded plank.

   Caution: A cushion's physical properties may be adversely affected by inclusion of too much regrind material especially when molding smaller or complicate? forms. When molding these shapes, the virgin resin and recycled component do not always properly fuse to one another.

IBM Engineering Specification 5897661 (E/C 844576) should be used to promote the the recycling of plastic packaging materials. The specification has been reprinted in its entirety and is included in "Appendix H. IBM Engineering Specification - Recyclable Packaging Materials" on page 111.

The specification should be referenced on engineering drawings and on IBM purchase orders for plastic packaging materials which have not been in contact with contaminants including hazardous materials. The specification includes an overview of SPI's resin coding system and makes recommendations on the methods used to encode plastics with the resin identifier.

4.9.10 Products Made from Recycled Plastics

The excellent value and versatile use of the recycled resin material produced from post-consumer or scrap material has spurred the rapid development in recycling technology and creative end-uses for the recycled material.

The suitability of a recycled resin for a particular application will depend upon the technical demands of the application and the nature of any contamination resulting from the prior material use. It is expected that the initial market for recycled resins will be

those applications that are tolerant of the variations in properties that exist among various resins of each type.

Typical secondary applications for popular foam types are listed below:

Polystyrene: Expanded polystyrene foam may find secondary applications in either its original, but shredded form, or in a reprocessed variety.

1. Soil aeration (Plants)
2. Inexpensive toy stuffing or filling
3. Bean bag chair stuffing
4. Regrind for subsequent molding in EPS cushions (< 3% regrind)
5. Semi-rigid Styrene Products, including:

- Trash containers,
- Children's toys
- Office Products or equipment,
- Videotape Housings
- Plastic lumber

Polyurethane: Urethanes of ether or ester can be used for rebond applications. All colors of material are processable as are densities of up to 2.2 psi. Higher ILDs (between 20 and 150). are preferred for rebond applications. Polyurethane rebond may be used for:

1. Carpet Rebonding
2. Seat cushions
3. Tractor seats

Urethanes may also be ground and used without additional processing in furniture cushioning. One common application is encountered in patio furniture cushions.

Polyethylene: Popular secondary applications for polyethylene resin are:

1. base cups for PET bottles,
2. refuse cans,
3. flower pots,
4. piping,
5. traffic cones,
6. plastic lumber.

Mixed Plastics: Should you experience difficulty locating an application for your particular resin, most resins may be commingled and used in one of the following ways:'

1. Treated lumber (which is estimated to be a 3 billion pound market)

2. Landscape timbers (which is estimated to be a 1/2 billion pound market)
3. Shipping Pallets (which is estimated to be a 30 billion pound market)
4. Horse fencing
5. Farm pens for poultry, pigs and calves
6. Roadside posts

4.9.10.1 Packaging Products Manufactured from Recycled Plastics

Several states are in the process of establishing laws which govern the disposal of solid waste including packaging materials. Most of these laws are similar in that they provide for exemptions from proposed taxes or restrictions provided materials used in products (or packages) are made from recycled materials in whole or in part (usually 30-50%).

Some packaging manufacturers have developed methods and sources and purchased and built equipment, to utilize recycled materials to qualify for the legislated exemptions. Current offerings include:

1. Rigid and semi rigid plastic packaging (including conductive)
2. Strapping (PET)
3. Pallets (HDPE/mixed)
4. Drums (HDPE)
5. Pails (HDPE)
6. Structural urethane foam (PET)

5.0 Material Redaction and Reusable Packaging Guidelines

5.1 Introduction

5.1.1 Abstract

Source reduction is part of an integrated approach to reducing solid waste disposal problems. Two important source reduction techniques include;

- material reduction, and
- material reuse.

In addition to reducing solid waste problems, material reduction and reuse are often very cost effective. The cost effectiveness of material reduction and material reuse programs is often the result of significant savings in material purchase costs. This chapter provides guidelines for material reduction and reusable packaging programs.

5.1.2 Purpose

The purpose of this chapter is to establish references and guidelines for evaluating and developing material reduction and reusable packaging programs. The information may be used when alternatives to disposable containers and materials are needed. These alternatives may be needed when;

- packaging material solid waste needs to be reduced,
- packaging material costs need to be reduced,
- materials handling or automation improvements are needed, or
- Continuous Flow Manufacturing (CFM) programs are required.

The guidelines and references in this chapter should be used as part of packaging and container evaluations for new and existing programs. The guidelines and references may help in evaluating reduction and reuse programs as alternatives to the most environmentally sound and cost effective packaging for IBM product and part manufacturing and shipping.

5.2 Material Reduction

5.2.1 Objectives

Besides reducing solid waste problems, material reduction can reduce our depletion of natural resources and often results in a less expensive package. The following are objectives of packaging material reduction:

- Use less packaging materials, but still provide the required packaging features and functions, such as product protection.
- Use less packaging materials, but use materials that have been recycled or will be recyclable, reusable, or have no environmental impacts when disposed in landfills or incinerated.
- Use less packaging materials, but use materials that require minimal natural resources and non-toxic materials to manufacture.

5.2.2 Material Reduction Techniques

Some material reduction techniques include the following:

Material Light-Weighting: Material light-weighting is a simple concept that involves using less material in a design. The objective is to use only enough material to provide the required level of performance (e.g., shock protection, stacking strength, durability, etc.). Some examples of light-weighting are included in the following list:

- Reduced thickness or bursting test on corrugated fiberboards. For example, when stacking strength, durability for repeated uses, or puncture resistance is not needed in a container, lower strength boards may be selected. This may mean reducing triple-wall boards to high-performance double-wall materials, or it may mean reducing the bursting strength of a board (e.g., 350 lb test to 275 lb test).
- Reduced wall thickness on plastic containers. When impact strength, precise dimensions, or durability is not significant, wall thickness's of plastic containers can be reduced. In the case of vacuum-formed containers, a thinner wall may be accomplished with no tooling changes. Changing wall thickness's of injection-molded parts may be more difficult and costly.
- Reduced wall thickness on molded cushions. Reduced wall thickness's may also be used on molded cushions (e.g., molded expanded polystyrene or EPS end caps and cushioned trays). If material is not needed for structural integrity or for shock protection (foam will only provide shock protection, if it can deflect during impact), material is probably not needed and can be removed.
- Modified corner cushions. Protective foam cushions, designed to fit on the corners of a part or product, often have unneeded or extra material that can be removed, without affecting the shock protection ability. Protective cushioning material is usually needed only on the flat surfaces or faces of the product. Material directly in the corner (i.e., the area formed by the intersection of three adjacent product sides) is often not needed and may be removed.

Alternate Material Selection: Sometimes the use of an alternate material and design can result in the reduction of material used. For example, shock protection requirements for a design can be met by using several different types of foam cushioning material. Because of chemical composition and physical structure differences, the volume and mass

of foam needed will vary, depending on the material selected. In general, the stiffer foam materials will require less volume in a design. Polystyrene materials offer the highest stiffness, polyethylenes and polypropylenes offer medium stiffness, and polyurethanes offer the lowest stiffness's; however, certain polyurethane esters are available in moderately high stiffness's.

Since the cost of the foam materials varies significantly, the package design using the lowest volume of foam may not have the lowest package cost. When this is the case, savings from lower transportation costs (due to better density) or lower container costs may offset the higher foam costs. Lower transportation costs are more likely to occur when smaller cushion thickness's (rather than less cushion bearing area) are used to reduce the volume of cushioning material needed in a package. For example, if one inch of cushion thickness is removed from all sides of a 5.0 cubic feet packaged product (weighing 30 pounds), the package volume will be reduced to about 3.7 cubic feet. This smaller package will cost about $8 less to ship by air within the U.S. and about $15 less to ship by air from the U.S. to an international location.

Bulk versus Unit Packages: A material reduction technique often used with supplier and interplant packaging programs is bulk packaging. Quite often the use of bulk packaging requires less packaging material, per part, than individually packaged parts. In addition to material advantages of more parts per package, bulk packages often require less material for shock protection. Bulk packages, especially when palletized, are less likely to be dropped from high drop heights. Unit and manually handled packages are more likely to dropped from higher heights and require more shock protection (e.g., more dunnage and cushioning).

Reduced Product Protection: Quite often packaging materials can be reduced and sometimes eliminated when the product requires minimal protection. Minimal protection may be the result of;

- increased product ruggedness,
- the use of material handling equipment (e.g., carts), and/or
- well controlled or minimal handling, shipping, and storing environments (e.g., close or nearby vendors).

Reusable Packaging: One of the most cost effective and environmentally-sound material reduction techniques is reuse of materials. Because of its significance, a separate and expanded section is included in this guide.

5.3 Reusable Packaging

5.3.1 Elements of Cost

The following are some of the cost elements in packaging material and container programs. Although it is not an all-inclusive list, it does list some of the more common and significant items that should be considered.

Materials: The material costs generally are the costs to purchase the container or packaging item. The purchase or material costs of a reusable item should be compared to the cost of the disposable item. This comparison should be made on a total program life

basis. The total number of disposable items required, times the disposable item's material cost, should be compared to the the total number of reusable items required, times the material cost of the reusable item.

Example:

(# disposable items) x (disposable item purchase cost)
versus
(# reusable items) x (reusable item purchase cost)

In addition to the purchase costs, any material cost required to maintain or repair reusable items should also be estimated.

Reuse Life: Although not an element of cost, the reuse life is used to help define the number of reusable items needed to support a program. Reuse life should be considered a major cost lever or item that greatly influences material costs of reusable items. As reuse life increases, fewer reusable items are needed, which then lowers the material costs.

Pipeline: Like reuse life, inventory pipeline effects material costs. The inventory pipeline defines the number of reusable items needed at any given time. Inventory pipeline should also be considered a major cost lever. Reusable programs are often most cost effective when pipelines are small.

Return: Return costs include the handling and shipping costs to return an item from the end of one use, back to the starting point of the next use. This may include both transportation and labor costs required to return an item.

Shipping: In addition to return shipping costs, the cost to ship packaged items in reusable containers and disposable containers should be estimated. In many situations, container characteristics such as size and mass will effect transportation costs.

Labor: Labor costs not included in other cost elements should be uniquely identified and estimated. Labor costs may include

- Administration: This may include the labor to manage, control, and analyze requirements of an on-going reusable program. This should be compared to administrative costs (if any) for a disposable program.
- Packing/Use: This is the labor involved in actually using a package or container. This should be compared to the labor of using disposable containers and packaging. This should include labor to both pack and unpack.
- Repair/Cleaning: This is the labor required to repair, refurbish or clean a reusable item, so that it may be reused.

Disposal: This is the cost to dispose of containers and packaging. A comparison of disposal costs for reusable items versus disposable items should be made. Included in the comparison should be;

- labor costs to sort and place items in appropriate waste containers, compactors or bailers,
- lease or purchase costs for special equipment (e.g., compactors and bailers), and
- costs of waste material pick-up and/or disposal.

Equipment/Tooling: Capital and expense costs for equipment and tools needed to use or make disposable and reusable items should be estimated. In many cases, out-of-pocket cost analyses are used to compare reusable and disposable programs. If out-of-pocket

analyses are used, all tools and equipment can be treated as expenses or out-of-pocket cash flows.

5.3.2 Technical & Business Considerations

The following are some items that should be considered when evaluating, developing or implementing reusable programs:

Transportation Distance: Physical shipping distance and time greatly effect the inventory pipeline and the total number of reusable items needed. When shipping distances are short, pipelines usually are small, and the total number of reusable items is usually small. In addition, short distances result in lower transportation costs, especially for returning reusable items. Pipeline and return costs are often the largest costs in a reusable container program.

Example: Local Vendors

Reusable programs often work best when transportation distance is very short. For example, with packaging programs for supplier parts, it may be easier to implement reusable programs with nearby or local vendors.

- The pipeline will be short, so there will be fewer reusable items to buy.
- Return shipping costs will usually be low.
- Many suppliers may have their own trucks, so return shipping may be free. This is especially true when a local supplier has a truck coming back empty, after making a delivery.
- With vendors very close, inventory on parts packed in reusable containers is likely to be very low, because the vendor can make frequent. deliveries. The low parts inventory requires fewer reusable containers. There will be fewer or no containers holding parts in an IBM warehouse.
- When the pipeline is small and easy to control, a reusable item is more likely to be used as an integral part of material handling systems at both the supplier and IBM. This is especially true with local vendors who make frequent deliveries to IBM. In addition, the vendor is more likely to accept management responsibility for much of the reusable program (e.g., purchasing, repairing, scrapping reusable items).

Part Size: With supplier parts, larger parts are often better candidates for reusable programs, than smaller sized parts.

- There are fewer parts per container, so the containers make more round trips. This is a cost benefit, if the container is well designed, very durable, and has a high reuse life. When the life of a program is close to or shorter than the reuse life of a container or reusable item, a higher number of reuses makes a reuse program more easily justified.

- The cost differential between disposable and reusable containers is often smaller with large parts, than with small parts. With a high number of reuses, this makes the total materials cost very low.

- Large parts are often good candidates for warehouse on wheels (WOW) or kanban on wheels (KOW) inventory management programs. When parts suppliers are not close, just in time (JIT) delivery programs are more easily justified with larger parts. The larger parts often are the more expensive and require the most amount of storage space. So, eliminating these parts from warehouse storage, usually results in significant inventory savings. Frequent delivery and no warehouse storage also reduces the number of reusable containers needed and results in low or free return shipping costs, especially when the vendor's trucks are returning empty.

Inventory Control: Consider inventory management practices, when evaluating and designing reusable containers.

- Be sure reusable containers hold the right number of parts to match inventory disbursement or manufacturing kanban quantities.

- Where inventory control is poor or when inventory levels (or part demands) are likely to vary significantly, keep the reusable container or packaging cost very low, to minimize costs to replace lost items or to buy new ones. Also, keep the design of the reusable item very simple, so procurement lead-times will be very short. Durability and high reuse may have to be sacrificed, so replacement or new items will be inexpensive and easy to get.

Bulk vs. Unit Packs: Bulk packaging applications are good candidates for reusable containers. Look for single unit packages that currently use several different materials in the package design. For example, ESD sensitive and fragile components and assemblies (e.g., small disk drives, cards and boards) shipped by suppliers and component plants are often individually packed with conductive bags, foam cushioning, and fiberboard cartons. These individual and disposable packages can sometimes be replaced with bulk (holding many parts) containers made of conductive corrugated fiberboard with antistatic foam inserts.

Other Design Factors: In addition to the design factors listed above, the following design considerations should be made:

- Design Style & Reuse: Select container and packaging styles that lend themselves to high reuse. For example, HSC & cap style containers are better suited to multiple openings and closings, than RSC style containers. They also can use closures other than tapes that may damage the container (e.g., tape removal may peel away liner board).

- Easy Use: Design reusable containers and packaging to allow easy packing, unpacking and repacking. This will help to ensure parts are properly protected and packaging items are not misused or misplaced. Avoid jig-saw puzzle complexity. If a reusable package is used only occasionally by individuals (e.g., IBM Customer Engineers using field replacement part packages for parts return) minimize complexity so the package can be easily reassembled and reused, without a high degree of packing expertise. Where possible, the packing process should be no more than three steps - open, place (the part), and close/seal.

- Cushioning Materials: Avoid foam cushions made with low density materials, especially foam-in-place urethanes and expanded polystyrenes. These materials will easily break apart and compress with high reuse. The shock protection ability will then be seriously degraded. Cushioning materials selected should be able to provide adequate shock protection, after many drops and reuses. As a general guide, for each reuse, a reusable cushion should be able to pass the test requirements of IBM

Corporate Specification, C-H l-9711-005, Packaged Product Tests. For example, the test specification requires eight (8) drops - one on each package face, one edge and one comer. If ten reuses are planned for a cushion, the cushion should be tested with a total of eighty (SO) drops from the required drop height.

- Component Replacement: Design reusable containers so worn or damaged components can be easily replaced, without having to throw away the entire container. Also keep component designs simple, to facilitate easy and fast replacement and procurement. For example, complex designs, sophisticated materials, and special tooling may cause high replacement cost and long replacement times.

- Cleaning: For reusable-items that need to be cleaned, be sure to include adequate liquid flow and drain holes. Or include materials that do not require special solvents needed for cleaning or removing labels and markings.

- Disposal: Consider end-of-life disposal. When the container can no longer be used, can its materials be recycled for other uses, or will the container material and design dictate landfill or incineration only? Select materials that can be easily recycled and design packages to make recycling easy (e.g. all one material or several materials that are easy to separate and sort). Quite often, the container or package manufacturer can suggest alternatives to make your container or material recyclable.

- Other Uses: When possible, design containers and packaging to be used for other programs (both current and future). With slight design changes, a reusable item designed and cost ‘justified for one program may be applied to other programs that may not be able to justify unique reusable container or packaging designs. Also, very durable designs, with minor modifications, may be cost effectively applied to future programs, thus extending a reusable item’s reuse life beyond the life of one program.

- Shipping: Consider shipping weight and size to minimize shipping costs. These should be considered for both full and empty containers or outgoing and returning reusable packaging materials. In addition to size and weight, the container style may affect shipping costs. For return shipping, it may be possible to design reusable containers to nest together or collapse when empty. However, these features often add more cost and are sometimes less conducive to automation.

- Protection and Handling: Be sure reusable packaging provides the same level of protection (e.g., shock, vibration, abrasion, ESD, humidity, etc.) as the disposable packaging. In addition, be sure the reusable containers can be handled as easily as a disposable containers; avoid the need for additional handling labor or additional handling devices. This should be considered for all phases of container handling (e.g., packing, storing, shipping, unpacking, return shipping).

Material Selection: The following is an overview of some materials typically used for reusable packaging and containers. Also included is an overview of some manufacturing techniques used to manufacture reusable containers. The materials and manufacturing techniques included are not all-inclusive. Those materials included are only some of the more commonly used and in most cases, the most commonly recycled materials.

High Density Polyethylene: Some of the most widely used reusable container materials are high density polyethylenes (HDPE). HDPE’s offer good to excellent stiffness thru an excellent temperature range (-40 degrees F to + 150 degrees F). HDPE is also a commodity material readily available and easily recycled.

High Impact Polypropylene: This material is more durable than polyethylene, but not as stiff. Nor does it have the low temperature range usefulness that polyethylene has; it

has a tendency to crack at impacts below 0 degrees F. Although recyclable, polypropylene recycling is not as widespread as HDPE and some other materials.

High Impact Polystyrene: High impact polystyrene is another extremely stiff material that has excellent compressive load strength and good temperature range usefulness. However, polystyrene is more brittle than polyethylene and polypropylene and has a tendency to crack under high impact. It is also readily attacked by solvents. Polystyrene is used most often for shelf storage boxes, container inserts, and trays, rather than for shipping containers. It also holds it original shape after molding better than polyethylene and polypropylene. Polystyrene is easily recycled.

Plastic Container Manufacturing: The above plastics are some of the more commonly used plastics for reusable containers. In many applications, these materials can be designed and manufactured into very rugged and durable containers. Although this guide does give general descriptions of manufacturing techniques, the package designer should work with plastic container suppliers to identify and select the most environmentally-sound, cost effective and durable container design and manufacturing technique. The following are general descriptions of some of the more common manufacturing techniques:

- Injection molding: This is the most common method or process for manufacturing plastic containers. It provides design flexibility and can produce fine details and uniform wall thickness's. Injection molding tooling is often very expensive. A variation of injection molding, structural foam molding, requires less expensive tooling. The process involves blowing nitrogen gas through plastic in a mold. This produces a container wall that has bubbles or voids, but still very stiff. This technique offers stiffness with less material.

- Rotational molding: In this process, liquid (melted) plastic is formed into a container within a female mold, while the mold is rotated around two axes and heat is applied. Rotational molding is often used for larger containers that require lots of material. Tooling is moderately to very expensive.

- Vacuum forming: There are three types of vacuum forming; straight, pressure molding and stretch forming. Vacuum forming is generally used for containers that have simple configurations and for lower container volumes (number of units), where higher priced tooling and techniques can not be justified. Vacuum forming is also generally limited to smaller containers and containers where dimensional tolerance and consistency is not critical. Tooling for vacuum forming is relatively inexpensive.

High Density Cushions: To provide durability and adequate shock protection over a long reuse life, reusable cushions are usually made of high density foams. The most common high density foam material used is expanded-polyethylene. Densities of 32 kPa (4 lbs/cubic ft) or greater are often used. This material can be molded and hand or machine fabricated. It is also commonly available and recyclable. Other high density foams sometimes used are polypropylenes and some polyurethanes.

Corrugated Fiberboards: One of the biggest concerns with reusing corrugated fiberboard containers is with top-to-bottom compression strength. The compression strength, after repeated uses and exposure to changing temperature and humidity conditions, quickly weakens. A few alternatives to maintaining or increasing compression strength include;

- adding more fiber thru thicker linerboards and mediums or by using a multi-wall construction (i.e., double or triple wall)...this adds to material cost and increases the container weight and size, adding to transportation costs;

- using cross-linked fibers...this paper production technique redirects some wood fibers to run 90 degrees to the paper's machine direction, resulting in more fibers running vertically up and down on the linerboard of containers;

- using high-pressure forming...this paper production technique involves extending the point of pressure on paper fibers, to more tightly compress them, resulting in a denser sheet of material;
- using multiple or bonded mediums...this paper making technique is based on laminating (usually with corn-starch adhesives) two or more layers of medium together and then sandwiching the material between cross-linked or pressure formed liner boards; and
- using chemically treated fibers...this paper making process involves the bonding of fibers with corn starch, glues, adhesives, PCB's, heavy-metals, and plastic or urea-formaldehyde resins; the use of chemically treated fibers is NOT RECOMMENDED, because many of these additives may make recycling difficult or may contaminate pulping systems during recycling.

5.3.3 Evaluation Process for Reusable Programs

The following is a guide for evaluating reusable programs. It includes some suggested steps or a process to use. Also included is a guide for general cost analyses that can be used for comparing costs of reusable and disposable packaging programs.

5.3.4 Process Checklist

Physical Characteristics: Determine the physical characteristics of the item to be packaged and the packaging and handling requirements.

- Is there a reusable or disposable package on a similar product or part? If so, gather all applicable information and determine if the package design or actual packages can be reused for the proposed or new product or part program.
- What are the dimensions and weight of the part or product?
- What is the handling or shipping environment for the part or product?
  - Determine the physical logistics and number of handlings.
  - Identify special shock, compression or environmental hazards.
  - Identify special handling or access requirements for the part or product, during packing, use and/or unpacking.
  - What is the planned shipping, disbursing, and/or manufacturing kanban sizes or quantities?
- What level of shock and vibration protection is required (i.e., what is the fragility level of the part or product)?
- Are there other protection requirements (e.g., ESD, humidity, cleanliness, etc.)?

Preliminary Designs: Design disposable and reusable packaging alternatives, based on the above requirements. In addition, consider the following:

- disposability/recyclability
- easy use,
- cushion and material durability,

- container cleaning,
- component replacement,
- other uses, and
- shipping mass, size and density.

5.3.5 Cost Analysis Guide

Estimate Unit Material Costs: Estimate unit costs or the per piece purchase cost of the proposed designs. Several supplier quotations may be appropriate for getting a good estimate.

Obtain Product Volumes: Obtain plans or estimates of manufacturing or shipping volumes (i.e., quantity vs. time, or manufacturing/shipping schedules) for the part or product to be packaged.

Estimate the Pipeline: Estimate the number of reusable items in the pipeline. Analyze all portions of the pipeline, including frequency of deliveries, transit times, process times, inventory buffers, kanban sizes, return shipping times, return shipping frequency, and any contingency buffers. The number of reusable items in the pipeline will change if the product volumes change. The cost calculation below assumes the pipeline quantity remains the same. A more complex cost calculation is needed, if product volumes and pipeline quantities change significantly over time.

Determine Reuse Life: From design or prototype testing information, estimate the reuse life of the reusable item. How many reuses will the item have?

Estimate Packaging Quantity: From the above information, estimate the total number of disposable or reusable items needed for the life of the part or product program.

Estimate Material Costs: Multiply the unit cost estimate times the quantity estimate. This will be your packaging material costs. Add to this number any material or component replacement costs needed to repair or refurbish the reusable item.

Example :

Disposable = ($/unit) (part volume)/(parts/unit)

Reusable = ($/unit) (# units in pipeline) (# reuse lives)

$$\text{(integer value) \# reuse lives} = \frac{\text{(part volume)/(parts/unit)}}{\text{(\# units/pipeline or cycle)(cycle life)}}$$

Assumptions:

1) Volume increments (e.g., weeks, months, etc.) are constant thru the life of the program;
2) Pipeline quantities or times are constant;
3) # of reuse lives calculated must be rounded up to the next whole number; this reflects total units purchased or the effect of using some units less than their total expected life.

Estimate Return Costs: Estimate handling and shipping costs to return reusable items.

Estimate Shipping Costs: Estimate the cost to ship packaged items in reusable and disposable packages. If there is no weight or size difference between the reusable and disposable designs, shipping costs may be ignored.

Estimate Labor Costs: Estimate labor to use the disposable and. reusable designs. Often there will be no difference, if the package designs are similar. Also estimate administrative and repair or cleaning costs associated with the reusable package

Estimate Disposal Costs: Estimate disposal costs associated with both the reusable and disposable containers or packaging items.

Estimate Equipment/Tooling Costs: If not included somewhere else, estimate special equipment and tooling costs associated with both the reusable and disposable designs.

Estimate Other Costs: Identify and estimate any other costs associated with the disposable or reusable designs. These may include things such as implementation costs, inventory carrying costs, part or product quality-related costs (e.g., scrap & rework), and tax impacts or benefits.

Cost Comparison: Compare the estimated costs for both the reusable and disposable designs. Select the reusable design, if its total costs are lower than the disposable design costs. The reusable design may also be selected, if its costs are higher than the disposable, yet provides an environmentally-sound solution to a significant disposal issue. Before a higher cost reusable design is implemented, other design alternatives should be investigated, to ensure there is not a more cost and environmentally effective design.

The cost comparison should be made across the entire life of the product or part program. The comparison should be structured as an out-of-pocket cost comparison and should include net present value and internal rate of return analyses. Any local business case requirements should also be included in the analysis and comparison.

6.0 Pallet Reutilization

6.1 Abstract

The Pallet Reutilization section provides recommendations on some of the main alternative methods to improve the control of all pallets used in IBM to maximize their reuses and thereby minimize disposals. A checklist is provided to help to identify the size of the opportunity and to aid in the economic justification of some of the alternatives.

The intent of this program is to eliminate the inferior pallets entering our distribution system to enhance reuses of our existing pallets and then to further enhance those reuses through effective audit & repair programs. For pallets or components which become unusable, additional alternatives for disposal other than into the trash are identified. Our efforts can also extend to the improved processing of our pallets by our customers through possible use of pool pallets which could provide regional return capabilities for further reuses. IBM could also initiate packaging collection systems from our customers for recycling and reuse. There is also the possibilities of a no pallet distribution system, such as with slip sheets, discussed.

6.2 Purpose

The purpose of this section is to identify the ways IBM can improve its pallet programs and reduce the number of pallets that it directly or indirectly contributes to the solid waste stream. In the past this has usually meant being thrown into the trash and finishing in landfills or at incinerators. Both of these disposal methods have be identified as current and future problems. Some of the alternatives to improve our pallet controls, usage and reuse are:

- Pallet Standardization & Specification.
- Implementation of proper pallet conformance efforts.
- Methods for establishing pallet revitalization programs.
- Alternative outlets for unsalvageable pallets.
- Identification of other alternative pallet programs.
    - Using of pool pallets to enhance returns & reuses.
    - Possible return from customers for audit, repair & reuse.
    - Consider a no pallet distribution system (ie slipsheets).

These methods can improve the number of potential pallet reuses and thereby minimize the number entering the solid waste stream. We would also be conserving our natural & energy resources with opportunities to turn potential scrap into useful products. The intent is to provide the necessary tools and guidelines to assist in implementation of these proposed methods at IBM facilities.

6.3 Scope

The Pallet Reutilization section will address the various methods that can be implemented to improve our pallet controls and utilization to extend the useful life of our pallets and then identify ways to most effective ways to dispose of the nonsalvageable pallets or components from an environmental and business basis. This will encompass all of the following areas:

- Pallets from our component & raw material suppliers.
- IBM Pallet specification & conformance methods.
- Pallet audit & revitalization programs.
- Pallet & component recycling opportunities.
- Pallet pool leasing opportunities.
- No pallet distribution systems possibilities.
- Pallet returns from customers for reuse.

6.4 Introduction

Pallet Reutilization is an approach where a number of different methods can be used to obtain maximum utilization for each pallet that enters the distribution system. The intent is to reduce the number of pallets being disposed of into the solid waste stream. This section of the Design Guide will address some different alternatives and provide a CHECKLIST for the development and maintenance of “pallet reutilization” programs.

“Why should IBM implement a Pallet Reutilization Program?” Pallets comprise a significant portion of our current solid waste on a weight or volume basis. Some of the reasons that IBM should be involved in such an effort that will be addressed in this section are:

- Conservation of Natural Resources & Energy.
- Reduce Solid Waste Inputs & Minimize the Current Crisis.
- Prolong Landfills Useful Lives & Help Control Future Costs.
- Improved Protection of the Environment.
- IBM is an Environmentally Responsible Company.

- IBM Should Be a Positive Industry Environmental Leader.
- Potential Improved Customer Acceptance & Approval.
- Potential Process Improvements & Reduced Disposal Costs.

It is possible to have a successful pallet reutilization program that reduces our negative effects on the environment without including all of the following steps. However, to maximize the overall benefits of such a program, we recommend that each of the following steps at least be evaluated, and where shown to be advantageous be implemented:

- Pallet Standardization.
- Pallet Requirement & Conformance Programs.
- Pallet Revitalization.
- Pallet Recycling Alternatives.
- Pallet Disposal Priorities Recommendations.
- Overall Effects on the Environment.

6.4.1 Pallet Standardization

One of the key 'first steps that we recommend is that IBM require the use of our existing standard size and design pallets as the only acceptable pallets for normal use. This includes all incoming shipments on pallets from our suppliers and other IBM sites and on our outbound shipments to other IBM sites, our customers &/or dealers. One of the best ways to minimize the number of pallets used in the IBM system is to insure that all entering pallets are of the proper size and design to be damage free and usable throughout our entire processes.

The standard IBM USA size pallets are:

- IBM Standard 40" x 48" full pallets
- IBM Standard 40" x 24" half pallets
- IBM Standard 20" x 24" quarter pallets (to be added shortly).

Some of the ways Pallet Standardization can help IBM in its efforts to improve its impact on the environment and improve its systems are:

1. Increase the pallets potential reusability.
   - Can increase the quality of our incoming pallets.
   - Can reduce the number of repalletizations for damaged & improper size pallets.
   - Can enhance the potential reuse of incoming pallets.
2. Increase the quantity demands per pallet design.
   - Can increase the availability & potential CFM deliveries.
   - Can increase pallet vendor competition & lower costs.
3. Aids in the enforcement of pallet requirements.
   - Can assist suppliers in obtaining quality standard pallets.

- Can lead to combined volumes of IBM & suppliers pallets.
- Can reduce proper pallet costs to our suppliers.

4. Aids in developing pallet revitalization programs.

- Fewer different pallets for vendor sortation & control.
- Better potential use of materials between pallets in repair.
- Higher potential volumes can minimize per pallet costs.

In summary, by implementing a pallet standardization program the quality of the incoming pallets can be enhanced and maintained which will reduce the number of pallets that have to be replaced to complete just the first cycle. This can also reduce the number that can be reused for further shipments. By controlling the sizes & designs, we can be assured that the incoming pallets will be able to be efficiently processed through the IBM distribution system. By the inbound pallets being the same as the outbound there is an automatic demand which will encourage further reuses. With IBM and all of its suppliers using the same pallet designs, there are potential volume advantages which can result in better availability, lower costs and such special advantages such as CFM or JIT delivery possibilities. This standardization can also be very beneficial in the pallet revitalization programs and other alternatives which will be discussed later in this section.

6.4.2 Pallet Requirement & Conformance Programs

It is equally clear that if we do not properly inform our suppliers that we will only accept the standard IBM design pallets, we are not likely to make much progress. Further, we must effectively audit for the use of the proper pallets and reinforce our requirements when violations occur if we are going to improve.

Therefore, we recommend that all sites utilize the Corporate Specification for Packaging and Material Handling (GA21-9261-xx) which is obtainable from Mechanicsburg Publications. We recommend that this document be supplied to every current site supplier and to any new suppliers. It would be most beneficial if it was accompanied with a letter from the site stressing key areas of special interest to the site such as the use of the proper pallets. Since shipments from any IBM site are considered supplier shipments, this document replaced the similar Interplant Packaging & Handling Specification in 1988. Therefore they are also covered by this document.

Now as to recommended Conformance procedures, Appendix C of this Supplier Specification displays an *IMPROPER PACKAGING REPORT* (GX-21-9263-2) which we recommend. It can also be ordered from Mechanicsburg Publications. These forms should be filled out by the Receiving Department and forwarded to Purchasing &/or Packaging Engineering so that the buyer can communicate with the supplier about the violations to insure that they are resolved on future shipments. This will be very little extra work for the Receivers and could save on future repalletizations etc. (It takes much more time to repalletize loads than to fill out a form.) In addition, these violations will likely continue until someone takes appropriate action with the supplier. The same hold true for other IBM plants but may require the assistance of the Packaging or Distribution Engineering groups at both sites to resolve.

In summary, by specifying our pallet requirements to our suppliers and following it up with proper audits and appropriate actions with the suppliers to correct violations, the number of inferior and nonstandard size & design pallets will be reduced and eliminated. This process can also improve the quality of the pallets entering our system and reduce

the number of repalletizations and increase the number of pallets that will be usable for further outbound shipments. In so doing, there will be fewer new pallets entering the system that will eventually have to be disposed of in the solid waste stream. As we will see in some of the following subsections, this standardization and conformance will be very helpful in some of the other alternatives that will be considered such as pool pallets and pallet revitalization programs.

6.5 Pallet Revitalization.

In the past, when the pallets became worn, damaged or otherwise of questionable quality, in many cases we used to throw them into the trash. In many cases the pallets that we received were of such poor quality that they had already suffered damage in transit to IBM and had to be replaced with one of our pallets. Similarly, there have been many cases of nonstandard size &/or design pallets which could not effectively be handled in our internal distribution system and had to be replaced with a standard IBM pallet. Not only did this cost IBM for the materials, labor, facilities and space to do this repalletization which further delayed the materials enroute to manufacturing or storage, but also added another pallet to the system that would eventually have to be destroyed.

Similarly, in the past if there was any question as to whether a standard pallet was acceptable for reuse, it was usually discarded rather than spend the time and energy to fully evaluate it for further use.

All of these situations plus our normal wear and tear on our pallets amounted to a significant portion of our solid waste being comprised of pallets. Some of our sites have already identified this problem and have implemented corrective actions which the rest should likely follow.

This section will identify how to set up an effective “Pallet Revitalization” program where questionable, damaged, or all pallets can be audited, sorted and repaired to make them available for reuse.

The first question to ask is whether your location currently has to buy any new IBM standard pallets. If so, and you currently have to dispose of any incoming pallets, it would be a good idea to consider setting up a Pallet Revitalization program.

The second question is where can I find such a vendor to do this work? This effort does not require a very high level of technical training or much complicated or expensive fixtures & tools. It is therefore easy to see that almost any interested organizations can qualify. Some of the possible organizations to consider are:

- Current local or regional new pallet supplier.
- Other local or regional new pallet suppliers.
- Possible local or regional pallet repair companies.
- Handicapped and Minority Vendors.
- Other local or regional trash or recycling companies.

The next step is to discuss these considerations with the above possible vendors through the Purchasing organization and establish a set of requirements. This can vary according to the sites and the resources of the different vendors. The standard pallet specifications are available in a form to be presented to the competitors for their review and bids.

There are several such pallet revitalization programs currently operating at different IBM sites. The following are what most suppliers offer:

- Pickup all pallets.
- Inspect & sort the pallets.
- Repair pallets as necessary or possible.
- Dispose of unusable pallets or components.
- Sell the approved pallets to IBM or suppliers.
- Deliver pallets to IBM or suppliers.

The revitalization vendor can take good components from a damaged and nonrepairable pallet to repair salvageable pallets. By limiting our pallet designs we enhance the possibilities of easier interchangeability and reuse of the components. Every reused component is that much less that would otherwise enter the solid waste stream.

The major change from the current programs that we would propose is that the unusable pallets and/or components be disposed of through some of the recycling alternatives outlined in the "Recycling" section which follows shortly. This can further reduce the amount of such materials entering the solid waste stream.

The pallets can either be given or sold to the supplier and then the good pallets can be purchased back. The net effect is that the pallets are usually about 1/3 to 1/2 the cost of new pallets. Some sites may do their own inhouse pallet inspections and the costs for space, manpower & equipment may exceed the expense outside where a better opportunity for repairs also exists.

In summary, rather than discard used, worn, questionable & damaged pallets into the trash, we can setup vendors to audit and repair these pallets for reuse by IBM and its suppliers. Pallet revitalization programs offer such benefits as:

- Conserve Natural Resources.
- Improve Protection of the Environment.
- Extend landfills useful lives.
- Help control future landfill costs.
- Help reduce Solid Waste Crisis pressures.
- Offers possible work for minority &/or handicapped vendors.
- Possible reduced costs for pallets.
- Possible reduced costs for solid waste disposal.

6.5.1 Other Pallet Recycling Alternatives

There are a number of reasons why a pallet may not be usable in IBM and appear to be a candidate for the trash. If we are involved in a pallet revitalization program there may be components of this pallet even if it is not the proper size or design that could be used to repair a damaged pallet so that it could be reused. However, sooner or later there is going to be something that we can not make use of in our pallets. We would still

like to minimize the amount of this material entering the solid waste stream even though it may be a useful ingredient in the incineration of other scrap materials.

The following are outlines on how the different recycling alternatives can be used to reduce the negative impacts of IBM's pallets on the solid waste problem while offering many added benefits to IBM & its suppliers.

1. **Non Pallet Revitalization Alternatives**

   In some instances, there may not be sufficient pallet volumes, interested vendors or a new pallet need to justify a pallet revitalization program. We would still recommend that we attempt to seek out other alternatives for the pallet disposal. Some other wood suppliers or pallet repair vendors might be interested in paying for them or taking them for free. Others may take them for free if delivered to them which still may be cheaper than paying to dispose of them in landfills and would definitely be better for the environment.

   Pallet vendors and wood suppliers or repair operations may be able to utilize all or much of these pallet materials for positive alternatives which would delay or eliminate their entering the Solid Waste Stream. IBM could thereby reduce the amount of such materials we were adding to landfills and incinerator inputs. We could be helping to reduce the environmental problems and still could come out ahead Ii-nancially by avoiding some or all of the transportation costs as well as the dumping or tipping fees.

2. **Shredding of Pallets for Disposal**

   For pallet components that could not be used to repair other pallets, and for pallets which no interested vendor could be identified, there is at least one other alternative prior to the trash. There are a few vendors who are now shredding pallets into different sized fibrous materials. These materials are used for such worthwhile and varied uses as:

   - Industrial fuel and charcoal furnish.
   - Animal bedding and/or poultry litter.
   - Soil amendment and/or mulch.
   - Pulp and particleboard furnish.
   - Possible use in recycled paper.

   Here again, IBM can help the environment and still possibly reduce its solid waste disposal costs. If these fiber can be used in producing recycled paper, they may be able to reduce any exposures to deteriorating strength due to the decreasing fiber length from reprocessed corrugated.

   The information on the pallet shredding is from a report by Virginia Polytechnic Institute & State University called "Properties of Shredded Wood Pallets" by Marshall White and John A. McLeod III (Bulletin # 12). The National Association of Wood Pallets & Containers Association identifies companies involved in this process in "Appendix K. Processors of Pallets" on page 159.

6.5.2 Summary of Advantages & Savings through Recycling.

The following are some of the potential savings activities &/or systems enhancements which Pallet Revitalization programs and Recycling efforts can provide in addition to helping the Environment:

- Repaired or reapproved pallets cost about 1/3 to 1/2 of new pallets.
- Reduced pallet costs from Pallet Revitalization programs can encourage suppliers to conform to our pallet requirements. This can reduce repalletizations & amount of unreusable solid waste.
- Shows IBM to be a good Corporate Citizen and is providing leadership and a commitment to protecting the environment at NO cost.
- Provides significant improvements in resource management.
- Reduced costs on dumpster rentals to hold pallet volumes.
- Reduced costs of Inspecting and sorting for reusable pallets,
- Elimination of pallet disposal transportation fees.
- Elimination of pallet related tipping or dumping fees.
- Avoiding anticipated future increased landfill tipping fees.
- Possible passing on to IBM of some of suppliers' costs savings.

6.5.3 Customer Assistance

IBM can also provide assistance to our customers in the disposal of pallets on which we ship our finished goods or parts to them. This is of course much harder to accomplish. One of the options is to use a National or International Pool Pallet program where they can send the pallet to a local/regional outlet where it will be made available for reuse. Another alternative which IBM is considering is the development of packaging material collection systems to remove the burden of disposal from the customer and insure that we minimize the amount entering the solid waste stream. This can be accomplished through reuse, recycling or even the pool pallet system.

Thus IBM can assist its customers in the proper disposal of the pallets that we send to them to completes the distribution cycle from "cradle to grave".

6.6 Pallet Reutilization Programs Implementation

There is a Packaging Reutilization Checklist in "Appendix I. Pallet Reutilization Checklist" on page 125 along with detailed recommendations of what to do and from whom what key information should be available etc. This subject will not be addressed specifically in this section of the Environmental Design Guidebook.

6.7 Pallet Disposal Priorities Recommendations

There are a number of possible actions that can be taken to handle the disposal of pallets. The following section will provide recommendations on the priorities by which these alternatives should be pursued. This is in a descending order of recommendation order.

- Have pallets repaired, inspected and returned for reuse.
- Return leased pallets to outlets for credit & their maintenance.
- Sale to pallet manufacturers or repair operations.
- Sale to wood product manufacturers or repair operations.
- Sale to pallet reprocessor who grinds up pallets for other uses.
- Free to pallet manufacturers or repair operations for pickup.
- Free to wood product manufacturers or repair operations for pickup.
- Free to reprocessor who grinds up pallets for other uses, for pickup
- Send to pallet manufacturers or repair operations free for use.
- Send to wood product manufacturers or repair operations free for use
- Send free to pallet reprocessor who grinds up pallets for other uses

6.8 Overall Effects on the Environment

Pallets obviously comprise a significant portion of IBM's contribution to the solid waste stream. It is our contention that if IBM imposes the requirement that all incoming and outgoing pallets must be of the standard IBM sizes and designs and obtain compliance from our suppliers that there will be a significant reduction in inadequate, nonusable sizes or designs, and broken pallets which would require replacement. These higher quality pallets would also result in a higher number of pallets good enough for reuse being available for our outbound shipments. This would therefore reduce IBM's need to add additional pallets to the system that would eventually have to be disposed of into the solid waste stream or through recyclers. Therefore this standardization approach can result in a significant reduction in the number of pallets IBM might have to purchase to add to the system.

Next, by taking worn, damaged, questionable &/or all used pallets and having them audited, sorted and repaired as needed by a qualified vendor, most of these pallets could be converted from probable scrap to useful pallets again at less than new pallet costs. Therefore, IBM would reduce the amount of pallets entering the solid waste stream and reuse them in place of additional new pallets.

When a pallet or a component can no longer be used in this process it was usually thrown into the trash for disposal in the solid waste stream. Now that there are companies who will take these materials and grind or shred them up into various sizes of fibrous materials which can be used in place of other new materials we can take yet another positive step forward. One of the potential uses for this fibrous materials could

be in the manufacture of recycled paper for corrugated. Here these fibers could possibly overcome the concern about gradual decreases in the strength of the recycled paper as the fiber lengths get shorter each time it is recycled. An infusion of some of these fibers could possibly remedy this exposure while taking this once scrapped material and utilizing it to enhance the recycling of another important commodity.

Another major area of exposure that IBM wishes to attempt to remedy is the processing of IBM packaging materials by our customers. We may still impose a significant negative impact on the environment if all of the pallets that are sent to our customers with our finished goods and parts end up in the trash. One way to help with this both in IBM and for the customer would be the possible use of a National or International Pool Pallet system where there could be local or regional outlets where these pallets could be returned for reuse. Another consideration is IBM setting up its own packaging material collection system where our packaging would be sorted and processed for reuse or through recyclers. Both of these programs could result in a further significant reduction in the overall amount of solid waste that our pallets might comprise all over the USA and worldwide.

In summary, pallets can change from a significantly negative impact on the environment to an insignificant one in a very short period of time. It only takes the incorporation of the positive steps that have already been made and expanding them to all IBM sites and then improving them to include all aspects of their use and disposal. Finally by working to reduce the number of pallets that our customers may dispose of into the solid waste stream IBM can make a giant step in leading the way in reducing the negative impact of packaging on' the environment.

6.9 Recommendations

1. Pallet standardization programs should be enforced at all locations for incoming shipments.
2. All locations should consider implementation of a pallet revitalization program if only to provide IBM suppliers with good quality, low cost pallets.
3. Efforts should be made to dispose of pallets through a refurbisher rather than discard as solid waste.
4. IBM should impart its influence with associated pallet refurbishers to convert scrap pallets into useful resources using chipper or shredder technologies.
5. Consideration should be given to potential return and/or refurbishment programs when using specialty machine shipping pallets.

7.0 Customer Disposal of IBM Packaging Materials

7.1 Introduction

Because of the increased awareness of solid waste disposal issues, the delivery and installation of IBM products can cause a concern with IBM's customers. That is, what should be done with the discarded packaging material? The boxes, cushioning, film, pallets, strapping, etc., which allowed the products to arrive damage-free, once unpacked, can be perceived as a contribution to the solid waste problem.

This perception is, of course, related to the amount of post-consumer packaging material. Small systems, resulting in a few boxes and some cushioning are not usually seen as a problem. In fact, many customers retain these materials for later use (e.g., relocation of the system).

Regardless of the size of any particular system, the overall volume of products IBM delivers worldwide does produce a considerable amount of post-consumer packaging material which becomes part of the solid waste stream. Understanding this, the IBM packaging community has an obligation to minimize the concerns our customers may have with packaging material disposal to the extent possible.

7.2 Package Design

The obvious place to begin an assessment of packaging as a disposal concern is in the area of design.

Several trade associations (IoPP, etc.) and environmental task groups have developed guidelines for packaging design which they consider effective as a means to solid waste minimization. While none of the guidelines available provide product specific or "cookbook" detail for package design, they do present a well considered approach to packaging requirements development, which a packaging designer can translate into more environmentally friendly products.

The Coalition of Northeastern Governors (CONEG) Source Reduction Task Force has developed and published a set of guidelines for preferred packaging practices. These guidelines are viewed as a first step in an awareness approach to packaging source reduction. The following is an excerpt from 'the final report of the Source Reduction Task Force.

"An overriding barrier to source reduction identified by the Task Force is the inadequate consideration given by industry, government and consumers to the solid waste manage-

ment impacts of packaging. Package design and production decisions by industry, regulatory and procurement policies of government and purchasing decisions of consumers -- all have contributed to the mounting garbage crisis confronting the Northeast region. Yet if each of these players better understood the relationship of their actions to the management of solid waste, the generation and environmental impact of packaging could be reduced.

To be most effective, source reduction initiatives must be based upon a system of quantifiable goals and standards. Developing such a system will require considerable thought and a thorough examination of the many issues involved in assigning measurable, numerical goals and timeframes to achieve reductions in the generation of packaging waste.

In the meantime, until these quantifiable goals can be established with some level of confidence, actions by industry, government and consumers must at the very least be guided by some basic, commonly shared notions as to what does and what does not constitute preferred packaging practices from the standpoint of source reduction.

Preferred packaging guidelines are an essential first step to focusing the attention -- of the product designer, the packaging professional, the government regulator and the consumer -- on the opportunities to reduce packaging-related waste. In addition, preferred packaging guidelines should serve as a foundation for the development of quantifiable goals and standards."

As implied in this excerpt, the next step in packaging source reduction will be quantifiable standards to which industry must perform. Knowing this, the IBM packaging community must continue its efforts to produce packaging designs which include packaging disposal as an important consideration.

7.3 CONEG Preferred Packaging Guidelines

ASSESSMENT OF PACKAGING PRACTICES

OVERVIEW

Packaging provides certain functions in the distribution system. These include:

1. Product Protection
   - in the transportation system
   - against tampering and pilferage
   - through maintenance of product integrity, quality and safety
2. Consumer Information
   - visual inspection
   - product information, directions, ingredients
   - product brand identification
   - labeling requirements by regulation or statute
3. Consumer Convenience or Acceptance
   - retailer convenience in warehouse storage or stocking shelves

- consumer needs or acceptance of product
- storage, handling, opening and dispensing convenience and compatibility with consumers' habits and lifestyles.

4. Attractiveness

- positioning in marketplace
- physical attractiveness of package related to product differentiation and marketing techniques

The health, safety, product integrity and regulatory requirements addressed by functions of product protection and consumer information are considered to be priority needs. However, efforts should be made to fulfill these functions through preferred packaging practices. Regulatory and statutory requirements that increase the volume of packaging should be reviewed through the Northeast Source Reduction Council to determine present day applicability and the need for amendment or repeal. The objective of consumer convenience/acceptance and attractiveness are considered less compelling for packaging and therefore, present the greatest opportunity for source reduction. The packaging associated with consumer convenience or acceptance may be minimized additionally through an aggressive education program.

To assist the Northeast states in managing solid waste, industry should begin to assess its packaging practices. The following packaging practices are listed in order preference:

1. *No Packaging*

   The need for any packaging of a product should be evaluated in the research and development stages and prior to introduction in the marketplace.

2. *Minimal Packaging*

   Alternative methods of product and packaging design should be pursued to minimize packaging material required.

3. *Consumable. Returnable or Refillable/Reusable Packaging*

   - Consumable packaging is eliminated in the process of using the product so that no packaging remains.
   - Returnable packaging is a container returned to a business or industry for reuse and redistribution.
   - Refillable/Reusable packaging is a container or package that may be refilled by a customer or consumer from bulk or larger size containers.

4. *Recyclable Packaging/Recycled Material in Packaging*

   - A package is considered to be recyclable if there is an economically viable and widely available collection, processing and marketing system for the material.
   - Recyclability of a package is maximized when that package is made of a homogenous material or of materials that do not need to be further separated prior to introduction into the recycling process. Labels, closures and seals should be made of a like or similar material to the primary package.
   - Recycled content should be made up, to the greatest extent possible from post-consumer waste material -- a waste product or material generated by a business or consumer which has served its intended end use and which is discarded for

disposal or recycling. The use of in-plant or mill scrap alone is not sufficient to be considered a recycled content package.

GUIDE QUESTIONS

This guide can be used by industry to evaluate packaging choices. Without compromising health, safety or product integrity standards or violating statutory or regulatory requirements, can the following preferred packaging practices be implemented?

Toxics in Packaging

1. Are there toxic materials or agents in the content of the package?

   If toxic materials or agents are present:

2. Can non-toxic agents or materials be substituted?

3. Can the toxic agents or materials be eliminated otherwise?

Packaging Elimination, Reduction and Reuse

1. Can the package be eliminated?

   If the package cannot be eliminated:

2. Can the packaging be minimized through:

   - product design changes?
   - packaging design changes?
   - use of new or different types of lower volume packaging?
   - lightweighting with a reduction in volume?
   - elimination of secondary packaging or wrapping material?
   - decreasing size of packaging to product ratio?
   - other volume reduction?

3. Can the package be made so that it is eliminated in using the product?

4. Can the package be made returnable for reuse and redistribution?

5. Can the package be made to be refilled by a customer or consumer either from bulk or larger containers?

6. Can the package be made to have an identifiable and valuable consumer reuse for another purpose?

Packaging Recyclability

1. Is the packaging recyclable? (Packaging is recyclable if there is a widely available, economically viable collection, processing and marketing system for the material.)

   If the packaging is not presently recyclable:

2. Can the packaging be made easier to recycle by composing it predominantly of a single material for which an economically viable collection, processing and marketing system could be developed?

3. If the packaging is made of more than one material, can the non-homogeneous material be eliminated?

4. If non-homogeneous materials cannot-be eliminated, can they be made to be removed easily so as not to prevent, interfere with or add cost to the recycling process?

Recycled Content of Packaging

1. Does the package contain the maximum feasible amount of post-consumer material (i.e., waste product or material generated by a business or consumer which has served its intended end use and is discarded for disposal or recycling)?

   If additional post-consumer material cannot be added to the packaging:

2. Can additional in-plant or mill scrap be added to the packaging?

3. Do purchasing specifications hinder the use of recycled materials in the packaging?

4. Can purchasing specifications be modified so as to encourage the use of recycled materials in packaging?

7.4 Customer Recycling

The United States Environmental Protection Agency has established a national goal of recycling 25% of the solid waste by 1992. Because of this, and because of increasingly limited landfill capacity, many states have enacted legislation requiring the establishment of recycling programs for certain communities and municipalities. These regulations generally stipulate a recycling percentage, a timeframe, and are based on (demographic) population.

Pennsylvania (the one-time location of CCPE) established a recycling act in July 1988. As of January 1990 the implementation can be characterized by the following statistics:

Total population: **2,600,285 (22%)**
Total programs: **245**

COLLECTION/ PROGRAM	NO. COMM.	PERCENT	MATERIALS	NO COMM.	PERCENT
Municipal Collection	99	40	Aluminum	180	73
Private Collection	141	58	Corrugated	44	18
Cooperative Collection:	5	2	Glass	180	73
			Magazines	1	0
Mandatory	109	44	Mixed Paper	6	2
Voluntary	135	55	Newspaper	205	84
			Office Paper	9	4
			Plastics	51	21
			Tin/Steel Cans	42	17
			Yard waste	17	7
			Three or more materials	164	67

What is seen here are the various types of solid waste materials involved in a recycling program, and also the point that 55% of the programs are voluntary.

The voluntary aspect of many recycling programs provides an opportunity for IBM Packaging to encourage customer participation. One good method of doing this, not mentioned in the CONEG Preferred Packaging Guidelines, is to ensure that IBM's packaging materials, which are recyclable, display appropriate markings (See "The Re-

cycling Symbol" on page 36 and "SPI Plastic Bottle Coding System" on page 40) proposed as convention by certain U.S. packaging material manufacturers and trade associations.

This can provide the customer with confidence that IBM's packaging is designed to be recyclable, and will also contribute to efficiencies in the necessary separation of materials for the various recyclers.

Appendix A. Packaging/Environmental Legislation

A.1 Massachusetts

An initiative has been drafted by Massachusetts PIRM which would eliminate after December 31, 1995 any packaging which does not meet the following conditions:

1. Can be reused at least five times,
2. There is proof that at least fifty or more percent (by weight) of the packaging is recycled material,
3. There is proof that at least thirty-five percent of each of the materials in the packaging is being recycled (The recycled contribution rises to fifty percent after the year 2000.)

A.2 Vermont

Legislation is expected which will tax packaging if:

1. It is not reusable,
2. Fifty percent of its material is not recyclable.

A.3 Rhode Island

No later than two years after passage, no packaging may be sold or used which contains more than minute portions of lead, cadmium, mercury, hexavalent chrome in any part of the packaging including inks, dyes pigments, adhesives, etc..

Maximum total content of the above toxins cannot exceed the following:

1. 600 parts per million - up to two years after passage
2. 250 parts per million - during the third-years after passage
3. 100 parts per million - forth and following years after passage

A.4 Wisconsin

A bill aimed primarily at plastic packaging would require the elimination of rigid, clear plastic covers (among other plastics) if a recycling market is not demonstrated within three years.

A.5 City of Chicago

A city Alderman has reported his intention to introduce a requirement that by 1992 all packaging sold in Chicago be recyclable.

A.6 Minnesota

In April, 1988, the State of Minnesota approved a law (Statute S.F. No. 2131) prohibiting state and local (i.e., counties, towns, cities, and schools) government units and vendors from purchasing and using chlorofluorocarbon-processed packaging materials. The law specifically prohibits CFC-11, CFC-12, CFC-113, CFC-114, and CFC-115. The law was effective on January 1, 1990.

The law does provide for temporary exemptions. In November, 1989, IBM requested the Minnesota Pollution Control Agency to exempt IBM from the requirements of the law, until January 1, 1991. With the request, IBM committed to eliminate the use of all CFC-manufactured packaging from our products, by the end of 1990.

A.7 Ontario, Canada

The Legislative Assembly of the Province of Ontario enacted a law prohibiting ozone depleting substances. Bill 218, an amendment to the Environmental Protection Act, prohibits the making, using, transferring, displaying, transporting, storing or disposing of any packaging, wrapping, or container that is made in a manner that uses an ozone depleting substance (specifically CFC-11, CFC-12, CFC-113, CFC-114, or CFC-115). The bill was effective on July 1, 1989.

The Ontario Ministry of the Environment was given responsibility to develop and enforce regulations supporting the bill. Regulations have been written that prohibit making and transferring. A clear, legal definition of transfer has not been provided by the Ministry.

To date, the Ontario Ministry of the Environment has exempted using, displaying, transporting, storing, and disposing requirements of Bill 218. In addition, other CFC applications (sometimes associated with the manufacturing of packaging materials) have been exempted. These applications include release agents for molds, cleaners and solvents. All of the above exemptions will probably be removed in the next few years.

A.8 Denmark

A proposed national law in Denmark would prohibit the use of CFC-11, CFC-12, CFC-113, CFC-114, and CFC-115. The law covers the industrial use, import and export of products containing or produced with CFCs.

The Danish Ministry of the Environment would be given regulatory responsibilities for the law. The use of CFCs in packaging may be prohibited as of January 1, 1991.

Appendix B. Outlets for Recyclable Materials

Several sources list companies that buy, sell, collect or process waste materials for the purpose of recycling.

B.1 1989 Directory of U. S. & Canadian Scrap Processors & Buyers.

This directory provides the first comprehensive listing of firms that buy or process scrap plastics. It can be used to identify outlets for waste plastic materials generated by IBM or it can be used to identify companies that manufacture packaging or materials from recycled resin.

The directory identifies companies that conduct business with both the industrial and post-consumer sectors. It similarly identifies markets by resin type (PS, PE, commingled), form (whole, ground, shredded, baled, flaked or reprocessed) source (plastic processor, other manufacturer, post- commercial, or post-consumer), and preferred shipment type (truckloads or railcar loads). The listing is organized by company.

The directory is recommended for the solid waste coordinator at each location. It is available for $40.00 per copy (and $25.00 for each additional copy) through:

Plastics Recycling Update
Resource Recycling Incorporated
Post Office Box 10540
Portland, Oregon 97210
(503)-227-1319

B.2 1989 Plastics Recycling Directory

This directory lists recyclers (including brokers), end-product manufacturers (if you want to sell processed plastic to manufacturers of new products) and equipment manufacturers (for the processin, of waste material) involved in the recycling of post-consumer plastics. This directory is published by the Plastic Bottle Institute (A Division of the Society of the Plastics Industry) and is not as comprehensive as the previous as it is limited to companies that handle plastic bottles. Many of these companies also recycle industrial plastic scrap, but those that limit their business to plastic plant scrap only are not included in this directory.

The 1989 Plastics Recycling Directory is a free service provided and available through:
Plastic Bottle Institute
The Society of the Plastics Industry (SPI)
1275 K Street, N. W.
Suite 400
Washington, D. C. 20005 (202) 371-5244

B.3 BASF Styropor News (February, 1990)

BASF has published a listing of companies involved in the recycling of polystyrene materials. It includes recyclers, brokers and handlers and has been reprinted in its entirety below.

Alabama:	Plastic Services of America 650 Fountain Street Montgomery, AL 36104 (205) 264-9578
Arizona:	Plastics General, Inc. 455 West Diamond Drive Suite 101 Tempe, AZ 85283 (602) 839-0070
California:	Bay Polymer Corporation 44530 Grimmer Boulevard Fremont, CA 94538 (415) 490-1791
California:	Eonexx Plastics 1127 West State Street Ontario, CA 91761
California:	Joe's Plastics, Inc. 7065 Paramount Boulevard Pica Rivera, CA 90660 (213) 949-3619
California:	Talco Plastics, Inc. 11650 Burke Street Whittier, CA 90606 (213) 699-0550
California:	Tech Polymers P.O. Box 4429 Berkeley, CA 94704 (415) 644-1180
California:	Western Gold Thermoplastics 815 East 61 Street Los Angeles, CA 90001 (213) 235-3387

Colorado:	U.S. Recycling Industries 2441 Broadway Denver, CO 80205 (303) 296-6116
Connecticut:	H. Muehlstein & Company, Inc. 800 Connecticut Avenue P.O. Box 5445 Norwalk, CT 06856 (203) 785-0458
Connecticut:	Ingenuity 75 Daggett Street New Haven, CT 06519 (203) 785-0458
Connecticut:	ZIII Company 137-211 Norwich Road Plainfield, CT 06374 (203) 564-0181
Florida:	Alaric, Inc. 2110 N. 71st Street Tampa, FL 33619 (8 13) 626-0458
Florida:	National Recovery Corp. 20801 Biscayne Boulevard Miami, FL 33180 (305) 931-1754
Florida:	Polytech International Corp. 12899 Biscayne Boulevard Suite 225 North Miami Beach, FL 33181 (305) 945-3203
Georgia:	Able Plastic 3078 Castleton Way Marietta, GA 30062 (404) 565-1522
Georgia:	M. A. Industries 303 Dividend Drive Peachtree City, GA 30269 (404) 487-7761
Georgia:	Polymer Marketing, Inc. 1147 Willow Avenue Marietta, GA 30067 (404) 952-1147
Georgia:	Southern Industrial Plastic Recycle 5575B Chamblee Dunwoody Road Suite 387 Dunwoody, GA 30338 (404) 752-6750

Illinois:	B.M.W. Plastics Company 1515 N. Harlem Avenue Oak Park, IL 60302 (312) 848-8020
Illinois:	Empire Plastics, Inc. 3352 Commercial Avenue Northbrook, IL 60062 (312) 564-8595
Illinois:	FDA Plastics Recycling 2001 North 22nd Street P.O. Box 966 Decatur, IL. 62525 (217) 429-3373
Illinois:	Maine Plastics 1550 West 24th Street P.O. Box 939 North Chicago, IL 60064 (312) 473-3553
Illinois:	Mid Continent Plastics, Inc. 6401 West 65th Street Bedford Park, IL 60638 (312) 496-3232
Illinois:	Midwest Recycling Company 1086 Old Elm Glencoe, IL 60022 (312) 835-2020
Illinois:	Nucon Corp. 540 Frontage Road Northfield, IL 60093 (312) 446-6777
Illinois:	Plastic Materials Unlimited 4129 White Ash Road P.O. Box 512 Crystal Lake, IL 60014 (815) 455-5083
Illinois:	S. B. Recyclers 1501 East 142nd Street Dolton, IL 60419 (312) 841-3800
Illinois:	V/J Enterprises 1522 Chickasaw Naperville, IL 60540 (312) 357-2499
Massachusetts:	Asian Export, Inc. 129 Spiers Road Newton, MA 02159 (617) 332-7929

Massachusetts:	Entis Associates 1496 Beacon Street Suite 5 Brookline, MA 02146 (617) 267-2322
Massachusetts:	L. Fine & Company, Inc. 143 Lynfield Street Peabody, MA 01960
Massachusetts:	Plastics Again 24 Tytek Park Leominster, MA 01453 (508) 840-1521
Massachussets:	Turn-Key Plastics Corp. 1030 Stafford Street P.O. Box 171 Rochdale, MA 01542 (508) 892-1777
Massachussets:	U.S. Polymers, Inc. 10 Harbor Street Danvers, MA 01923 (508) 777-3424
Michigan:	American Commodities, Inc. 16165 West 12 Mile Road Southfield, MI 48076 (313) 559-5300
Michigan:	Processed Plastics Company 1790 East Bluewater Highway P.O. Box 68 Ionia, MI 48846 (616) 527-6677
Minnesota:	Disco Plastics, Inc. 725 Florida Avenue, South Minneapolis, MN 55426 (612) 593-0160
Minnesota:	Plasti-Cyc, Inc. 4623 South 28th Street Omaha, NE 68107 (402) 731-5580
New Jersey:	CVM, Inc. Box 261 Asbury, NJ 08802 (201) 752-4949
New Jersey:	Frankel Industries 249 Harrison Avenue Highland Park, NJ 08904 (201) 932-5237

New Jersey:
Mart Plastics & Chemical
5 Colony Court
Parsippany, NJ 07054
(201) 263-1902

New Jersey:
Materials for Recycling
225-239 Ridgewood Avenue
Newark, NJ 07108
(201) 242-1731

New Jersey:
Mid-Atlantic Plastic System
320 Chestnut Street
P.O. Box 507
Roselle, NJ 07203
(201) 241-9333

New Jersey:
Polydex, Inc.
825 Brook Road
Lakewood, NJ 08701
(201) 905-9338

New York:
Fox Run Recycling
3419 Route 89
P.O. Box 230
Seneca Falls, NY 13148
(315) 549-8241

New York:
H. Heller & Company, Inc.
707 Westchester Avenue
White Plains, NY 10604
(914) 682-0010

New York:
Kenny Plastics Corp.
41-40 Union Street
Suite 15-C
Flushing, NY 11355
(718) 762-4681

New York:
M. G. Chemical Company, Inc.
29 Broadway
Suite # 1602
P.O. Box 304 Bowling Green Station
New York, NY 10274
(212) 269-5533

New York:
Marsh Plastics
4043 Maple Road
Amherst, NY 14226
(716) 834-6500

New York:
Polystyrene Recycling, Inc.
220 DuPont Street
Brooklyn, NY 11222
(718) 349-3601

New York:	Recoverable Resources Boro Bronx 2000 (R2B2) 1809 Carter Avenue Bronx, NY 10457
New York	Recycled Plastic Products 770 Garrison Avenue Bronx, NY 10474 (212) 893-2200
New York:	Star Plastics, Inc. 136 Fuller Road Albany, NY 12205 (518) 459-1080
North Carolina:	Universal Dispersions, Inc. 1039 Arosley Road Charlotte, NC 28207 (704) 375-4039
Ohio:	Cincinnati Plastic Recycling 5578 Wooster Park Cincinnati, OH 45227 (513) 271-8770
Ohio:	Cleveland Reclaim Industries 2366 Woodhill Road Cleveland, OH 44106 (216) 791-2100
Ohio:	Merit Marketing 781 Beta Drive Suite A Maylield, OH 44143 (216) 461-7760
Oregon:	Hee Company 4555 Southeast 122nd Avenue Portland, OR 97236 (503) 76l-4266
Oregon:	Pacific Resource Recycling, Inc. 1300 North River Street Portland, OR 97227 (503) 284-9540
Oregon:	Plastics Recovery Corp. 3315 Fisher Road, Northeast Salem, OR 97305 (503) 363-8539
Pennsylvania:	Dixon Recyclers 328 North 14th Street Lebanon, PA 17042 (717) 272-4655

Pennsylvania:	Edwards Enterprises 100 Nutt Road Phoenixville, PA 19460 (215) 935-5811
Rhode Island:	Ralco Industries, Inc. 1112 River Street P.O. Box 509 Woonsocket, RI 02895 (401) 767-2700
Texas:	Chemiplas, Inc. 15333 John F. Kennedy Boulevard Suite 160 Houston, TX 77032 (713) 442-4728
Texas:	Woods Bros. Industries 320 Carson Street Red Oak, TX 75154 (214) 348-2946
Washington:	Allstates Plastic Company, Inc. 223 East Reserve Street Vancouver, WA 98661 (206) 693-2730
Washington:	First Line Plastics 636 South Alaska Street Seattle, WA 98108 (206) 622-3335
Washington:	Interstate Plastics, Inc. 4300 Columbia Way Suite B Vancouver, WA 98661 (206) 694-1753
Washington:	J. M. McConkey and Company, Inc. 1615 Puyallup Street P.O. Box 1690 Sumner, WA 98390 (206) 863-8111
Washington:	Partek Corp. P.O. Box 1387 Vancouver, WA 98666 (206) 695-1777
Washington:	Rainier Plastics, Inc. 1101 Ledwich Avenue P.O. Box 9125 Yakima, WA 98909 (509) 248-1473

Wisconsin:	Plastic Recovery Service P.O. Box 51605 2625 Greely New Berlin, WI 53151 (414) 481-6866
Wisconsin:	Riverside Materials 800 South Lawe Street P.O. Box 179 Appleton, WI 54912
Canada:	Canadian Recycling Corp. 5805 Whittle Road Mississauga, Ontario L477z2J1 CANADA (416) 890-0508
Canada:	Domtar Recycling Division 66 Shorncliffe Road Toronto, Ontario M8Z5K1 CANADA (416) 232-8824
Canada:	Entropex 1390 Lougar Avenue Sarnia, Ontario H7S5N7 CANADA (519) 332-0430
Canada:	Greenline Resins Limited 200 Universal Road Woodstock, Ontario N4S8A2 CANADA (519) 539-0401
Canada:	Industries Transplastek, Inc. 1475 Boulevard Marie-Victorin St. Bruno, Quebec J3V4P6 CANADA (514) 653-1535
Canada:	Simcoe Plastics Ltd. 7089 Younge Street Thornhill, Ontario L3T2A7 CANADA (416) 881-1505

Appendix C. Industry Associations

C.1 Council on Plastics and Packaging in the Environment (COPPE)

Council on Plastics and Packaging in the Environment (COPPE)
1275 K Street, N. W.
Suite 400
Washington, D. C. 20005

Executive Director:
Edward J. Stanza
(202) 371-5228

C.2 Council on Solid Waste Solutions

Council on Solid Waste Solutions
SPI
1275 K Street, N. W.
Suite 400
Washington, D. C. 20005

Executive Director:
Donald B. Shea
(202) 371-5228

C.3 Flexible Packaging Association

Flexible Packaging Association
1090 Vermont Avenue, N. W.
Suite 500
Washington, D. C. 20005

President:
Glenn E. Braswell
(202) 842-3880

C.4 Food Service and Packaging Institute (FPI)

Food Service and Packaging Institute (FPI)
1025 Connecticut Avenue, N. W.
Washington, D. C. 20005

Director of Public Affairs:
Nancy J. Sherman
(202) 347-0020

C.5 National Association for Plastic Container Recycling (NAPCOR)

National Association for Plastic Container Recycling (NAPCOR)
Post Office Box 7784
Charlotte, North Carolina 28210

President:
Luke B. Schmidt
(704) 523-8543

Appendix D. Recycling Equipment

D.1 1989 - 90 Waste Recyclers Council (WRC) -

Directory of Waste Recycling Companies, Services and Equipment.

The WRC's mission is to promote the role of the private sector in recycling and work to expand the markets for recycled materials. Their directory provides information on recycling companies, services and equipment.

Recycling Equipment Vendors that manufacture collection equipment and processing equipment including balers, crushers, stationary compactors, shredders screening equipment, and wood grinders are listed in this directory.

The directory is available through the Waste Recyclers Council at the following address:

Waste Recyclers Council
Suite 1000
Washington, D. C. 20036 (202) 659-4613

Appendix E. Source Reduction Council of CONEG

Model Toxics Legislation

Legislative Language
Working DRAFT
December 14, 1989

Section 1. (Title)

Section 2. The legislature finds and declares that:

a. The management of solid waste can pose a wide range of hazards to public health and safety and to the environment;

b. Packaging comprises a significant percentage of the overall solid waste stream;

c. The presence of heavy metals in packaging is a part of the total concern in light of their likely presence in emissions or ash when packaging is incinerated, or in leachate when packaging is landfilled;

d. Lead, mercury, cadmium and hexavalent chromium, on the basis of available scientific and medical evidence, are of particular concern; and

e. It is desirable as a first step in reducing the toxicity of packaging waste to eliminate the addition of these heavy metals to packaging; and

f. The intent of this act is to achieve this reduction in toxicity without impeding or discouraging the expanded use of post-consumer materials in the production of packaging and its components.

Section 3. Definitions

"Package": means a container providing a means of marketing, protecting or handling a product and shall include a unit package, an intermediate package and a shipping container as defined in ASTM D996. "Package" shall also mean and include such unsealed receptacles as carrying cases, crates, cups, pails, rigid foil and other trays, wrappers and wrapping films, bags and tubs.

"Distributor": means any person, firm or corporation who takes title to goods purchased for resale.

"Packaging Component": means any individual, assembled part of a package such as, but not limited to, any interior or exterior blocking, bracing, cushioning, weatherproofing, exterior strapping, coatings, closures, inks and labels.

Section 4.

a. As soon as feasible, but not later than two years after the adoption of this act, no package or packaging component shall be offered for sale or for promotional purposes by its manufacturer or distributor in the state of _____ which includes, in the package itself or in any packaging component, inks, dyes, pigments, adhesives, stabilizers or any other additives. to which any lead, cadmium, mercury or hexavalent chromium has been intentionally introduced as a element during manufacturing or distribution as opposed to the incidental presence of any of these elements.

b. As soon as feasible, but not later than two years after the adoption of this act, no product shall be offered for sale or for promotional purposes by its manufacturer or distributor in the state of _____ in a package which includes, in the package itself or in any of its packaging components inks, dyes, pigments, adhesives, stabilizers or any other additives to which any lead, cadmium, mercury or hexavalent chromium has been intentionally introduced as an element during manufacturing or distribution as opposed to the incidental presence of any of these elements.

C. The sum of the concentration levels of lead, cadmium, mercury or hexavalent chromium present in any package or packaging component shall not exceed the following:

- 600 parts per million be weight (0.06%) effective two (2) years after enactment of this statute;
- 250 parts per million by weight (0.025%) effective three (3) years after enactment of this statute; and
- 100 parts per million be weight (0.01%) effective four (4) years after enactment of this statute.

Section 5. Exemptions

All packages and packaging components will be subject to this act except the following.

a. those packages or package components with a code indicating date of manufacture that were manufactured prior to the effective date of this statute; or

b. those packages or packaging components to which lead, cadmium, mercury or hexavalent chromium have been added in the manufacturing, forming, printing or distribution process in order to comply with health or safety requirements of federal law or for which there is no feasible alternative, provided that the manufacturer of a package or packaging component must petition the (state administrative agency) for any exemption from the provisions of this subsection of this act for a particular package or packaging component based upon either criterion; provided further that the (state administrative agency) may grant a two year exemption if warranted by the circumstances; and provided further that such an exemption may upon meeting either criterion of this subsection be renewed for two years; or

C. packages and packaging components that would not exceed the maximum contaminant levels set forth in subsection c of section 4 of this act but for the addition of post-consumer materials; provided that the exemption for this subparagraph shall expire four years after the adoption of this act.

Section 6. Certificate of Compliance

As soon as feasible, but not later than two years after the adoption of this act, a Certificate of Compliance stating that a package or packaging component is in compliance with the requirements of this act shall be furnished by its manufacturer or supplier to the purchaser of the package or packaging component provided, however, where compliance is achieved under the exemption(s) provided in subsection 5 b or c, the Certificate shall state the specific basis upon which the exemption is claimed. The Certificate of Compliance shall be signed by an authorized official of the manufacturing or supplying company. The purchaser shall retain the Certificate of Compliance for as long as the package or packaging component is in use. A copy of the Certificate of Compliance shall be kept on file by the manufacturer or supplier of the package or packaging component. Certificates of Compliance, or copies thereof, shall be furnished to the (state administrative agency) upon its request and to members of the public in accordance with section 9.

If the manufacturer or supplier of the package or packaging component reformulates or creates a new package or packaging component, the manufacturer or supplier shall provide an amended or new Certificate of Compliance for the reformulated or new package or packaging component.

Section 7. (Each state to add its own enforcement provisions.)

Section 8. (The state enforcement agency) shall, in consultation with the Source Reduction Council of CONEG, review the effectiveness of this act no later than eighteen (18) months after the effective date and shall provide a report based upon that review to the Governor and legislature. The report may contain recommendations to add other toxic substances contained in packaging to the list set forth in this act in order to further reduce the toxicity of packaging waste, and shall contain a recommendation whether to continue the recycling exemption as it is provided for in subsection c of section 5 of this act, and a description of the nature of the substitutes used in lieu of lead, mercury, cadmium, or hexavalent chromium. (Add power to gather this information under section 7.)

Section 9. Public access

(see below; needs to be related to section 6)

Any request from any member of the public for any Certificate of Compliance from the manufacturer or supplier of a package or packaging component shall be:

a. Made in writing with a copy provided to the (state administrative agency);

b. Made specific as to package or packaging component information requested; and

c. Responded to by the manufacturer or supplier within 60 days.

Section 10. Effective Date. This act shall become effective two (2) years after adoption.

Appendix F. IBM Engineering Specification - Restricted Heavy Metals

Packaging Materials--Restricted Heavy Metals

Originator: CCPE IBM Raleigh

Released by: Distribution Engineering IBM Rochester

DATE	18JUN90					
EC NUMBER	844576					

DATE	18JUN90					
EC NUMBER	844576					

Table of Contents

DATE	18JUN90					
EC NUMBER	844576					

1.0 Introduction

1.1 Abstract

IBM's environmental policy recognizes the need for global environmental protection relative to safe waste disposal. On the basis of available scientific and medical evidence, the presence of heavy metals in packaging material is of concern in the management of solid waste.

1.2 Purpose

This engineering specification identifies the heavy metal elements which are restricted, and stipulates the maximum concentration levels of these elements acceptable to IBM as contained in any pack: material or packaging component.

When the requirements of this specification conflict with applicable governmental regulations, the more stringent shall take precedence.

2.0 Scope

1. This specification applies to all primary, secondary, and tertiary packaging for products, designated parts, subassemblies, materials, and supplies purchased by IBM for use in its manufacturing distribution operations.

2. This specification applies to all packaging purchased by IBM for use in protecting, handling, marketing of IBM products and supplies.

3. This specification is to include, but is not limited to, the following packaging materials and packaging components.

   - Adhesives
   - Chipboard
   - Coatings
   - Corrugated
   - Cushioning
   - Dunnage
   - Film
   - Foil
   - Inks
   - Paper
   - Paperboard
   - Pallets
   - Plastic
   - Strapping

3.0 Heavy Metals in Packaging Materials

This specification is based on the overriding tenet that materials used in IBM packaging are not to include toxic agents that can create problems in disposal or recycling systems. While toxic material in packaging (eg, heavy metals) pose no inherent danger to the user when the package is purchased or used, they do present a concern in the solid waste management system. These materials frequently are used as plastics additives and coloring agents.

Sometimes toxic constituents may be formed or released by reactions of packaging materials when exposed to certain conditions. As the discarded package is subjected to treatment in the disposal system (incinerated in resource recovery facilities or buried in landfills), toxic components may be released into the air (stack emissions) or onto the land and potentially into groundwater (leachate)

from land disposal of package or incinerator ash, etc). Although packaging is not the major contributor of these toxic agents in the solid waste stream, removal of these toxic substances from packaging can make solid waste management safer.

4.0 Specification

1. No packaging material or packaging component shall contain any amount of lead, cadmium, mercury, or hexavalent chromium as an element which has been intentionally introduced into its composition as a part of its manufacture, forming, distribution, or printing.

2. The sum concentration level of incidental amounts of lead, cadmium, mercury, and hexavalent chromium present in any packaging material or packaging component shall not exceed 100 parts per million (100 ppm) by weight (0.01%).

5.0 Supplier Responsibility

1. This specification is applicable to suppliers of packaging materials and packaging components to IBM.

2. Suppliers of packaging materials and components, who are distributors and not manufacturers, shall ensure that their source manufacturers are in compliance with this specification.

3. Suppliers of packaging materials and components, who are manufacturers, shall ensure that their source manufacturers and materials suppliers are in compliance with this specification.

4. Suppliers of packaging materials and components shall be prepared to provide IBM with certification documentation ensuring compliance with this specification.

5. Suppliers should contact IBM Purchasing at the appropriate manufacturing or distribution location with any questions concerning this specification.

6.0 IBM Responsibility

It is expected that local Purchasing and/or Packaging Engineering organizations having design specification and/or purchasing responsibility for IBM products, supplies packaging materials, and packaging components will establish audit processes to ensure and track compliance with this specification.

7.0 Terms and Definitions

Cadmium A metallic element used in plastics manufacture as a heat stabilizer and as a pigment constituent. It is a carcinogen and a toxin.

Hexavalent Chromium A chromium compound used as a constituent of inorganic pigments. It is carcinogenic and corrosive on living tissue.

Lead A metallic element used in plastics manufacture as a heat stabilizer and in inorganic pigments for opacity. It is a cumulative toxin.

Mercury A metallic element used in inorganic pigments. It is a neurotoxin.

Package A container providing a means of marketing, protecting, or handling a product; including a unit package, an intermediate package, and a shipping container as defined in American Society for Testing Materials (ASTM) D996.

Packaging Component Any individual assembled part of a package such as, but not limited to, any interior or exterior blocking, bracing, cushioning, weatherproofing, exterior, strapping, coatings, closures, inks, and labels.

Appendix G. IBM Engineering Specification - Prohibited Expansion Agents

IBM Engineering Specification

EXPANDED PACKAGING MATERIALS: PROHIBITED EXPANSION AGENTS

AUTHOR Jeff Miller, CCPE Mechanicsburg 16JAN90
RELEASED BY C. E. Robbert 16JAN90

IBM Engineering Specification

Contents

1.0 Introduction

1.1 Abstract

IBM is very concerned about the effects its products have on the environment. Fully halogenated chlorofluorocarbons (CFCs) are suspected of destroying the earth's protective stratospheric ozone layer and should not be used in the manufacture of expanded packaging materials (i.e. foam).

1.2 Purpose

1. To specify the chlorofluorocarbons (CFCs) that are prohibited during any stage of the expanded foam manufacturing process.
2. To identify the types of foam packaging material that may contain prohibited CFCs.

2.0 Scope

1. This specification defines the types of CFCs that shall not be used during any stage of production or manufacture of expanded foam materials including, but not limited to:
   - Expanded Polyethylene,
   - Expanded Polypropylene,
   - Expanded Polystyrene, and
   - Expanded Polyurethane.
2. This specification applies to expanded packaging materials manufactured using the five "Group I" CFCs governed by the Montreal Protocol.

   The "Group I" CFCs include:
   - CFC-11,
   - CFC-12,
   - CFC-113,
   - CFC-114, and
   - CFC-115.

   Further reference and composition of these compounds can be found in section 3.0, "Definitions and Key Words" and the Appendix, "Chemical Compositions of Prohibited CFCs".
3. This specification applies to all primary, secondary, and tertiary packaging of all parts, subassemblies, products and materials which will be shipped to IBM manufacturing or distribution locations. This specification also applies to all foam packaging material and systems purchased by IBM.

3.0 Definitions and Key Words

Blowing Agent — A chemical or gas compound used to expand the resin to form a cellular foam structure.

CFC — Fully halogenated chlorofluorocarbons, suspected of reducing the stratospheric ozone layer when released into the atmosphere.

Expanded Foam — Expanded resinous material with a cellular structure, manufactured by the dispersion of a gas in the liquid resin, and the subsequent setting of the expanded mass.

Fabricated Foam — Foam, usually expanded and extruded in plank form, that is cut and/or pieced into its useful form.

Foam-In-Place — Two liquid components combined under heat to produce a polyurethane foam which is cast and formed around a particular shape. This process may be performed in either of two ways:

1. using a mold, as with pre-molding where finished cushions will be sent to the packager, or
2. using only the item to be packaged and the shipping carton, as with free-rise foam-in-place.

HCFC — Non'-fully halogenated CFCs or hydrogenated CFCs; HCFCs have an additional hydrogen molecule.

Molded Foam — Foam that has been cast into a particular form and allowed to expand and form its cellular, bubble-like structure.

Montreal Protocol — The international treaty, signed in September 1987, aimed at reducing ozone-depleting CFCs and halons.

Primary Package — The first layer of packaging in contact with the part.

Secondary Package — The second layer, contains primary package(s).

Tertiary Package — This includes the shipping container and all additional internal dunnage materials if any.

4.0 Packaging Material Molding Process

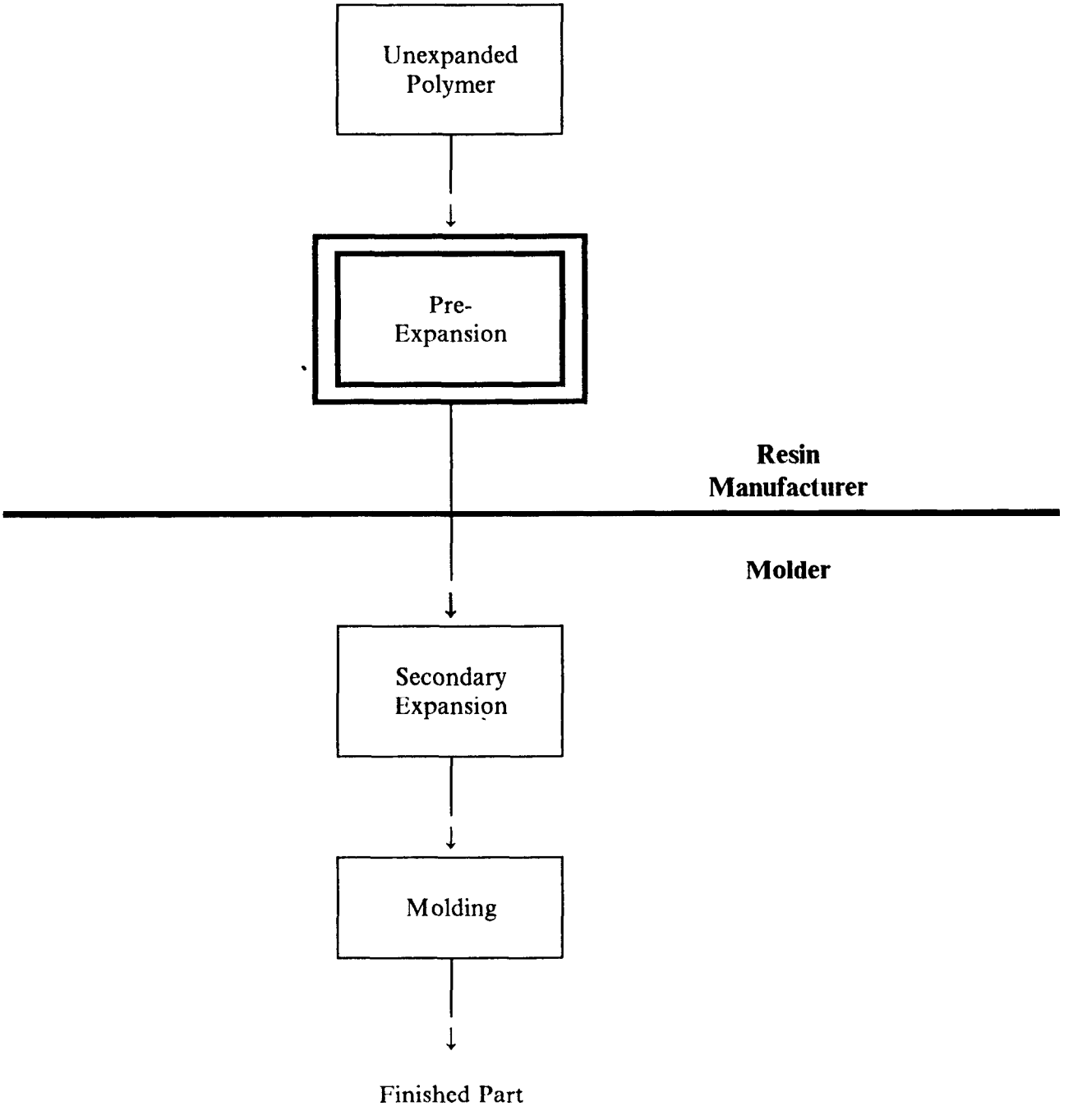
The bold boxes in Figure 1 on the following page indicate where, during foam manufacture, CFCs are employed for the purpose of bead expansion. In order to determine if CFCs are used in the foam manufacturing process, one should look beyond the immediate packaging material supplier (i.e. molder or fabricater) to the resin manufacturer. Resin manufacturers commonly pre-expand the resin and ship the bead in a pre-expanded state. It is during this initial expansion of olefin materials that CFC blowing agents are sometimes used: Molders typically further expand or process the bead prior to its molding, however, the molder's processing is normally void of CFCs. CFCs are prohibited from ALL stages of the manufacturing process.

Suppliers of all types of expanded packaging material and chemical components used for the processing of expanded packaging material (i.e. foam-in-place urethane components) must ensure materials have not been manufactured with or contain chlorofluorocarbons (CFCs). This group of suppliers includes, but is not limited to, the following:

- Molded foam material of all types,
- Plank foam material of all types,
- Pre-molded foam-in-place cushions, and
- Foam-in-place chemical systems.

Figure 1:

BEAD EXPANSION PROCESS



5.0 Alternatives to CFCs

Two popular alternatives to CFC blowing agents include:

- Non-fully halogentated or hydrogenated CFCs (HCFCs) and
- Hydrocarbons (e.g. Pentane).

These two elements are acceptable alternatives to fully halogenated chlorofluorocarbons (CFCs) and their use is not restricted by the Montreal Protocol.

6.0 Responsibilities of IBM's Suppliers

1. These requirements apply to all expanded packaging materials used to make shipments to IBM. They also apply to all expanded packaging materials purchased by IBM, and subsequently used by IBM for its part and product shipments.
2. Suppliers who use expanded foam materials for shipments to IBM or sell expanded foam materials to IBM, but do not manufacture and monitor all phases of the expanded foam being shipped, shall verify that their supplier of foam or foam resin does not use CFCs.
3. Suppliers should be prepared to provide IBM Purchasing with written certification that the expanded foam being used is CFC-free when foam is purchased by IBM or used to pack items shipped to IBM.
4. Suppliers should contact IBM Purchasing at a manufacturing or distribution location if they are in need of assistance in meeting our elimination objectives.

7.0 Local IBM Responsibilities

It is recommended that local Purchasing and Packaging Engineering groups set up site audit programs to assure expanded foam entering the manufacturing or distribution site is CFC-free. These programs may vary depending upon number of suppliers, number of parts received, etc..

Appendix A. Chemical Compositions of Prohibited CFCs

Chemical Compound	Chemical Composition
CFC-11	CCl_3F
CFC-12	CCl_2F
CFC-113	$C_2Cl_3F_3$
CFC-114	$C_2Cl_2F_4$
CFC-115	C_2ClF_5

Appendix H. IBM Engineering Specification - Recyclable Packaging Materials

Recyclable Packaging Materials--Selection and Identification

Originator: J J Miller, CCPE IBM Raleigh

Released by: Distribution Engineering IBM Rochester

DATE	06SEP90					
EC NUMBER	844576					

DATE EC NUMBER	06SEP90 844576					

Table of Contents

IBM ENGINEERING SPECIFICATION

Originator: J J Miller 09/06/90

TITLE: Recyclable Packaging Materials--Selection and Identification

1.0 Introduction

1.1 Abstract

IBM uses a comprehensive waste management system to reduce the impact of our waste material on the solid waste stream. This integrated system emphasizes source reduction and recycling programs prior to investigating alternatives for disposal.

Material recycling strategies will focus upon the use of:

1. Recycled material(s) in our packaging,
2. Other materials which provide a resource for secondary applications (eg, recyclable material)

1.2 Purpose

1. To establish goals for the content of recycled fiber to be included in corrugated packagings
2. To promote recycling by providing information (in the form of markings) which will increase likelihood of recycling of packaging materials.

1.3 Scope

This specification considers two ways recycling may be used to reduce our contribution to municipal solid waste.

- It redirects material which would otherwise be sent to a landfill.
- It may conserve natural resources or reduce the amount of waste material generated from processes which utilize raw or virgin materials.

1.4 Application

1. This specification applies to all primary, secondary, and tertiary packaging for products, developed parts, subassemblies, materials, and supplies purchased by IBM for use in its manufacturing distribution operations.
2. This specification applies to all packaging purchased by IBM for use in protecting, handling marketing of IBM products and supplies.
3. This specification is to include, but is not limited to, the following packaging materials and packaging components:
   - Molded cushions (of any resin)
   - Fabricated cushions (of any resin)
   - Corrugated fiberboard
   - Paperboard

1.5 Exemption

1. This specification does not apply to IBM contracts negotiated prior to its date of publication

2.0 Requirements

DATE	06SEP90					
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2.1 Cellulosic Materials

2.1.1 Performance of Recycled Paper Products

The following principles should be adopted to achieve maximum performance from recycled paper products:

- Use a recycled fiber source of premium grade (long fiber length).
- Use a recycled fiber source that is free of contaminants.
- Use previously recycled fiber in moderation.

High-performance corrugated packaging is best achieved through the specification of performance properties (eg, compressive strength) and not necessarily the material burst strength.

2.1.1.1 Guidelines for Recycled Fiber Content

Corrugated fiberboard packagings should be manufactured using the maximum content of recycled fiber that will not seriously degrade the compressive performance of the combined board.

The total percent weight of recycled material for various board configurations is provided below:

Board Type	Total Recycled Fiber (% weight):		
	Minimum	Recommended Maximum	Target
Single Wall	30%	50%	40%
Double Wall	40%	70%	50%
Triple Wall	40%	70%	50%

Table 1. Required Contribution of Reclaimed Material

2.1.1.2 Selective Placement of Recycled Fiber

To obtain maximum performance from corrugated fiberboard containing recycled material, recycled fibers should be used in strategic locations including:

1. Noncritical components:
   - Corrugated mediums
   - Inside liners of multiwall board (eg, double wall or triple wall).

   These noncritical components may be manufactured from up to 100% recycled fiber without seriously degrading compressive performance of the combined board.
2. Critical components:
   - Two outer facings

Recycled content of the corrugated boards facings or liners will have a dramatic impact on the performance of the combined board. **It is recommended that the recycled content of each of the two outer facings contain no more than 35% recycled fiber.**

Note: It has been shown that the use of the recommended content of recycled fiber may reduce the combined board's bursting strength, but I minor affect on container top-to-bottom compressive strength.

2.1.1.3 Calculating Recycled Fiber Content

Because corrugated mediums travel in the vertical as well as horizontal direction, take-up factors must be used when calculating a materials combined basis weight to compensate for the additional material.

Industry approximations for the take-up factors are shown below:

Flute:	***Take-up*** **factor:**
A	1.55
B	1.35
C	1.43

Sample Calculation

The combination of 100% recycled mediums and interior liners with near-virgin outside liners produces a high-performance, corrugated product with a proportionately large amount of recycled fiber. An example of a high-performance board with a similarly high contribution from reclaimed material is illustrated in Table 2 on page 7.

Board Type: Double wall
Flute: B/C
Test: 350 psi
Liner Combination: 42/26/44/26/42
Combined Basis Weight: 200 lbs/msf

Component	Basis Weight (lbs/msf)	Recycled Content (%)	Recycled Content (lbs/msf)	Take-up Factor	Quantity	Total Recycled Content (lbs/msf)
Liner	42	25%	10.5	--	2	21.0
Liner	44	100%	44.0	--	1	44.0
Medium	26	100%	26.0	1.43	1	37.2
Medium	26	100%	26.0	1.35	1	35.1
Total						137

Table 2. Recycled Content Calculation

$$\text{Recycled Content (\%)} = \frac{137 \text{ lbs/msf}}{200 \text{ lbs/msf}} = 68.5\%$$

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2.1.2 Recycling Aids for Second-Generation Cellulosic Materials

The performance of any recycled paper product may be enhanced by incorporating any all of the following practices:

- Minimize use of bleached kraft/oyster white board.
- Use water-based inks when printing materials. Ink components which have been FDA/USDA approved are the only acceptable alternatives.
- Use only functional coatings or impregnating that does not adversely affect material recycling. Some coatings that aid resistance to water, grease, or scuffing may be with no adverse effect on material recycling.
- Avoid the use of film laminations and/or cross-linked resins such as urea formaldehyde
- Unless specifically instructed otherwise, use tape and starch glues in place of staples and hot-melt adhesives on container manufacturer's joints.

2.1.2.1 The Recyclable Symbol

The American Paper Institute (API) promotes the use of the recyclable symbol, all paper products that can reasonably be expected to be recycled. Containers that are free of contaminants induced through either package manufacturing corrugated coatings) or as a result of direct contact with potentially-contaminated products should be marked with a symbol. The recyclable symbol is shown Figure 1 on page 9.

If part-specific artwork has not been included with the purchase order, the recyclable symbol should be printed near the boxmaker's certificate in approximately the same size. Markings should appear on bottom major flap RSC- or HSC-type containers, and the width panels of tubes (eg, double-covered packagings).

2.1.2.2 The Recycling Symbol

The API recycling symbol may be used to identify any packaging that is manufactured from recycled material. This symbol should be applied to all packaging materials that contain any amount of recycled fiber. The recycling symbol is shown in Figure 2 on page 9.

Note: The recycling symbol should be printed without the API's optional text.

Recycled Content Notation: Boxmakers are encouraged to identify the amount of reclaimed material using a carton marking similar to that shown in Figure They may choose to utilize a safety factor (eg, 80%) so the notation does not overstate the actual recycled content. This notation is optional, but it is the preferred method of identifying the use of recycled fiber. If the amount of reclaimed material is identified, this marking should be used in lieu of the A recycling symbol.

If part-specific artwork does not accompany the purchase order and material used conform to requirements identified in 2.1.2.1 and 2.1.2.2, both the recycled and recycling symbol (or notation on minimum quantity of reclaimed material should be printed on the container. One of each symbol should be placed on each side of the boxmaker's certificate. All symbols should be of similar size

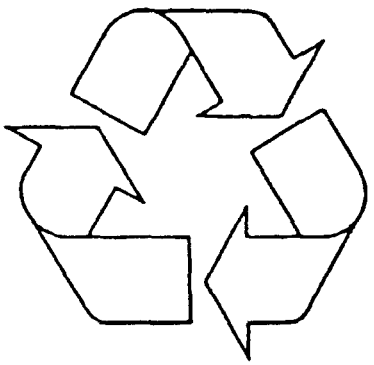

Figure 1. The Recyclable Symbol

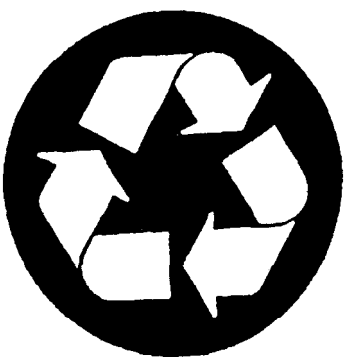

Figure 2. The Recycling Symbol

THE XYZ BOX COMPANY
CERTIFIES THAT THIS
350 PSI BURST BOARD
CONTAINS A MINIMUM OF
55% RECYCLED MATERIAL

Figure 3. Example of Recycled Contribution Illustration

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EC NUMBER	844576					

2.2 Polymeric Materials

2.2.1 SPI Plastic Bottle Coding System

The Society of Plastics Industry (SPI) has developed a coding system that identifies the commonly used plastic resins for the purpose of recycling. Although originally designed assist plastic bottle manufacturers, industrial plastic manufacturers have adopted use system to assist them with resin sortation for recycling.

The code is a three-sided triangular arrow with a number in the center and letters underneath. The numbers and the letters indicate the resin type. An example of the ma to be used on EPS cushions is shown in Figure 4.

Following is a list of the seven codes developed by the bottle industry. Popular cushion packaging types are printed in ***bold*** type.

1 PETE--Polyethylene terephthalate (PET)

2 HDPE--High-density polyethylene

3 V--Vinyl/polyvinyl chloride (PVC)

4 ***LDPE--Low-density polyethylene***

5 ***PP--Polypropylene***

6 ***PS--Polystyrene***

0 or 7 ***OTHER--Copolymers, specialty resins, multilayered materials, and all other resins***

Figure 4. The Resin Identifier for EPS

Application of the resin identifier requires that resins be 99% pure to avoid contaminated during subsequent recycling. Otherwise, use the “other” (7 or 0) identifier and the plastic may be reprocessed in a commingled state.

Suppliers of plastic packagings having knowledge that their materials contain or have in contact with contaminants, including hazardous materials, must consider the effects these elements and may best serve the recycling effort by intentionally omitting the resin identifier.

2.2.2 Marking of the Resin Identifier

Molded Parts: The resin identifier can be readily placed on a molded part through permanent embossing of the appropriate designation into the part mold. Each time a

cushion is molded, the resin identifier (eg, six for EPS) will be permanently displayed on the molded part.

An alternative method uses embossing of the part ejection pins to mark the plastic piece with the resin identifier. Because the pins are not an integral part of the mold, the molder selects the appropriately marked pin whenever new parts are molded. This method of imprinting is preferred as this process adds no expense to tool development or the piece price of molded cushion parts.

Fabricated Parts: Fabricated parts including those made of polyurethane or polyethylene should similarly apply the resin identifier using either hot wire imprinting or a stamp which prints the appropriate mark using permanent ink. Caution must be used when selecting the ink to ensure it does not smear or transfer to machine covers.

2.3 Responsibilities of IBM's Suppliers

1. These requirements apply to all packaging materials used to make shipments to IBM. They also apply to all packaging materials purchased by IBM, and subsequently used by IBM for its part and product shipments.

2. Suppliers who design packages for shipment of parts, supplies or product must ensure that they utilize materials and methods which are conducive to recycling. Two examples that introduce contaminants which would preclude the subsequent recycling of packaging materials are:

   - The use of free-rise foam-in-place where foam is dispensed directly into the corrugated container, or
   - The use of adhesives to bind two dissimilar materials (eg, polyethylene foam glued to a corrugated pad).

3. Suppliers who use packaging materials for shipments to IBM or sell packaging materials to IBM, but do not manufacture and monitor all phases of the material production, shall verify that their supplier of cellulosic material furnish contains some amount of reclaimed material if materials are to be marked with the recycling symbol.

4. Suppliers should be prepared to provide IBM Purchasing with written certification of the amount of recycled material (eg, fiber) used in a finished package which is purchased by IBM or used to pack items shipped to IBM.

5. Suppliers should contact IBM Purchasing at a manufacturing or distribution location if they are in need of assistance in meeting our recycling objectives.

2.4 Local IBM Responsibilities

It is recommended that local Purchasing and Packaging Engineering groups establish site audit programs to assure packaging materials entering the manufacturing or distribution process are properly identified with the correct resin identifier (in the case of cushioning) or properly marked using the recyclable and/or recycling symbols (whichever is applicable). These programs may vary depending upon number of suppliers, number of parts received, etc.

2.5 Definitions and Key Words

Cellulosic A substance made of plant parts including wood.

Expanded Foam Expanded resinous material with a cellular structure, manufactured by the dispersion of a gas in the liquid resin, and the subsequent setting of the expanded mass.

Fabricated Foam — Foam, usually expanded and extruded in plank form, that is cut and/ pieced into its useful form.

Foam-In-Place — Two liquid components combined under heat to produce a polyurethane foam which is cast and formed around a particular shape. This procedure may be performed in either of two ways:

1. Using a mold, as with premolding where finished cushions will be sent to the packager.
2. Using only the item to be packaged and the shipping carton, as free-rise foam-in-place.

Molded Foam — Foam that has been cast into a particular form and allowed to expand form its cellular, bubble-like structure.

Polymeric — A substance made of plastic.

Primary Package — The first layer of packaging in contact with the part.

Recyclable — Waste material which is capable of being processed for subsequent Materials are only recyclable if there is a widely available economic viable collection, processing, and marketing system for the material

Recycled — Material which has already been reclaimed from a waste product are processed in order to regain material.

Recycling — The conversion of an item or material from its existing state for reuse as a similar or different item or material.

Reusable — When applied to packaging, reusable means a container, package, or component of the container or package (eg, a foam cushion, plastic, etc) is capable of being used more than one time, without being significantly changed (ie, used in its same physical form, requiring a minor repair or cleaning). Reusable is not to be confused with recycled (which reprocesses the material).

Secondary Material — Resultant material of a processed recyclable.

Secondary Package — The second layer contains primary package(s).

Source Reduction — The design and manufacture of products and packaging with minimum volume of material and/or a longer useful life.

Suppliers — Organizations who provide parts, products, and components to an IBM site. This can include other IBM sites as well as independent vendors.

Tertiary Package — This includes the shipping container and all additional internal dunnage materials, if any.

Appendix I. Pallet Reutilization Checklist

The following section will outline steps that should be followed when implementing a Pallet Reutilization program. Each steps will be discussed in greater detail on the following pages. Not all steps will necessarily apply to all locations, but we recommend that they at least be considered.

1.1 Recommended Implementation Steps.

1. **Identify the current volume of pallet disposals.**
   - By Size and design-type (whether standard or nonstandard).
   - Worst offending suppliers.
   - Use a form similar to that shown on figure 1 of this section.
2. **Identify key process elements and total disposal costs.**
   - Additional dumpster costs.
   - Additional disposal costs
3. **Evaluate methods to reduce pallets entering solid waste.**
   - Standardization and conformance programs.
   - Pallet revitalization programs
   - Alternative Pallet Programs (i.e. rental)
4. **Implement best methods to reduce pallets entering solid waste.**
   - Standardization and conformance programs.
   - Pallet revitalization programs
   - Alternative Pallet Programs (i.e. rental)
5. **Control disposal of nonusable pallets and components.**
   - IBM
   - IBM pallet revitalization outlets.
   - Customers.

I.1.1 Pallet Disposal Tracking Form - Figure 1

DATE: __/__/__ to __/__/__ DEPT # _____
SUBMITTER: _____

Pallet Style	Average Monthly Disposals	Average Monthly Repalletizations	Worst Offending Suppliers	Part Numbers Involved
Standard Full Size Pallets				
Non-standard Full Size Pallets				
Standard Half and Quarter Pallets				
Non-standard Half and Quarter Pallets				
Other sized pallets				

I.2 Pallet Reutilization Checklist - Detail

This section identifies recommended steps to establish and maintain a "Pallet Reutilization" program. The checklist will track possible alternatives and highlight options that exist at each alternative level.

I.2.1 Identify Current Pallet Disposal Volumes.

1. **Determine volume of disposals for each size and style**

   It is necessary for each location to quantify the annual number of each size and type pallet being disposed of to establish the size and scope of the problem. You may use a representative sample of 2 weeks to a month and extrapolate to arrive at estimated annual totals. The following are the pallet categories recommended for identification:

   - IBM Standard Full Size Pallets
   - IBM Standard Half Size Pallets
   - IBM Standard 1/4 Size Pallets
   - Non Standard Full Size Pallets
   - Non Standard Half Size Pallets
   - Others

2. **Identify worst offenders - Suppliers and IBM sites.**

   While working with receiving departments, obtain both the number of pallets being scrapped and the worst offending shipper of each type. This could be limited to the top ten offenders. Return after making some visible progress in resolving these discrepancies. Information on the involved part #s, POs etc. will help identify the proper channels which may be used to communicate with the supplier. (See "Pallet Problem Report Summary Form" as a tool which can be used for this purpose).

   - Poor Quality Pallets Requiring Repalletization.
   - Improper Size Pallets Requiring Repalletization.
   - Improper Style or Design Pallets Requiring Repalletization.
   - Potential Opportunities for Reusable Pallets.
   - Other Problems.

   This information should be used in the efforts which will be outlined in a later step to "Reduce the Pallets Entering the Solid Waste Stream".

I.2.2 Obtain Current Key Process Cost Elements:

Next, identify the costs associated with each of the following elements to assist in determining your locations current pallet disposal costs. The Site Solid Waste Coordinator may be able to assist in compiling this information.

1. Cost of Dumpster
   - If rented, Purchasing or Traffic should have rental cost/dumpster
   - If IBM-owned, Purchasing should have purchase cost/dumpster.
2. Cost for Dumpster Processing
   - Purchasing or Traffic should have pickup and return cost/dumpster.
3. Transportation Fees
   - Traffic or Purchasing should have transportation costs/dumpster. (Make sure not included in the dumpster processing costs.)
4. Dumping or Tipping Fees
   - Purchasing or Traffic should have dumping costs/dumpster. (Make sure that not included in Dumpster Processing costs).

I.2.3 Methods to Reduce Pallets Entering the Solid Waste Stream.

Several means of reducing the number of pallets entering the solid waste stream have been identified.' These next sections will identify how to evaluate the alternative methods and the effectiveness of the correction efforts.

1. Pallet Standardization

The quantity of pallets being disposed of in the initial section can be used as your guide to emphasize the need to either standardize or reduce the total volume of pallets. It will be difficult to get real value from nonstandard pallets because:

- Excessive sortation is required.
- Insufficient numbers of same size & type pallet for needed parts.
- Extra handling and segregation of all different types.
- Extra investment for additional fixtures and tools.
- Insufficient demand for repaired nonstandard pallets.

Minimizing the number of different pallets to be processed will likely increase the number of competitive suppliers who will wish to participate and thus minimize the cost of the recycled pallets.

If there are few pallets entering the trash OR there is minimal new pallet purchases required at a location, the advantages of standardizing the pallets or establishing a revitalization program are minimal.

If there are many varied sizes, types and quality pallets being disposed of in the trash, then it would likely be advantages to standardize on the pallets and enforce conformance to optimize the benefits. Here again if there is minimal demand for new pallets the overall benefits to the location may be reduced but likely still pursued. Local or regional pallet repair 'vendors may still have a demand for these pallets for a fee or free. Both would end up saving IBM money through reductions in our disposal fees.

2. Pallet Conformance Program

It will make little difference if you only request that all IBM locations and suppliers use the standard sizes and design pallets if you do not CHECK and ENFORCE their use. IBM has a Corporate "Specification for Supplier Packaging & Handling" (GA21-9261), which only some locations provide to their suppliers. For those that do, not all use the "Improper Packaging Report" form (GX-21-9263) to report exceptions and get them corrected. Utilizing these documents and associated procedures it is possible to significantly reduce the number of inferior & nonstandard pallets entering the system which can not be reused or effectively reutilized. IBM ends up paying to replace them or dispose of them.

3. Pallet Revitalization Program

There are a number of available options if establishing a "Pallet Revitalization" program. In addition to known defective pallets there are always others which are questionable as to their potential further use by IBM. Some locations have implemented strict inspection or review processes so that they will use only top quality pallets, particularly for IBM Product shipments. Other locations have felt this process was too costly and dispose of questionable pallets. A pallet revitalization program can allow IBM to position this quality audit activity at a vendor where it can be done not only for less but where defective pallets can be repaired and then reused effectively. The following are some of the potential vendors for such an operation.

a. New Pallet Suppliers.

The suppliers of our new pallets could be interested in providing such a service. They would have a potential to more than replace the loss in new pallet volumes with the repair and recertification of pallets for IBM and it suppliers.

The following are some reasons why the new pallet suppliers could be interested in such revitalization programs:

- Maintain or improve their Gross Sales Dollars.
- Possible added IBM supplier purchases of pallets.
- Already have training and tools for process.
- May have uses or markets for pallet scraps.

b. Pallet Repair Vendors.

There are already companies who specialize in the inspection and repair of pallets for resale at much lower than new pallet costs. Some of the reasons that this can be a practical alternative are:

- IBM has the necessary pallet drawings & specifications.
- May have uses or markets for pallet scraps.
- Can expand their income opportunities.
- Can expand their customer base with both IBM & its suppliers.

c. Handicapped or Minority Vendors.

The majority of the work involved in this inspection and repair activity involves handling, sortation, storage & transportation. The closer the vendor is the lower the potential costs can be. The following summarizes the reasons that this is a good alternative:

- IBM likes to support such operations,
- Can have lower costs & could reduce recycled pallet price.
- IBM has the necessary pallet drawings & specifications.
- Does not require significant training or technical skills.
- Does not require significant or costly tooling.
- May have uses or markets for pallet scraps.
- Can expand their income opportunities.
- Can expand their customer base with both IBM & its suppliers.

In summary, because the inspection and repair is simple and requires very little training or equipment it is normally very easy to establish. This is particularly true when there are a number of different types of organizations willing and able to compete for this business.

Finally, as pointed out several times before, IBM can reduce its solid waste as well as its disposal cost while reducing the amount it has to pay for its pallet needs. IBM can be a good Corporate Environmental Citizen and help to protect the environment and reduce the waste of natural resources while we improve our operations and processes.

I.2.4 Alternative Recycling Alternatives.

There can still be situations where there is no need for pallets at a location that would warrant setting up a Revitalization program. There are still many better ways to dispose of the excess and defective pallets than to add them to the solid waste stream to incinerators & landfills.

This section will point out some of these additional disposal options which can lead not only to reducing IBM's disposal costs but turn this otherwise trash into useful products. The following are some of the potential outlets for such materials:

1. Pallet Recyclers

Just as above where there was a need for new pallets most of the same organizations could be interested in our excess and scrap pallets. Many may be willing to pay us for them while others will pick them up for free. Some may require delivery but this would likely still be less in cost than disposal in landfills etc and would help environmentally. The only group that would not likely be as interested would be the special operations at a minority or handicapped operation.

2. Pallet Repair Vendors

There can be local or regional pallet repair vendors who could be similarly interested in our excess and scrap pallets. They can repair these pallets and sell them to our suppliers and other interested companies. Again, IBM can possibly reduce its solid waste and the associated disposal costs while helping the environment.

3. Other Wooden Product Manufacturers

Similarly, there can be some regional wood products suppliers who could be interested in our pallets for use in their operations. Our benefits would be limited to the following but still important items:

- Possible payment for pallets otherwise disposed of as trash.
- Reduced disposal costs.
- Help control future disposal costs and landfills lives.
- IBM good Corporate citizen & environmentalist image.

I.2.5 Reusable Pallet Systems.

Currently despite the fact that our IBM pallets are capable of being reused several times we consider most of them disposable. There are ways by increasing our investment in the pallets' designs so that they could be reused even more. However, at least at this time there are no adequate systems for pallet collection and reuse to warrant the investment. Another option of this approach is that we could use appropriate pallets from a national &/or international pallet pool organization. IBM's Corporate Purchasing Organization is pursuing the feasibility at the present time for our purchases and return for credit possibilities. Some of the potential benefits are:

- Possible reduced pallet costs to IBM & IBM suppliers.
- Reduced disposal costs.
- Possible parts cost savings from reduced supplier pallet costs.

I.2.6 Palletless Distribution Systems.

Many food companies and now Apple Computers are using "slipsheets" rather than pallets for the unitization and movement of their parts, subassemblies & finished goods through the distribution environment. It may not be possible for IBM to implement such a program for all aspects of its operations. Some groups who are reviewing these possibilities which may eventually result in some pilot operations on specialized product situations.

A slipsheet is usually a solid fiber or plastic sheet of < 1/2" in thickness which can be designed for the specific size of the product load. It has protruding lips on 1 side and 1 end which allows special equipment (which can be added to a normal fork truck) to grasp the slipsheet. The load is usually stretchwrapped to the slipsheet. The special handlers are called "push / pull" devices. This special equipment grasps the slipsheet and "Pulls" it onto the platen / forks and then it can be removed from the fork truck by means of a pneumatic "Push" operation. This special equipment can be rapidly and easily added or removed from normal fork trucks and costs only about $5,000.

Some of the possible advantages of slipsheet operations are:

- Costs less than pallets.
- Require far less storage space.
- Could help IBM load density.
- Reduced height may help loading/unloading safety.
- More Potential products per shipment.
- Offers improved stacking strength potentials.
- Loads are more stable.

- More evenly disperses weight to lower loads.
- Create less top damage to loads below them.

(This section will be updated as more information is made available.)

I.2.7 Summary

By the implementation of these methods it should be possible to make an immediate and significant improvement on the effects that our pallets have on the environment and the solid waste stream.

This will usually start at the plant site and as the program grows it will extend its influence over our suppliers and then our customers. We will not only have been an excellent Corporate Environmental Citizen but can usually accomplish all of this while reducing the overall operating costs by:

- Reducing our amount of trash & therefore our disposal costs.
- Reducing the amount of repalletizations previously required.
- Reducing the cost for our pallets by auditing &/or repair to extend reuses.
- Possibly getting passed on savings from our suppliers who can also save significantly.
- Reducing the damage caused by inferior or not properly handable sized or designed pallets.
- Use of palletless distribution we may be able to increase our load densities & volumes and therefore reducing our transportation expenses.
- Using the shredded pallets may increase the potential reuse of paper and corrugated that might otherwise reduce to readily in strength and therefore add the need for higher priced raw materials.

In addition to all of these noteworthy attributes we can also assist our suppliers, dealers, consolidation vendors, brokers and our customers into doing a better job in handling their solid waste. As a good Industry leader, IBM can influence our competitors, environmentalists, and legislators to show what can be done when the proper effort and thought is utilized. Our efforts hopefully will spur all of these people to use our example to further the packaging environmental efforts all over the world.

Appendix J. IoPP Packaging Redaction, Recycling & Disposal Guidelines

Institute of Packaging Professionals

Executive Offices
11800 Sunrise Valley Drive
Reston international Center
Reston, Virginia 22091 US4

Tel: 703-620-9380
Fax: 703-391-6897

IoPP PACKAGING REDUCTION, RECYCLING & DISPOSAL GUIDELINES
(Spring 1990)

PREAMBLE

The Institute of Packaging Professionals' (IoPP) Package Recycling and Disposal Committee has developed the following guidelines to help packaging professionals and corporate decision makers evaluate packaging options while assessing their impact on the environment.

Answers to the guidelines' questions for each specific package will most often be subjective. Absolute categories of right and wrong answers generally do not exist. Each package will have different considerations and therefore, different answers.

The guidelines are classified into five main sections: source reduction: recycling: degradability; disposal; and, legislative considerations. Each section contains important information to help guide the packaging professional through the package structural design and engineering evaluation process.

All five sections should receive separate attention. However, the impact of one package structural design or engineering decision on the total packaging system must be continuously considered. For example, if lightweighting the primary package results in more secondary or tertiary packaging, lightweighting may not be a good idea.

The issue of environmental impact is a very complex one. Each of the questions in the Guidelines should be approached on three levels: theoretical; technological; and, practical. For example, a material my

be theoretically and technologically recyclable, but there may not be a system in place to accomplish the recycling, so that practically speaking, the material is not recyclable at this time.

IoPP maintains that, although a package's environmental impact is a significant component of the package structural design/evaluation process, the integrity of the product must never be compromised. For the packaging decision maker, the physical, chemical, and biological integrity of a product must supercede any actual or possible environmental impact. Product protection and preservation, along with consumer safety must remain the primary responsibilities of the packaging professional.

Furthermore, it is impossible to consider the guestions posed in the Guidelines without evaluating economic realities. Each question must be balanced with the economic considerations facing the packaging professional. It benefits no one if a packager pursues an "environmentally sound" policy only to suffer severe economic repurcussions resulting in either a marked reduction in sales or forced abandonment of the environmental policies after a short period.

In those rare cases when serious conflict existsbetween environmental and more traditional concerns, the packaging professional should work in conjunction with management to resolve this conflict. Final decisions on a package's various components and materials will ultimately be determined by the individual package manufacturers and users considering the total manufacturing/distribution/marketing/consumer system.

New environmental legislation and technological advances which impact packaging occur daily. These Guidelines are based on a 1990 understanding of packaging technology and environmental issues and will be updated periodically to recognize change.

HOW TO USE THE GUIDELINES

These Guidelines were developed to help companies consider environmental implications during the package structural design process. There are no formulas presented by which to judge how "environmentally friendly" a package is. Rather, guestions are presented to help packaging professionals address environmental considerations as related to their particular packaging situations.

When using the Guidelines, a company may find that there are some sections that should be tailored to better suit its specific situation. IoPP recommends doing so and incorporating the Guidelines into the formal package structural design process as company policy.

It should be noted that for every answer that suggests a negative effect on the environment, there should be concrete reasons why the package causes this effect. These must then be reviewed to determine if the negative impact on the environment is unavoidable or if changes can be made to lessen or remove it.

SURVEY

At the end of the Guidelines, there is a survey form to complete after using the Guidelines. This is optional and is included to help keep IoPP up to date on industry activity with regard to environmental issues. Each company, and even different groups and divisions within a company, will have unique experiences in this area. The more IoPP knows about successful programs and developments, the more information it can disseminate to the packaging community and other interested parties.

SOURCE REDUCTION

Source reduction is an on-going materials and energy conservation process to reduce post-consumer solid waste by developing and adopting a wide variety of functional systems and techniques that minimize the use of materials and energy resources.

Of all the environmental considerations packaging professionals must evaluate, none more directly affects municipal solid waste than source reduction. This is the EPA's highest priority solid waste management option and should be the first and most important consideration. Depending on consumer acceptance of recycling programs, a package which achieves significant source reduction goals may actually have a better environmental impact than a highly recyclable package which, nonetheless, never gets into a recycling system.

Among questions packaging professionals should ask are:

1. Can the package or any of its components be eliminated entirely (i.e. does the product really need an individual package or can it be sold as is or in bulk)?

   [ ] Yes, the package can be eliminated.

   [ ] Yes, a component of the package can be eliminated.

   [ ] No, neither the package nor any of its components can be eliminated.

2. Are measurable source reduction benefits made possible by the reuse of the package without remanufacturing?

   [ ] yes [ ] No

3. a. Can source reduction goals be achieved by packaging geometry or structural design changes (e.g., lowerpackaging surfacearea

to product volume ratios)?

[ ] Yes [ ] No

b. Can overall packaging volume be reduced by using different packaging or container forms?

[ ] Yes [ ] No

C. Can overall packaging weight be reduced by using different packaging or container forms?

[ ] Yes [ ] No

4. a. Does a reduction in materials in one part of the package system require as much or more materials to be used in another part of the system?

[ ] Yes [ ] No

b. Is it possible to increase secondary or tertiary packaging to reduce primary packaging and achieve a net overall reduction?

[ ] Yes [ ] No

5. Through product design changes (e.g., liquid concentrates, improved product ruggedness), can the package be redesigned to use less material without compromising the product?

[ ] Yes [ ] No

6. Can the package or one of its components be designed to be safely refilled or reused by the consumer?

[ ] Yes [ ] No

7. Can source reduction goals be met by replacing a number of smaller packages with a single larger, more efficient package size (e.g., family-size or bulk containers rather than individual portion packages)?

[ ] Yes [ ] No

a. a. Is it possible to reduce or eliminate secondary or tertiary packaging or wrapping?

[ ] Yes [ ] No

9. Are customer suggestions on source reduction possibilities for secondary and tertiary packaging throughout the distribution system solicited and encouraged?

[ ] Yes [ ] No

10. Does a product or package change which results in source reduction cause an increase in solid waste in other areas (e.g. an increase in the amount of food spoiled and thrown away as a result of changing from smaller to larger packaged servings)?

[ ] Yes [ ] No

11. Can source reduction be achieved by changing the distribution process or transportation modes?

[ ] Yes [ ] No

RECYCLING

Recycling of a package or using recycled material in a package is generally considered the second most desirable alternative for reducing the environmental impact of the package.

But using a material that can be technically recycled may not be preferable to other means of reducing environmental impact if there is not a commercially viable recycling system in place. Too often, the term "collectable" is confused with "recyclable," and there is a very big difference between the two.

Because same municipalities have establish& recycling systems while others have not, the package's distribution area must be considered.

Recycling is an issue that necessarily involves individuals outside the packaging community as well as those within it. Suppliers, users, environmental groups, government personnel, consumers, and legislators must work together to establish and coordinate recycling program and help create real markets for recycled materials.

As a practical matter, to be recyclable a material must have an existing, economically practical and functional commercial recycling system through which it can be processed. If there is not such a system in place, but the technology and market exist to have one, then all parties involved should work together to develop such a system if it is economically feasible.

NOTE: In the committee's opinion, new package forms and packages made of materials not currently being recycled will probably besubjected to higher levels of scrutiny than traditional package forms andmaterials that are already being recycled.

12. a. Does the technology exist to collect packaging from consumers and recycle it commercially?

[ ] Yes [ ] No

b. If not, is the necessary research being conducted to develop this technology- either alone or in conjunction with industry, government officials or academia?

[ ] Yes [ ] No

13. a. Is the package or one of its components reuseable as the same item without remanufacturing?

[ ] Yes [ ] No

b. Is there a system in place to collect and reuse these used packages?

[ ] Yes [ ] No

c. If not, is there active development of such a system?

[ ] Yes [ ] No

14. a. Is the package recyclable (i.e., is there a system in place to recycle the package)?

[ ] Yes [ ] No

b. If so, area symbol and instructions used on the package to encourage recycling?

[ ] Yes [ ] No

15. Can the material be identified on the package (e.g., the plastic resin recyclng code) to aid collection and recycling?

[ ] Yes [ ] No

16. a. Has an in-house or in-plant resource recovery or recycling system to use waste products generated from the manufacture of yourproduct or package been established?

[ ] Yes, into the same product.

[ ] Yes, recycled into a secondary product or single material.

[ ] Yes, recycled into a secondary product or commingled material.

[ ] Yes, materials must be reclaimed by a chemical or other process.

[ ] Yes, and the material is sold or given to an outside vendor to be recycled.

[ ] No.

b. If not, is there active development of such a system?

[ ] Yes [ ] No

17. a. Is the outer and inner packaging used for shipment and distribution of goods recyclable?

[ ] Yes [ ] No

b. Has a resource recovery and recycling system been established in cooperation with customers to collect and reuse distribution packaging waste that does not reach the ultimate consumer?

[ ] Yes [ ] No

c. If hot, is there active development of such a system?

[ ] Yes [ ] No

18. a. Are programs in place to require reuseable or recyclable secondary packaging from suppliers?

[ ] Yes [ ] No

b. If not, is there active development of such programs?

[ ] Yes [ ] No

19. a. If the technology does exist to collect and recycle post-consumer packaging, are systems in place to collect and recycle the packaging?

[ ] Yes [ ] No

b. If not, is the development of such systems being actively pursued-either alone or in conjunction with industry, government officials or academia?

[ ] Yes [ ] No

20. a. Are recycling systems established for the packaging material in all the regions in which the package will be sold or distributed?

[ ] Yes [ ] No

b. If not, is participation in the creation of such regional recycling systems being pursued?

[ ] Yes [ ] No

21. a. Is there a viable commercial market for these post-consumer recycled packaging materials?

[ ] Yes [ ] No

b. If not, are any projects or programs to increase demand for this recycled material being initiated -- either alone or in conjunction with industry, government officials or academia?

[ ] Yes [ ] No

22. a. Is the package mono-material or multi-material (e.g. laminated or coextrusion)?

[ ] Mono-material [ ] Multi-material

b. If the package is multi-material:

1) Are current recycling systems set up to handle these multi-material packages?

[ ] Yes [ ] No

2) If there is not a recycling system in place to process the multi-material package, is your company pursuing the development of such a system -- either alone or in conjunction with industry, government officials or academia?

[ ] Yes [ ] No

3) Is this combination of materials the most environmentally sound structural design possible without compromising product integrity?

[ ] Yes [ ] No

4) Do the materials need to be further separated to increase their recycling value or to avoid impeding the recycling process?

[ ] Yes [ ] No

23. a. Does the primary, secondary and/or tertiary package currently use recycled material?

[ ] Yes [ ] No

b. If so, is there a symbol and statement on the package to indicate that recycled material has been used?

[ ] Yes [ ] No

24. a. Have the effects that the use of recycled materials on the physical properties of the package (stacking strength, printing quality, etc.) been thoroughly considered?

[ ] Yes [ ] No

b. Will the use of recycled materials require more materials or an increase in the overall volume/weight of the package to maintain an acceptable level of package performance?

[ ] Yes [ ] No

C. Has the impact of recycled material use on your manufacturing/production processes been researched (e.g., will recycled materials run on your existing machinery; will the use of recycled materials require significantly more energy/labor consumption)?

[ ] Yes [ ] No

DEGRADABILITY

Degradability is perhaps the most misunderstood concept in the solid waste field. A package may have the characteristics that make it biodegradable, photodegradable, or chemically degradable: but, if it is not disposed of properly (under the right environmental conditions), it will not degrade and will remain a waste product in the municipal solid waste system. For instance, essentially no degradation takes place in a landfill. Biological degradation occurs in composting and sewage treatment plants.

Because successful applications of degradable packages are limited, the desirability of degradability follows source reduction and recycling. Inmostcases, degradability may actually be undesirable. It would not be appropriate to switch a package to a material that is degradable from one that is recyclable and for which a recycling system exsists.

Before a degradable system is considered as a viable option, all the impacts of that system on the environment must be fully understood and considered. Moreover, the issues of proper exposure conditions, time frames required, and levels of break-down should be established.

25. a. Is the package technically biodegradable?

[ ] Yes [ ] No

b. If yes, does the packaging material need to be separated before it can be considered biodegradable?

[ ] Yes [ ] No

c. Will the package be intended to be disposed of in a composting or some other specified treatment facility to ensure that biodegradation occurs?

[ ] Yes [ ] No

d. Will it produce any by-products through degradation which are harmful to the environment?

[ ] Yes [ ] No

e. Has research been conducted to evaluate the positive and negative aspects of using biodegradable material?

[ ] Yes [ ] No

26. a. Is the package photodegradable?

[ ] Yes [ ] No

b. If yes, does the package material have to separated before photodegradation?

[ ] Yes [ ] No

c. Will it produce any by-products through degradation which are harmful to the environment?

[ ] Yes [ ] No

d. Has research been conducted to evaluate the positive and negative aspects of using photodegradable materials?

[ ] Yes [ ] No

27. a. Is the package chemically degradable?

[ ] Yes [ ] No

b. If yes, does the package material have to be separated before chemical degradation?

[ ] Yes [ ] No

C. Will it be disposed of in a sewage treatment plant to ensure that chemical degradation occurs?

[ ] Yes [ ] No

d. Will it produce any by-products through degradation which are harmful to the environment?

[ ] Yes [ ] No

e. Has research been conducted to evaluate the positive and negative aspects of using chemically degradable materials?

[ ] Yes [ ] No

DISPOSAL

When a package finally reaches the end of its lifecycle, it must be disposed of properly. This is a problem that each geographic region must handle according to its own needs and resources. However, thepackage should be designed to facilitate its safe, and if possible, easy disposal. This may require instructions on the proper disposal method. Cooperation between industry and governments must be pursued to ensure that proper disposal is achieved.

28. a. Has the package and its components (i.e., inks, dyes, pigments, stabilizers, solders and adhesives) been made without the inclusion of toxic materials, such as heavy metals including cadmium, lead, mercury, and hexavalent chromium?

    [ ] Yes [ ] No

    b. If the package material currently uses toxic materials, can they be removed without compromising the package's functions?

    [ ] Yes [ ] No

29. a. Can the package be landfilled safely without leaching hazardous by-products or otherwise causing harm to the environment?

    [ ] Yes [ ] No

    b. If no, can the package be designed to avoid problems in landfill disposal?

    [ ] Yes [ ] No

30. Can the package be made smaller and/or designed to be compacted by consumers or waste management companies so that it takes up less collection/landfill space?

[ ] Yes [ ] No

31. Can the package be incinerated safely to recover the energy value of the packaging materials without harmful ash residue or emissions?

[ ] Yes [ ] No

32. Does the package contain sufficient combustible materials to be reprocessed for safe burning and energy recovery?

[ ] Yes [ ] No

LEGISLATIVE CONSIDERATIONS

Legislation which will directly impact packaging is being written and proposed in every part of the country. This legislation varies from area to area and, therefore, must be carefully considered in conjunction with the proposed distribution of the product/package.

33. Will existing or proposed legislation (i.e. package taxes, bans, desposits, solid waste bills, etc.) affect the package?

[ ] Yes, on the federal level.
[ ] Yes, on the state level.
[ ] Yes, on the local level.
[ ] No

34. a. Does your company act in an advisory capacity to federal, state and/or local governments to ensure that they have access to accurate packaging data?

[ ] Yes [ ] No

b. If yes, are the packaging structural design requirements fully considered by corporate lobbyists?

[ ] Yes [ ] No

C. Have you catalogued and considered all current and pending legislation in markets where your package will be sold or distributed?

[ ] Yes [ ] No

Institute of Packaging Professionals

ENVIRONMENTAL SURVEY

The purpose of this survey is to track industry use of IoPP's Packaging Reduction, Recycling & Disposal Guidelines. This information will help us keep current on industry activity and the need to update the Guidelines.

Any information you provide will remain confidential if you so desire. There is no need to identify your company. This survey is strictly voluntary.

1. Does your company currently use the Guidelines?

[ ] Yes [ ] No

2. If yes, for how long?

[ ] 0 -6 months
[ ] 6 -12 months
[ ] 12 - 18 months
[ ] 18 months or longer

3. Is it corporate policy to use the Guidelines?

[ ] Yes [ ] No

4. Has the use of the Guidelines affected packaging structural design decisions?

[ ] Yes, significantly
[ ] Yes, moderately
[ ] Yes, somewhat
[ ] No

5. Please rate on a scale of 1 to 5, where 1 is the least and 5 is the most, how each section of the Guidelines affects your decision making.

[ ] Source Reduction
[ ] Recycling
[ ] Degradability
[ ] Disposal
[ ] Legislative Considerations

6. Indicate any deficiencies in the Guidelines that you feel hinders their effectiveness.

[ ] Too long
[ ] Too short
[ ] Too specific
[ ] Too general
[ ] Outdated information
[ ] Other (please specify) _____

7. As a package professional, how much of your time is currently taken up with environmental issues?
(Circle appropriate %)

Less than 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

A. How does this compare with six months ago?
Less than 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

B. How does this compare with one year ago?
Less than 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

c. How much of your time do you expect to devote to environmental considerations in the next 12 months?
Less than 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

a. How have environmental considerations affected your annual packaging costs in the last two years?
[ ] Lowered annual costs by _____% (approximately)
[ ] No effect
[ ] Raised annual costs by _____% (approximately)

9. What impact do you expect environmental considerations to have on your packaging costs in the next 12 months?
[ ] Lower annual costs by _____% (approximately)
[ ] No effect
[ ] Raise annual costs by _____% (approximately)

Identification

10. Is the company for which you work a packaging supplier, a packaging user, neither, or both?

[ ] Supplier [ ] User [ ] Neither [ ] Both

11. If a supplier, what does your company supply to packaging users?

[ ] Machinery [ ] Materials [ ] Containers [ ] Supplies

[ ] Services [ ] Other (please specify) _____

12. Within the ccmpany what is your packaging responsibility?

[ ] Design [ ] Production [ ] Marketing [ ] Sales

[ ] Legal [ ] R&D [ ] Engineering [ ] Management

[ ] Other (please specify) _____

13. If your company is a packaging user, do you purchase, specify, recommend or influence the purchase of:

Machinery?	[ ] Yes	[ ] No
Materials?	[ ] Yes	[ ] No
Containers?	[ ] Yes	[ ] No
Supplies?	[ ] Yes	[ ] No
Services?	[ ] Yes	[ ] No

14. Approximately how many employees does your company have?

[ ] l-10 [ ] 11-50 [ ] 51-100 [ ] 101-500

[ ] 501-1,000 [ ] l,OOl-10,000 [ ] lO,OOO+

15. Approximately what percentage of those employees are directly involved inpackaging?

[ ] 0% [ ] l-10% [ ] 11-20% [ ] 21-50%

[ ] 51-75% [ ] 76-100%

16. Are there particular functions or services you would like IoPP to provide in helping you manage the environmental aspects of your packaging?

[ ] Yes [ ] No

17. If yes, which of the following would you like to see IoPP providing?

[ ] publish newsletter on packaging and the environment

[ ] Report number activities designed to reduce their packaging impact on the environment

[ ] Maintain database of environmental contacts

[ ] Conduct educational seminars on packaging and the environment

[ ] Issue papers on topical aspects of packaging and the environment

[ ] Serve as clearinghouse for environmental information

[ ] Collect, organize and distribute scientific research data

[ ] Collect, organize and distribute market research data

[ ] Improve and maintain liaison with corporate environmental affairs managers, various packaging associations and environmental organizations

[ ] Monitor and report regulatory and legislative activity affecting packaging

[ ] Organize environmental speakers bureau

[ ] Other (Please specify) _____

_____

(Optional)

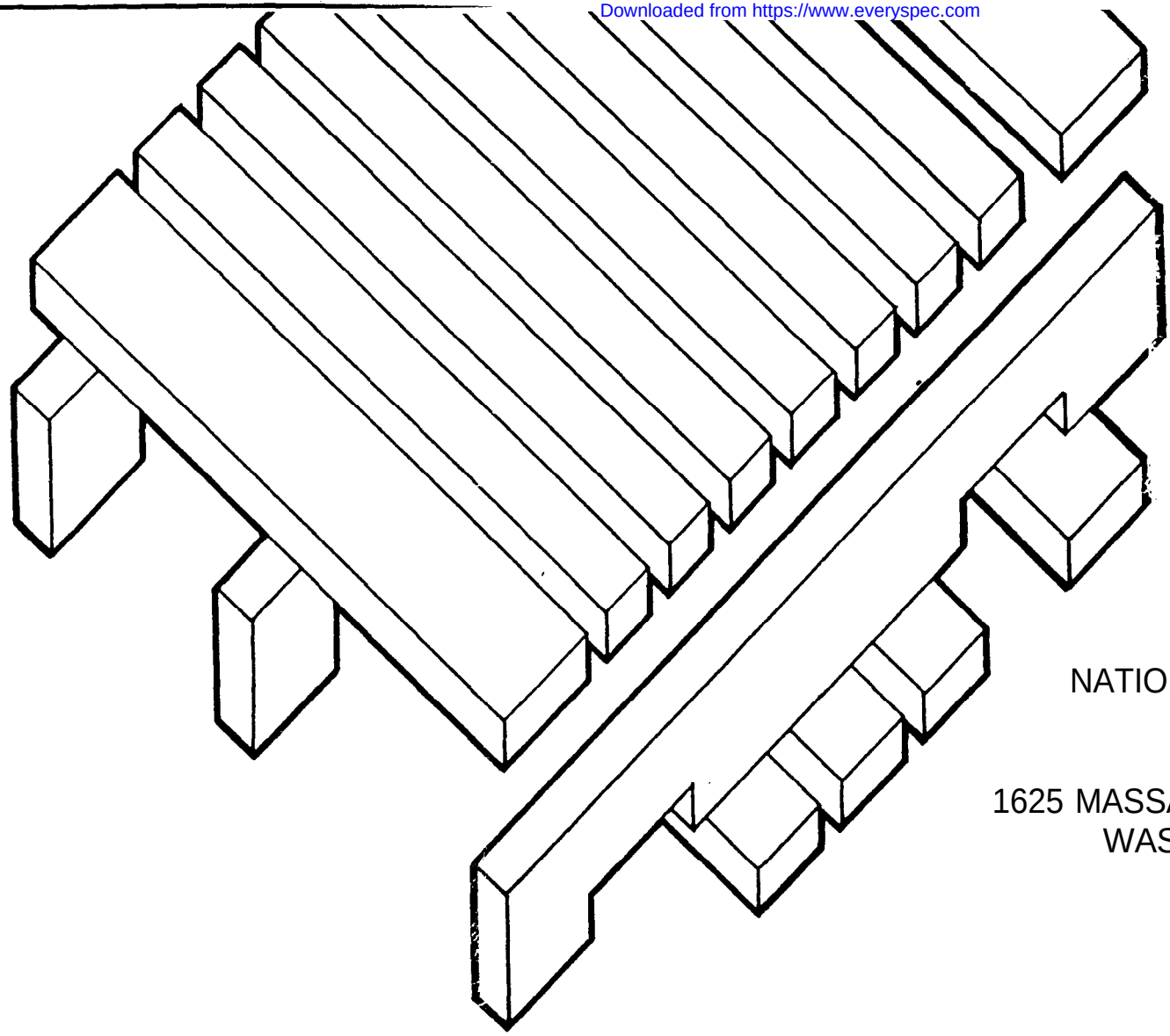
Your name _____

Your company _____

Please forward survey to:

Institute of Packaging Professionals
Reston International Center
11800 Sunrise Valley Drive
Reston, VA 22091
Tel: 703-620-9380/Fax: 703-391-6897

Appendix K. Processors of Pallets



NATIONAL WOODEN PALLET AND
CONTAINER ASSOCIATION

1625 MASSACHUSETTS AVENUE, N.W.
WASHINGTON, DC 20036-2279

(202)667-3670

PALLET AND CONTAINER SUPPLIERS,

PRODUCT IDENTIFICATION CODES

(01) MANUFACTURER

(02) WHOLESALER/DISTRIBUTOR

(03) SAWMILL FACILITIES

(04) REUSABLE WOOD

(05) REUSABLE METAL

(06) REUSABLE PLASTIC

(07) REUSABLE PAPER

(08) EXPENDABLE WOOD

(09) EXPENDABLE METAL

(10) EXPENDABLE PLASTIC

(11) EXPENDABLE PAPER

(12) SKIDS

(13) BASES AND TOP FRAMES

(14) PALLET RECYCLING/REPAIR

(15) USED PALLET CONTAINERS

(16) PALLET CONTAINERS

(17) BOXES AND CRATES

(18) FANCY WOOD BOXES

(19) BEVERAGE CASES

(20) WIREBOUND BOXES

(21) CLEATED PLYWOOD BOXES

(22) CLEATED CORRUGATED/ FIBERBOARD BOXES

(23) CABLE REELS

(24) TREATING FACILITIES

(25) OTHER

When contacting these companies, be sure to mention NWPCA as the source for their names.

ALABAMA

ALABAMA PALLET COMPANY, INC.
P.O. Box 482
Town Creek, AL 35672
(205)685-3322
01,04,08,12,13

C & L WOOD PRODUCTS, INC.
Route 6 Box 90-D
Hartselle, AL 35640
(205)773-3233
(205)773-3234
01,04,08,12,13,17,25

COXCO, INC.
P.O. Box 793
Bessemer, AL 35021
(205)428-6223
02,25

ELBA PALLETS, INC.
P.O. Box 276
Elba. AL 36323
(205)897-6421
01,03,12

BAKER DIVISION/SONOCO PRODUCTS
P.O. Box 668
Hartselle, AL 35640
(205)773-6581
23

ARIZONA

DEPENDABLE PALLET SERVICE
2828 South 35th Avenue
Phoenix, AZ 85009
(602)278-1009
01,04,12,14,17

PALLET EXCHANGE
1048 E. Broadway
Phoenix, AZ 85040
(602)276-3334

ARKANSAS

ANGELO MANUFACTURING COMPANY, INC.
P.O. Box 847
Jonesboro, AR 72403-0847
(501)932-4115
01,04,08,12,13,14

LOVE BOX COMPANY, INC.
833 Beechwood
Fayetteville, AK 72701
(501)442-9866
01,03,04,08,12,13,16,17

MARTIN LUMBER COMPANY, INC.
P.O. Box 100
Concord, AR 72523
(501)668-3441
01,03,04,08,12,13,17,21

MID SOUTH INDUSTRIAL SALES
P.O. Box 6425
Fort Smith, AR 72906
(501)646-7786
02,26

MULBERRY LUMBER COMPANY-PLANT
P.O. Drawer B
Mulberry, AR 72947
(501)997-8200
01,04,08,12,13,14,15,161,7,18

SMITH PALLET COMPANY, INC.
P.O. Box 207
Hatfield, AR 71945-0207
(501)389-6184
(501)389-6183
01,12,13,17,25

CALIFORNIA

BARDWELL PALLET COMPANY
14561 South Broadway
P.O. Box 1122
Blythe, CA 92226
(619)922-7111
01,04,08,12,14,25

GEORGE BASSI DISTRIBUTING COMPANY
P.O. Box 1169
Watsonville, CA 95077
(408)724-1028
01,04,08,12,13,14,15,16,17,21

CALIFORNIA PALLET COMPANY
P.O. Box 7 Weedpatch Highway
P.O. Box 70277
Bakersfield, CA 93387-0277
(805)366-4415
01,12,15,16,17

COMMERCIAL LUMBER & PALLET COMPANY, INC.
135 Long Lane
Industry, CA 91746
(818)968-0631
01,03,08,12,13,14,25

COMMERCIAL LUMBER AND PALLET COMPANY, INC.
83-158 Avenue 45
Indio, CA 92201
(619)347-0727
01,03,08,12,13,14,25

LARSON PALLET COMPANY
1000 Yosemite Drive
Milpitas, CA 95035
(408)946-4971
01,04,08,12,13,14,16,17

PALLETS & ACCESSORIES COMPANY
P.O. Box 5458
Long Beach, CA 90805
(213)422-0981
(714)827-3220
01,02,04,08,13,14,15,16,17,21

SELECT PALLET COMPANY
15228 Boyle Avenue
Fontana, CA 92335
(213)628-9782
(714)829-2003
01,04,08,12,13,14,15,16,17,21,
25

SONOMA PACIFIC COMPANY
Suite 105, 2100 Embarcadero
Oakland, CA 94606
(415)261-1843
01,04,08,12,14

UNITED WHOLESALE LUMBER COMPANY
8009 Doe Avenue
Visalia. CA 93291
(213)726-1113
01,02,04,08,12,13,16,17,21

UNITED WHOLESALE LUMBER COMPANY (PLANT)
8009 Doe Avenue
Visalia, CA 93277
(209)651-2037
01,02,04,08,12,13,16,17,21

COLORADO

DENPAK BUILDING PRODUCTS INC.
6777 Downing Street
Denver, CO 80229
(303)289-5461
01,02,08,12,13,16,17,18,21

DENVER REEL & PALLET COMPANY
4600 Monaco Parkway
Denver, CO 80216
(303)321-1920
01,12,13,16,17,18,23

CONNECTICUT

EAST HARTFORD PALLET COMPANY, INC.
95 Leggett Street
East Hartford, CT 06128-0147
(203)291-8646
02,04,12,14,15,17,25

ROSSI PALLET PRODUCTS, INC.
P.O.Box 769
Higganum, CT 06441-0769
(203)345-4521.
01,03,08,12,13,16,25

DELAWARE

IRON HILL PALLET COMPANY
1143 Elkton Road
Newark, DE 19711
(302)368-9131

FLORIDA

HARRIS SUPPLY CO., INC.
P.O.Box 617350
Orlando,FL 32861-7350
(407)298-3830
(407)298-3831
01,02,13,14

PENSACOLA SKID & PALLET INC.
P.O.Box 81
Cantonment,FL 32533
(904)968-1504
01,02,08,12,13,17

OUASCO, INC.
1300 West Beaver Street
Jacksonville, FL 32209
904-358-7152(715
01,14

RIDGE PALLETS, INC.
P.O.Box 819
Bartow.FL 33830
(813)533-1147
01,04,08,12,13,14,15,16,17,24

TAMPA PALLET COMPANY
P.O.Box 310386
Tampa,FL 33680
(813)626-5700
01,02,12,13,14,16,17,20,21

GEORGIA

AMWARE DISTRIBUTION WHSE, OF GA., INC.
124 Forest Parkway
Forest Park, GA 30050
(404)366-5587
01,02,14

BATTLE LUMBER COMPANY, INC.
P.O. Box 1147
Wadley, GA 30477
(912)252-5210
(912)252-1316
01,02,03,04,08,12,13

DANIEL LUMBER COMPANY
P.O. Box 340
La Grange, GA 30240
(404)884-5686
01,08,12,13,17

JEFFERSON IND. INC.
P.O. Box 428
Wrens, GA 30833
(404)547-2516
(404)547-2519
01,03,04,08,12

PALLETS SOUTH
P.O. Box 418
Cairo, GA 31728
(912)377-2066
01,03,04,08,12,13,14

RIDGE PALLETS, INC. (PLANT)
P.O. Box 712
Hazlehurst, GA 31539
(912)375-7745
01,04,08,12,13,14,15,16,17,24

SOUTHERN FOREST INDUSTRIES, INC.
P.O. Box 373
Smarr, GA 31086
(912)994-0000
(912)742-1433
01,02,03,04,07,08,11,12,13,14,
17,20,21,25

SOUTHWIRE WOOD PRODUCTS DIVISION
1 Southwire Street
P.O. Box 1000
Carrollton, GA 301197
(404)832-5600
(404)832-5601
01,03,04,08,12,13,16,24

THE TIMBERMEN, INC.
P.O. Box 107
Camak, GA 30807
404-465-3506
01,02,03,04,08,12,13

ILLINOIS

B-C INDUSTRIAL SUPPLY, INC.
17550 Chicago Avenue
Lansing, IL 60438
(708)474-4455
02

B-C INDUSTRIAL SUPPLY, INC.
10203 West 191st Street
Mokena, IL 60448
(312)479-6659
02

BELL FIBRE PRODUCTS CORPORATION
163rd Street
South Holland, IL
(312)568-6210
01,02,04,07,08,11,12,13,14,15

CFC FOREST PRODUCTS COMPANY
P.O. Box 20161
Chicago, IL 60620-0161
(312)624-8442
02

CHAMPION WOOD PRODUCTS, INC.
4 Windemere Lane
S. Barrington, IL 60010
(708)934-7580
02,04,08,12,13,14,17,18,21,22,
24

G.L. WOOD PRODUCTS, INC.
1135 Carolina Drive
West Chicago, IL 60185
(312)231-5440
01,02,12,13,14

HUBER PALLET COMPANY, INC.
1222 Buchanan Street
Rockford, IL 61101-1401
(815)963-4724
01,04,08,12,13.14,17

INTERSTATE PALLET COMPANY
1400 Mitchell Road
P.O. Box 4066
Aurora, IL 60507-4066
(312)892-7900
01,02,04,08,12,13,16,17,21

LIBLA INDUSTRIES, INC.
5161 North Moreland
Norridge, IL 60656
(312)457-8040
01,02,04,08,12,13,14

MOMENCE PALLET CORPORATION
Route 114 East, P.O. Box 708
Momence, IL 60954-0708
(815)472-6451
01,04,08,12,13,14,15,16,17

NORTHERN PALLET & SUPPLY COMPANY
1940 Lehigh, P.O. Box 34
Glenview, IL 60025
(312)724-7100
01,02,08,12,13,16,17

INDIANA

ARNOPALLET COMPANY
2030 10th Street
P.O. Box 219
Bedford, IN 47421
(812)279-9760
(812)279-5770
01,03,04,08,12

BELL FIBRE PRODUCTS CORPORATION
P.O.Box 3333
Marion, IN 46953
(317)664-1261
(312)210-2780
01,02,04,07,08,11,12,13,14,15

CHESTERFIELD LUMBER COMPANY
120 W. Vineyard
Anderson, IN 46012
(317)642-3763
01,03,04,08,12,13,17,21

DODD SAW MILLS, INC.
R.R. #4- Box 148
Sullivan, IN 47882
(812)268-4811
01,04,08,12

FINDLEY INDUSTRIES, INC.
R.R. No. 7. Box 91
Seymour, IN 47274
(812)522-1501
01,08,12,13,17,21

INDUSTRIAL WOODKRAFT, INC.
P.O. Box 591
Boonville, IN 47601
(812)897-4893
01,12,13,14,17,20,21,22

MARKLEVILLE LUMBER COMPANY, IN C.
P.O. Box 137
Markleville, IN 46056
(317)533-4311
01,08,12,17

SHIPSHEWANA PALLET CO., INC.
RR 1, Box 101
Shipshewana, IN 46565
(219)768-4021
01,02,03,08,12,13,16,17

WEXFORD INDUSTRIES CORPORATION
P.O. Box 33301
Indianapolis, IN 46203
(317)783-1779
01,02,04,08,12,13,14,15,16,17,

IOWA

ADDOCO, INC.
205 Security Bldg.
Dubuque,IA 52001
(319)557-1555
01,02,04,12,13,14,15,16,17

TASLER PALLET & LUMBER, INC.
Old Hwy 20 East, P.O. Box 622
Webster City, IA 50595
(515)832-5200
01,04,08,10,12,13

KENTUCKY

GRAHAM PALLET & LUMBER CO., INC.
3255 Cefina Road
Tompkinsville, KY 42167
(502)487-6609
(502)487-6196
01,03,12

THE NELSON COMPANY OF KENTUCKY
P.O. Box 87
Lewisburg,KY 42256
(502)755-4811
01,02,03,04,08,12,13,14,16,17,
20

SCOTT LUMBER, INC.
P.0 Box 7
Henderson, KY 42420
(502)827-9815
01,03,04,08,12,13

SOUTHLAND MANUFACTURING, INC.
P.O. Box 121
Bowling Green, KY 42102
(502)781-1444
01,08,12,17

LOUISIANA

CENTRAL LUMBER COMPANY, INC.
1267 Choctaw Drive
Baton Rouge,LA 70805
(504)344-1507
01,02,08,12,17

W. B. NELSON LUMBER COMPANY, INC.
476 Highway 546
West Monroe, LA 71291
(318)396-7555
01,03,04,08,14,17

MAINE

ISAACSON LUMBER COMPANY
P.O. Box L
Livermore Falls, ME 04254
(207)897-2115
(207)897-5711
01,03,12,13

MARYLAND

CODDINGTON LUMBER COMPANY, INC.
R.D. No. l, Box 175
Frostburg, MD 21532
(301)689-8816
01,03,08,12,13

THE NELSON COMPANY
2116 Sparrows Point Road
Baltimore,MD 21219
(301)477-3000
01,02,04,05,06,08,09,10,12,13,
14,17,21,23

P.T. O'MALLEY LUMBER COMPANY
4242 Old North Point Road
Baltimore,MD 21222
(301)477-0500
01,04,08,12,13,14,17,18,21,24

PALLET REPAIR INC.
6609 Moravia Park Drive
Baltimore,MD 21237
(301)485-1335
14

TIMBER **INDUSTRIES, INC.**
P.O. Box 6879
Towson,MD 21285-6879
(301)823-8300
02,04,05,06,07,08,09,10,11,12,
13,14

VALLEYWOOD INDUSTRIES INC.
6600 Landay Avenue
Baltimore,MD 21237
(301)488-5500
01,04,12,13,14

MASSACHUSETTS

JARDIN, INC.
Cambridge Street,P.O. Box 626
Middleboro,MA 02346
(508)947-6123
01,02,04,08,12,13,14,16,17

MIGHTY FINE QUALITY WOOD PRODUCTS
620 Boston Turnpike Road
Shrewsburg,MA 01545
(508)842-5558
(508)655-4606
14,25

NEFAB, INC.
545 BOYLSTON STREET, SUITE 902
BOSTON,MA 02116
(617)236-4226
01,04,08,16,17,18

NEW ENGLAND PALLETS & SKIDS
250 West Street - P.O. Box 342
Ludlow,MA 01056-0342
(413)583-6628
01,08,12,13

P & S PALLETS, INC.
P.O. Box 191
Westminster, MA 01473
(508)928-5634
(508)928-4741
02,04,12,13,14,25

MICHIGAN

AMERICAN CONEXION INC.
P.O. Box 2446
Dearborn,MI 48123
(313)565-3151
(313)361-1320
01,02,04,12,14,15,17,20

BELL FIBRE PRODUCTS CORPORATION
2000 Beverly Street, S.W.
Grand Rapids, Ml
(616)452-2111
01,02,04,07,08,11,12,13,14,15

BR PALLETS & CRATES, INC.
29160 Middle Crossing Road
Dowagiac, Ml 49047
(616)782-7850
01,12,13,14,17,18

C & K BOX CO., INC.
423 Barrett Avenue
P.O. Box 1817
Jackson,MI 49204
(517)784-1779
(517)784-0301
01,03,12,14,16,17

MICHIGAN (CONTINUED)

CANNONSBURG WOOD PRODUCTS
P.O. Box 678
Rockford, MI 49341
(616)866-4459
01,04,08,12,13,14

INDUSTRIAL PACKAGING CORPORATION
12871 Westwood
Detroit, MI 48223
(313)835-0930
01,02,03,04,08,12,13,16,17,20,
21

KAMPS PALLETS
2900 Peach Ridge
Grand Rapids, MI 49504
(616)453-9676
01,02,04,06,08,12,14,25

L & H WOOD MANUFACTURING COMPANY, INC.
P.O. Box 441
Farmington, MI 48024
(313)474-9000
01,02,03,04,05,06,08,10,12,13,
14,15,16,17,18,19,20,21,22

MATHEWS ENTERPRISES, INC.
P.O. Box 321
Trenton, MI 48183
(313)671-8500
01,02,04,12,14,15

MICHIANA BOX & CRATE, INC.
2193 Industrial Drive
Niles,MI 49120
(616)683-6372
01,03,04,08,12,13,16,17,21,22

PACKING MATERIAL COMPANY
27280 Haggerty Road Suite C-16
Farmington Hills, MI 48331
(313)489-7000
01,02,08,10,12,13,14,16,17,18,
18,20,21,22

PALLOX, INC.
P.O. Box 619
Clinton, MI 49236
(517)456-4101
01,04,08,12,13,14,16,17

ST. CHARLES LUMBER PRODUCTS, INC.
1225 N.Saginaw Street
P.O. Box 116
St.Charles,MI 48655-0116
(517)865-9915
01,02,04,08,12,13,14,15,16,17

WATERLAND ENTERPRISES, INC.
P.O.Box 567
Kalamazoo,MI 49005
(616)342-8113
14

MINNESOTA

MATTSON MFG. CO.
20 Jay Cooke Road
Esko,MN 55733-9604
(218)879-8553
01,08

PALLET EXCHANGE, INC.
3101 North 2nd Street
Minneapolis, MN 55411
(612)522-4394
01,02,04,14,15

PALLET SERVICE CORPORATION
4124 83rd Avenue N.
Minneapolis, MN 55443
(612)560-2434
01,04,05,06,08,10,14,15

SAVANNA PALLETS, INC.
P.O. Box 308
McGregor,MN 55760
(218)768-2077
01,04,08

VIKING PALLET CORPORATION
9188 Cottonwood Lane
P.O.Box 167
Osseo,MN 55369
(612)425-6707
01,04,08,12,13

VILLAUME INDUSTRIES, INC.
2926 Lone Oak Circle
St.Paul,MN 55121
(612)454-3610
01,03,04,08,12,13,14,16,17,18,
21,22,24,25

WOODLAND CONTAINER CORPORATION
P.O. Box 110
Aitkin, MN 56431
218-927-3721
01,02,03,12,17,18,21,23

MISSISSIPPI

CHATA DEVELOPMENT COMPANY
Route 7, Box M-20
Industrial Park Road
Philadelphia, MS 39350-0000
(601)656-6101
(601)656-5204
01,12,13,16,18

ALVIN B. LEE PALLETS
11170 Caesar-Necaise Road
Picayune, MS 39466
601-798-6426
01,03,04,14,16

MORTON MANUFACTURING COMPANY, INC.
P.O. Drawer K
Morton, MS 39117
(601)732-6121
(601)732-6122
01,03,08,12,13,14

RILEY & SONS LUMBER & BOX CO., INC.
P.O. Box 68
Fulton, MS 38843-0068
601-862-3637
601-585-3962
01,03,04,08,12,13,16,17

MISSOURI

ACE PALLET SERVICE, INC.
101 East 12th Avenue
N. Kansas City, MO 64116
(816)471-3311
(816)421-6206
01,04,08,12,13,14,15,16,17

ARROWHEAD PRODUCTS, INC.
Suite 1144, 818 Olive Street
St. Louis, MO 63101
(314)231-5553
(800)535-0394
02,04,08,12,25

BOTKIN LUMBER CO INC.
BOX & PALLET DIVISION
RR #3, Box 3320
Farmington, MO 63640
(314)758-0349
01,02,03,04,08.12,13,16,17,21

GARNETT WOOD PRODUCTS COMPANY, INC.
Old Highway 63, P.O. BOX 525
Brandsville, MO 65688
(417)867-5651
01,03,08,12,13,17,25

GARNETT WOOD PRODUCTS COMPANY, INC.
374 Greenmore
Ballwin, MO 63011
(314)391-1376
01,03,08,12,13,17,25

INNOVATIVE ENTERPRISES, INC.
7208 Weil Ave., P.O. Box 13049
St. Louis, MO 63119
(314)645-5330
01,02,07,08,11,13,16

LIBLA INDUSTRIES, INC.
P.O. Box 4058
Poplar Bluff, MO 63901
(314)785-1478
01,02,04,08,12,13,14,

MADISON COUNTY WOOD PRODUCTS, INC.
5101 Farlin Avenue
St. Louis, MO 63115
(314)383-5700
01,03,04,08,12,13,14,16,17,21

MERTENS ASSOCIATES, INC.
9216 Clayton Road Suite 10
St. Louis, MO 63124
(314)993-6600
01,02,04,06,08,12,13,14,15,16,

PACK-RITE PACKAGING & CRATING COMPANY, INC.
510 W. Pearce, P.O. Box 598
Wentzville, MO 63385
(314)327-5808
01,02,03,04,05,06,08,09,10,11,
11,12,13,17,20,21

J.R. PERKINS LUMBER COMPANY
818 Olive Street, Suite 1144
St. Louis, MO 63101
(314)241-0603
02,04,08,12,25

NEW HAMPSHIRE

KEARSARGE REEL CORPORATION
Breezy Hill Road, P.O. Box 423
Bradford, NH 03221
(603)938-2266
01,03,04,08,12,23

NEW JERSEY

ALEXANDER'S PALLET INC.
P.O. Box 2004
Secaucus, NJ 07084-2004
(201)867-4726
01,02,04,08,12,13,14

AMERICAN PALLET SYSTEMS, INC.
One Maynard Drive
Park Ridge, NJ 07656-1877
(201)391-8181
26

CUTLER BROTHERS BOX & LUMBER COMPANY
P.O.Box 217
Fairview,NJ 07022
(201)943-2535
01,02,04,08,12,13,14,15,16,17,
21

DELISA PALLET CORPORATION
91-97 Blanchard Street
Newark,NJ 07105
(201)344-8600
01,02,03,04,08,12,14,15

GENERAL PALLET CORPORATION
P.O.Box 254
S. Plainfieid, NJ 07080
(201)549-1000
01,02,04,05,06,08,12,13,14,15

NEW YORK

ACME PALLET COMPANY, INC.
45-19 Court House Square
Long lsland City, NY 11101
(718)784-8020
(212)233-6645
02,04,06,08,12

B & B LUMBER COMPANY, INC.
P.O. Drawer T
Jamesville, NY 13078
(315)492-1786
01,03,04,08,12,13

BRIDGEPORT CRATING CO., INC.
Box 479
Bridgeport, NY 13030
(315)633-9692
01,04,08,11,12,13,14,16,17,21,

D & F PALLET, INC.
16 University Park
Fredonia,NY 14063
(716)672-2984
01,04,08,12,13,14

H & H WOOD PRODUCTS, INC.
5600 Camp Road, P.O.Box 566
Hamburg,NY 14075-0566
(716)648-5600
01,04,08,12,13,17,21

PETER C. HERMAN, INC.
Skinner Road, P.O. Box 45
Marion,NY 14505
(315)331-2850
01,02,03,04,08,12,17,25

INTERSTATE PALLET EXCHANGE, **INC.**
P.O. 406
Lockport,NY 14095
(716)434-5730
01,03,04,08,12,14,15,16,17

LSW INDUSTRIES, INC.
P.O.Box 151
Clyde, NY 14433
(315)923-2741
01,04,08,12,13,14,15,17

MCINTOSH BOX & PALLET COMPANY
Butternut Drive, P.O. Box 127
East Syracuse, NY 13057
(315)446-9350
01,04,08,12,13,14,16,17,21,22

PALLET CITY
310 Grand Island Blvd.
P.O. Box 911
Tonawanda, NY 14151-0911
(716)873-7700
01,02,12,14

PALLET SALES CORPORATION
132 Dupont Street
Plainview. NY 11803
(516)349-8000
02,04,06,08,12

PALLETS, INC.
99-1/2 East Street
P.O.Box 326
Fort Edward, NY 12828
(518)747-4177
01,02,03,04,06,08,10,11,12,14,
17

PALLETS-R-US INC.
38-42 Wyandanch Avenue
Wyandanch, NY 11798
(516)643-1164
(516)643-1174
01,02,04,08,12,13,14

PAUL BUNYAN PRODUCTS, INC.
P.O. Box 585
Cortland,NY 13045
(607)753-9368
01,02,03,04,12,13

TWIN MILLS LUMBER CO., INC.
R.D.#2, Co. Rt. 4
Central Square, NY 13036
(315)598-6178
01,02,03,04,08,12,13,17

NORTH CAROLINA

EDWARDS WOOD PRODUCTS, INC.
P.O. Box 219
Marshville, NC 28103
(704)624-5098
01,03,04,08,12,13,14,17,18

OHIO

DONOVAN E. MCLAURIN CO., INC.
P.O. Box 07
Wade, NC 28395
(919)484-0116
01,03,08,1

MOUNTAIN LUMBER & PALLET COMPANY
2971 West Pine Street
Mount Airy, NC 27030
(919)789-2800
01,02,04,08,12,13,17

PALLET REPAIRS OF NC, INC.
Rt 14, Box 1312
Lexington, NC 27292
(704)731-8338
(919)764-2195
01,04,12,14

PLYMOUTH PALLET COMPANY
P.O. Box 18363
Raleigh, NC 27609
(919)793-1111
01,08,12

SHEFFIELD LUMBER & PALLET COMPANY, INC.
Route 6, Box 153
Mocksville, NC 27028
(704)492-5565
01,04,08,12

WNC PALLET & FOREST PRODUCTS
P.O. Box 38
Candler, NC 28715
(704)667-5426
01,03,04,08,12,13,14,16,17,21

BUCKEYE WOOD PRODUCTS, INC.
P.O. Box E
South Charleston, OH 45368
(513)462-8361
01,02,03,04,08,12,13,14,15,16,
17,21

COBLENTZ BROS., INC.
7101 S. Kohler Road
Apple Creek, OH 44606-9652
(216)857-7211
01,03,12,17

DIVERSIFIED WOOD PRODUCTS, INC
8330 Station Street
Mentor, OH 44060
(216)255-4708
(216)942-3366
04,08,14,18

GILBERT LUMBER COMPANY, INC.
Box 216
Smithville, OH 44677
(216)669-2726
01,08,12,13,14,15,16,17,21,23

GRH FOREST PRODUCTS
P.O. Box 230
Berlin, OH 44610
(216)893-2461
01,12,16,17

H.F. HAWKINS & SON COMPANY
190 Brookville-Pyrmont Road
P.O. Box 148
Brookville, OH 45309
(513)837-8265
23

HINCHCLIFF PRODUCTS COMPANY
13477 Prospect Road, Suite 211
Strongsville. OH 44136
(216)238-5200
01,02,08,12,16,17,21

INDUSTRIAL PALLET & PACKAGE CO.
24700 Chagrin Boulevard #305
Beachwood. OH 44122
(216)292-6015
01,02,04,08,12,14,15,16,17

INLAND WOOD PRODUCTS COMPANY
Route 1, Box 185
Marietta, OH 45750
(614)373-7187
01

J & N WOOD INC.
1000 Clarendon Avenue
Columbus, OH 43223
(614)276-0292

KYLE PALLET & CONTAINER, INC.
P.O. Box 155
Negley, OH 44441
(216)426-4321
(216)426-4322
01,04,08,12,14,15,16,17,20

LIBERTY INDUSTRIES, INC.
555 Tibbetts Wick Road
Girard, OH 44420
(216)539-4744
01,02,03,04,05,06,07,08,09,10,
11,12,13,16,17,20,21,23

LITCO INTERNATIONAL, INC.
P.O.Box 150
Vienna,OH 44473-0150
(216)539-5433
01,02,04,05,06,08,09,10,12,13,
14,15,16,17,20,21,23,25

LITCO INTERNATIONAL, INC.
8208 South Kohler Road
Apple Creek,OH 44606
(216)-539-5433
01,02,04,05,06,08,09,10,12,13,

SCHOTT LUMBER CO., INC.
16303 Slaters Rt.2
Caldwell, OH 43724
(614)732-4633
(614)732-4963
03,12,13

SEMAC INDUSTRIES
P.O. Box 289
Millersburg,OH 44654
(216)674-6080
01,03,04,08,12,13,17

YODER LUMBER COMPANY, INC.
3799 CR 70
Sugarcreek,OH 44681
(216)893-2218
(216)893-3131
01,03,08,13,17

OKLAHOMA

BURGESS MFG. OF OKLA. INC.
P.O.Box237
Guthrie, OK 73044
(405)282-1913
01,02,04,08,12,13,14,16,17,21,
37

OREGON

SHADYBROOK LUMBER PRODUCTS, INC.
Route3,Box272
Hillsboro, OR 97124
(503)647-2213
01,03,04,08,16

PENNSYLVANIA

A & L WOOD, INC.
R.D. 1
Mt. Pleasant Mills, PA 17853
(717)539-8922
01,12,13,14,16,17

L. L. BAUMUNK & SON, INC.
P.O. Box 1
Shunk,PA 17768
(717)924-3231
01,03,04,08,12

C & S WOOD PRODUCTS COMPANY, INC.
P.O.Box 192
Olyphant,PA 18447
(717)489-8633
01,08,12,13,16,17,18,21,25

D.F. CAREY & SON LUMBER & PALLETS
Box 179 HC-31
Williamsport, PA 17701
(717)435-5051
(717)435-5050
01,03,12,17,18,21

EAST BRADY LUMBER COMPANY, INC.
Box 338
East Brady,PA 16028
(412)526-3391
01,08,12,13,16,17,35

EASTERN WOOD PRODUCTS COMPANY
P.O.Box 1056
Williamsport. PA 17703-1056
(717)326-1946
01,02,08,12,13,16,17,25

ESTEN LUMBER PRODUCTS
2015 Trumbauersville Road
Quakertown, PA 18951
(215)536-4976
(215)536-4982
01,04,08,12,13,16,17

HOUSE WOOD PRODUCTS COMPANY
Lutes Avenue, P.O. Box 277
Mansfield,PA 16933
(717)662-3868
01,04,08,12

MOUNTAIN VALLEY FARMS & LUMBER PRODUCTS, INC.
1240 Nawaka Road
Biglerville. PA 17307
(717)677-6166
01,03,04,08,12,17

THE NELSON COMPANY ASSOCIATED BOX DIVISION
812 North Cedar Street
New Castle,PA 16103
(412)652-6681
01,02,04,05,06,07,08,09,10,11,
12,13,14,17,21,23

PENN PALLET INC.
P.O. Box 8, Fillmore Road
St. Marys, PA 15857
(814)834-1700
01,12,13,14,17,24

PENNBOX DIVISION, PENNSYLVANIA PACIFIC CORPORATION
P.O. Box C-5070
Warminster, PA 18974
(215)672-5300
01,02,03,04,05,06,07,08,10,11,
12,13,16,17,18,19,20,21,22,24

PENNSYLVANIA PACIFIC CORPORATION
P.O. Box C-5070
Warminster, PA 18974
(215)672-5300
01,02,03,04,05,06,07,08,10,11,
12,13,16,17,18,19,20,21,22,24

PERRY PALLET, INC.
R.D. #1, Box 620
Millerstown, PA 17062
01

R & R WOOD PRODUCTS, INC.
645 Fretz Road,P.O.Box 65
Mainland, PA 19451-0065
(215)723-3470
01,02,04,05,08,12,13,14,16,17,
25

REMMEY WOOD PRODUCTS
1040 Industrial Highway
Southhampton, PA 18966
(215)355-3335
01,02,04,05,06,08,12,13

RODGERS PALLET COMPANY
P.O. Box 85
Shady Grove, PA 17256
(717)597-3171
(301)797-7467
01,12,14,15,16,17,18,21

J. F. ROHRBAUGH & COMPANY, INC.
Ridge Avenue
Hanover, PA 17331
(717)632-4353
01,02,04,08,12,13,16,17,21

SPARTYWOOD PRODUCTS, INC. DIVISION OF SEMAC INDUSTRIES
Route 2
Spartansburg, PA 16434
(814)654-7111
01,03,04,08,16,25

STRASBURG PALLET COMPANY
413 White Oak Road
Strasburg, PA 17579
(717)687-8131
01,04,08,12,13,16,17,21

TREEN BOX & PALLET CORPORATION
1950 Street Road, P.O. Box 368
Bensalem, PA 19020
(215)639-5100
01,02,03,04,08,12,13,14,15,16,
17,18

TREEN BOX & PALLET CORPORATION (PLANT)
Wagner Road
Mifflintown, PA 17059
(717)535-5800
01,03,04,08,12,13,14,15,16,17,
25

YERGER WOOD PRODUCTS
R.D. #1 Box 464
East Greenville, PA 18041
(215)679-4413
01,12

CARIBE PALLETS AND PACKAGING CORP.
P.O. Box 1886
Trujillo Alto, PR 00760-1886
(809)755-3622
(809)755-3623
01,04,08,12,13,16

RHODE ISLAND

AB PALLET, INC.
P.O. Box 1049
Woonsocket, RI 02895
(401)765-3292
(800)446-2212
01,02,04,06,08,10,12,13,14,17,

ATLAS PALLET CORPORATION
50 Old Mill Street
Harrisville, RI 02830
(401)568-2900
01,02,04,08,12,13,14,15

TURNQUIST LUMBER COMPANY
Route 101
Foster, RI 02825
(401)647-2383
(401)647-7382
01,02,03,04,08,12,14

SOUTH CAROLINA

PALLET MAKERS, INC.
P.O. Box 100
Hartsville, SC 29550
(803)383-2233
01

TENNESSEE

ALLIED WOOD PRODUCTS
Route 2, Box 135
Red Boiling Springs, TN 37150
(615)258-3581
(615)258-3927
01,02,03,04,08,12,13,16,17

CANTLEY-ELLIS MANUFACTURING COMPANY
P.O. Box 1512
Kingsport, TN 37662
(615)246-4671
01,04,08,12,13,21

FABRICATION SPECIALTIES CORPORATION
P.O. Box 211
Centerville, TN 37033
(615)729-2283
(615)729-2585
01,04,08,12,13,17,21

GRAVES-BUTTRAM LUMBER COMPANY
2112 Railroad Avenue
P.O. Box 567
Athens, TN 37303
(615)745-0380
01,04,08,12,13,17

LOWE LUMBER SALES, INC.
P.O. Box 446
Cookeville, TN 38503
(615)526-3369
01,03,04,08,12,25

PALLET SUPPLY CO., INC.
587 Hernando Street
Memphis, TN 38101
(901)529-0051
01,12,13,14,16

PALLETS PLUS, INC.
P.O. Box 431
Clinton, TN 37716
(615)457-4800
01,12,16,17

WRIGHT PALLET, INC.
78 Buchanan Street
Lavergne, TN 37086
(615)793-7101
(615)895-6040
04,14

TEXAS

FRASER INDUSTRIES, INC.
208 West 3rd Street
Big Spring, TX 79720
(915)263-1307
01,03,12

GROVES PALLET COMPANY
P.O. Box 546
516 Orchard Street
Pt. Neches, TX 77651
(409)722-2933
01,04,08

MULBERRY LUMBER COMPANY
5121 69th Street Suite A-5
Lubbock, TX 79424
(806)794-8787
01,04,08,12,13,14,15,16,17,18

PASADENA SKID & PALLET, INC.
P.O. Box 5513
Pasadena, TX 77508
(713)475-1653
(713)475-1698
01,02,12,13,16,17,21

SOUTHWEST WOODWORKS, INC.
Rt. 5, 2432 Market Avenue
Odessa, TX 79766
(915)334-7860
01

WARD-DAVIS, INC.
P.O. Box 1894
Texarkana, TX 75504
(214)793-5559
01,08,12,13,16,17,21

UTAH

TIMBERCRAFTS OF UTAH, INC.
2249 South 2700 West
Salt Lake City, UT 84119
(801)972-3282
01,04,08,12,16,17,18,21,22

VERMONT

KILLINGTON WOOD PRODUCTS COMPANY
P.O. Box 696
Rutland, VT 05701
(802)773-9111
01,04,08,12,13,14,16,17,21,23

VIRGINIA

ABELL LUMBER CORPORATION
P.0. Box 339
Lawrenceville, VA 23868
(804)848-2164
(800)446-1804
01,02,03,04,08,12,13,14,25

B C WOOD PRODUCTS, INC.
394 Air Park Road
Ashland, VA 23005
(804)798-9154
01,08,12,13,17

BRUNSWICK BOX COMPANY, INC.
P.O. Box 7
Lawrenceville, VA 23868-0007
(804)848-2222
(804)848-4400
01,04,08,12,13,16,17,24

DOMINION PALLET COMPANY, INC.
Route 3
Mineral, VA 23117
(703)894-5401
01,04,12

HALLWOOD ENTERPRISES, INC.
P.O. Box 381
Smithfield, VA 23430
(804)357-3113
02,04,08,12,13,14,17,25

HALLWOOD ENTERPRISES, INC.
105 Ferndale Drive
Collinsville, VA 24078
(703)647-7466
02,04,08,12,13,14,17,25

INTERSTATE PALLET COMPANY
P.O. Box 9162
Richmond, VA 23227
(804)226-0229
01,02,04,14,15

LOVE WOOD PRODUCTS
P.O. Box 4681
Martinsville, VA 24115
(703)632-4332
02,04,08,12,13

MCFARLAND'S MILL, INC.
Route 4, Box 178
Winchester, VA 22601
(703)667-2272
01,02,03,12

NEFF LUMBER MILLS, INC.
P.0. Box 172
Broadway, VA 22815
(703)896-7031
01,03,12,13,14,17

NIAB HESTRA AB
PSA INTERNATIONAL SALES
11026-A Villa Ridge Court
Reston, VA 22091
(703)758-8176
01,03,13,16,23,25

POTOMAC SUPPLY CORPORATION
Highway 203 North, P.O. Box 8
Kinsale, VA 22488
(804)472-2527
01,03,04

SCOTT PALLETS INCORPORATED
P.O. Box 657
Amelia, VA 23002
(804)561-2514
(804)739-3990
01,03,04

SHELDON WOOD PRODUCTS, INC.
P.O. Box 339
Toano, VA 23168
(804)566-8880
01,08,12,14

SMALLEY PACKAGE COMPANY, INC.
P.O. Box 231
Berryville. VA 22611
(703)955-2550
01,08,12,13,16,17

SWIFT CREEK FOREST PRODUCTS
CORPORATION
Highway 360 West, P.O. Box 507
Amelia, VA 23002
(804)561-4498
01,12,13

WILLIAMSBURG MILLWORK
CORPORATION
Route 301 South, P.O. Box 427
Bowling Green, VA 22427
(804)994-2151
01,03,04,08,12,13,16

WASHINGTON

GIRARD WOOD PRODUCTS, INC.
P.O. Box 830
Puyallup, WA 98371-0075
(206)845-0505
(206)467-0890
01,04,08,12,13,14,16,17,21

NEPA PALLET AND CONTAINER CO.,
INC.
P.O. Box 399
Snohomish, WA 98290-0399
(206)568-3185
01,08,12,13,14,16,17

RAINIER PALLET CORPORATION
20045 84th Avenue South
Kent, WA 98031-1292
(206)872-8543
01,04,08,12,13,14,16,25

WISCONSIN

GOEMAN WOOD PRODUCTS, INC.
P.O. Box 337
Hartford, WI 53027
414-673-6090
01,02,04

MARPLEX, INC.
P.O. Box 279
Rhinelander, WI 54501
(715)362-3193
01,03,04,08,12,13,16,17,21

MBX COMPANY
P.O. Box 929
Wausau, WI 54402-0929
(715)845-1171
01,03,04,08,12,13,16,17,21,22

MOLE LAKE WOOD INDUSTRIES, INC
Rt. #1, Box 567
Crandon, WI 54520
(715)478-5580
01,03,16,17

NECEDAH PALLET COMPANY
P.O. Box 220
Necedah, WI 54646
(608)565-2619
01,02,08,12,13,13,17

OPPORTUNITIES PALLET RECYCLING MFG., INC.
2835 N. 32nd Street
Milwaukee, WI 53210
(414)449-9334
04,12,14

TURNER PALLET SERVICES
2417 Saratoga Road
Waukesha, WI 53186
(414)544-4760
01,02,04,08,12,13,14,15,17

WALTERS BROTHERS LUMBER MANUFACTURING, INC.
P.O. Box 65
Radisson, WI 54867
(715)945-2217
(715)945-2646
01,03,04,08,12,13,17

WALTERS BROTHERS LUMBER MANUFACTURING, INC. (PLANT)
Highway 27
Holcombe, WI 54745
(715)595-4896
01,03,04,08,12,13,17

WISCONSIN BOX COMPANY
P.O. Box 718
Wausau, WI 54402-0718
(715)842-2248
800-876-6658
01,12,13,16,17,20

WEST VIRGINIA

GATEWOOD PRODUCTS, INC.
P.O. Box 207
Parkersburg, WV 26101
(304)485-4406
01,03,08,12,13,14,16,17,20,21,
24

HINCHCLIFF PRODUCTS COMPANY
P.O. Box 386
Parsons, WV 26287
(304)478-2500
01,02,08,12,16,17,21

LANNES WILLIAMSON PALLETS
2760 U.S. Route 35 South
Southside, WV 25187
(304)675-2716
(304)675-2727
01,03,04,08,12,13,14,17

AUSTRALIA

CHEP POOLING SYSTEMS C/O BRAMBLES HOLDINGS LTD.
P.O. Box 968
Crows Nest,
NSW 2065 AUSTRALIA
02-231-8222
01,02,04,05,06,08,12,14,16,17

RED ROCK PTY. LTD.-THE VINCENTS PALLET MANUFACTURER
P.O. Box 57
Cooee, Tasmania
7320 AUSTRALIA
6104-31-4150
6104-313915
01,04,08,12,13,17

CANADA

ADIAN MATERIALS HANDLING LTD.
349 Bowes Road, Unit #25
Concord, Ontario
L4K 1 J3 CANADA
(416)738-3525
01,04,08,12,13,17

ATELIERS LACHANCE INC.
55 Blvd. J.F. Kennedy
St. Jerome, Quebec
J7Y 4B5 CANADA
(514)438-4124
(514)430-3964
01,12,13,14,15,16,17,26

B 3 M PALLET MARKETING GROUP, INC.
165 Threevalleys Drive
Don Mills, Ontario
L4V 1A1 CANADA
(416)399-8442
02

BERNIE'S BOX AND PALLET
1299 St. Mary's Avenue
Mississauga, Ontario
L5E 1N9 CANADA
(416)-274-5550
01

CHASSE INC.
P.O. Box 610
Ste-Marie de Beauce, Quebec
G6E 3B8 CANADA
(418)387-5441
(418)387-3407
01,03,04,08,12,13,14,17

CHEP CANADA INC.
6299 Airport Road, Suite 703
Mississauga, Ontario
L4V 1N3 CANADA
(416)678-1372
14,25

H. ENGENESKI LUMBER LIMITED
P.O. Box 33
Scotland, Ontario
NOE 1R0 CANADA
(519)446-2239
(519)446-2230
01,03,12

LAURENTIEN WOOD, INC.
550 Cote St. Louis
Blainville, Quebec
J7E 4H5 CANADA
(514)430-7780
01,02,03,04,08,12,13,14,15,16,

LINCOLN WOOD PRODUCTS LIMITED
P.O. Box 1079
Beamsville, Ontario
CANADA
(416)563-7300
01,04,08,12,13,14,15

MACMILLAN BLOEDEL, LTD.
NIPIGON PLYWOOD DIVISION
50 Oak Street
Weston, Ontario
M9N 1S1 CANADA
(416)244-1741
(807)877-2017
01,04,25

MULTI-PALLET, LTD.
954 Middlegate Road
Mississauga, Ontario
L4Y 1M3 CANADA
(416)270-7901
01,02,04,12,14,

PALLET RENTAL SYSTEMS INC.
5815 Campus Road
Mississauga, Ontario
L4V-1A1 CANADA
416-673-7906
25

PREMIER PALLET REPAIR, LTD.
5819 Campus Road
Mississauga, Ontario
L4V 1A1 CANADA
(416)671-4441
(416)671-4445
01,04,08,12,14,17,25

SHUR-WAY INDUSTRIES, INC.
R.R. No. 1
Ayr, Ontario
NOB 1E0 CANADA
(519)623-2380
01,04,08,12,13,16,17,22,23

ST-REMI PALLETS (CANADA), INC.
1945 St-Paul Street
St-Remi, Quebec
JOL 2L0 CANADA
(514)454-4696
01,14,15,16,17,2

TDS LTD.
R.R. #5
Hagersville. Ontario
NOA 1H0 CANADA
(416)768-3308
(519)842-4211
01,08,13,16,17,20,21,24

THOMCO PALLET AND BOX
P.O. Box 280
Tweed, Ontario
KOK 3J0 CANADA
(613)478-2148
01,03,04,08,12,13,14,15,17

WAINFLEET WOOD PRODUCTS LTD.
P.O. Box 464
Fonthill, Ontario
LOS 1EO CANADA
(416)892-3813
01,08,12,13,14,15,17,18,20

COLOMBIA

INDUSTRIA COLOMBIANA DE
MADERAS LTDA.
Apartado Aereo 8710
Cali, Valle del Cauca
COLOMBIA
644364
12,14,16,17

ENGLAND

W.H. SHAW & SON LTD
Huddersfield Road
Diggle
Oldham,
OL3 5NX ENGLAND
0457 873013
01,04,08,13,16,25

ENGLAND (CONTINUED)

SHAW PALLET CONTROL, LTD.
Bridge Street
Slaithwaite-Huddersfield
West Yorkshire,
HD7 5JN ENGLAND
(0484)843531
01,04,08,12.13,14,16,17

UNIT PALLETS PLC
Bank Street
Gotborne, Warrington
WA3 3RN ENGLAND
0942 711 811
01,04,06,08,12,13,14,15,23

ITALY

TOSCANA PALLETS
Via Del Monte 88
Bientina, (PISA)
I-56031 ITALY
(0587)755529
01,03,04,08,12,13,14,16,17,18,

NEW ZEALAND

PALLET SUPPLIES LTD.
P.O. Box 97085
Manakau City, Auckland
NEW ZEALAND
09 2782003
01,04,08,12,13,14,17

TIMPACK INDUSTRIES, LTD.
P.O. Box 5445
Frankton,
NEW ZEALAND
0064-71-77157
01,04,08,16,17,21

SOUTH AFRICA

MACRALL TIMBERS
P.O. Box 910
Isando, Transvaal
1600 SOUTH AFRICA
(011)823-1340
01,04,12,17,23,24

GKN CHEP SA (PTY) LTD.
Suite 2010 Tower Block
Overport City, Durban
SOUTH AFRICA
(031)294271
01,04,12,17,23,24

SA COOPERATIVE CITRUS EXCHANGE, LTD.
P.O. Box 7733
Hennopsmeer,
0046 SOUTH AFRICA
(012)663-5100
14,26

SWEDEN

NIAB HESTRA AB
Box 119
330 27 Hestra,
SWEDEN
(370)35290
01,03,13,16,23,25

THE NETHERLANDS

NEDERLANDSE EMBALLAGE - EN PALLET INDUSTRIE VERENIGING
Buitenhofdreef 272
2625 RE Delft,
THE NETHERLANDS
(015)564700
01,04,08,12,17,25

WEST GERMANY

ANTON HEGGENSTALLER GMBH
Muehlenstrasse 7
D8892 Unterbernbach,
WEST GERMANY
49-08257810
01,02,03,04,08,13,16,17,20,24,

Appendix L. Key Words and Definitions

API	American Paper Institute
Audit	The inspection of all or portions of a process to assure conformance to the specified requirements involved.
Biodegradable	That which is able to be decomposed by bacterial action.
Biological Oxygen Demand (BOD)	The quantity of dissolved oxygen needed to satisfy the metabolic requirements of microorganisms living in water where there is a lot of organic material. Industrial effluents high in organic substances create a high BOD in the receiving water, thereby reducing oxygen levels in that water.
Burst Strength	The strength of material in pounds per square inch as measured by the Cadt or Mullen tester.
Carcinogen	Any agent - biological, chemical, radioactive - that causes cancer.
Cardboard	Term erroneously used by some of the public as a synonym for paperboard. Not a recognized term in container materials.
Cellulosic	A substance made of plant parts including wood.
Coating	**A** paint, varnish, lacquer or other finish used to create a protective and/or decorative layer.
Collector	Handles the collection of post-consumer recyclables in any of several ways -- curbside collection, operation of community drop-off sites, or management of community, municipal or regional recycling centers.
CONEG	Coalition of Northeastern Governors, representing: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont
Conformance Methods	Approaches used to obtain the stipulated or specified requirements.
Corrugated	The structure formed by one corrugated inner member glued between two flat facings (singlewall corrugated).
"Cradle to Grave"	An expression to indicate consideration from the point of initial conception of a packaging material or design through its entire useful life and eventual disposal. This disposal may be after many successful reuses and then hopefully by being put into an effective recycling channel.

Dioxin General term applied to any of 75 structurally related chlorinated compounds, the most toxic of which is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).

Disposable A disposable package is one that will be discarded after one use.

Dumping Fee: The charge for processing trash or solid waste at an incinerator or sanitary landfill. This is usually done on a weight basis but can also be on a volume or worst case basis.

Dumpster A large metal moveable container for the collection and transportation of trash for disposal usually to incinerators or sanitary landfills.

Effluent The liquid waste of sewage and industrial processing. Also known as discharge liquor.

Emulsion A liquid that is a mixture of liquids that do not dissolve in each other. In an emulsion, one of the liquids contains minute droplets of the other, which are evenly distributed throughout.

End-Product Manufacturer
Produces from recycled material either a finished product or a component for a finished product.

EPA United States Environmental Protection Agency

Furan General term applied to any of over 200 structurally related chlorinated compounds, the most toxic of which is 2,3,7,8-tetrachlorodibenzo - furan (TCDF), thought to be one-tenth as toxic as TCDD.

Furnish A form or collection of raw material or components for use in the manufacture of subsequent products.

Hazardous Waste Waste that requires special precaution in its storage, collection, transportation, treatment or disposal to prevent damage to persons or property. There are no universally accepted definitions for the term hazardous waste, and each country defines the term with its own criteria. In a general sense, however, hazardous wastes include explosive, flammable, volatile, radioactive, toxic and pathological wastes.

Incineration A waste disposal technology of the thermal destruction type. In incineration, combustion of wastes in the presence of excess oxygen produces water, carbon dioxide and ash, as well as non-combustible residuals. If combustion is incomplete, other organic by-products may occur.

Kraft Pulp Wood pulp resulting from a pulping process in which sodium sulphate is used in the caustic soda pulp-digestion liquor. Also known as sulphate pulp.

Leachate A liquid resulting from precipitation percolating through landfills containing water, decomposed waste and bacteria. In sanitary landfills leachate is collected and treated to prevent contamination of water supplies.

Lignin An amorphous structure comprising 17-30% of wood. It is so closely associated with the holocellulose which makes up the balance of woody material that it can be separated from it only by chemical reaction at high temperature. It is believed to function as a plastic binder for the holocellulose fibers.

Municipal Solid Waste Includes non-hazardous waste generated in households, commercial establishments, institutions, and light industrial wastes; it excludes industrial process wastes, agricultural wastes, mining wastes and sewage sludge.

Mutagenic Causing a change (mutation) in the DNA (deoxyribonucleic acid, the genetic "information") of a cell's chromosomes. A mutagen may also be a carcinogen.

NCASI National Council of the Paper Industry for Air and Stream Improvement.

Nonsalvagable No longer usable in current or modifiable form.

Organic Any compound that contains carbon and hydrogen (or other elements substituted for hydrogen). An organic compound can also be called a hydrocarbon. They include both naturally occurring and synthetic compounds.

Organochlorines Term for over 300 chlorinated compounds (TCDD, TCDF, chloroform, carbon tetrachloride, etc.) formed in processes involving chlorine, wood lignin, and heat.

Pallet Pool A cooperative system for use and reuse on a lease basis for pallets of a common or established design that is managed by a National or International pallet company.

Pallet Reutilization The effective use of pallet resources to maximize their potential life through designs, inspection, repair and reuse.

Pallet Revitalization The effective regeneration of questionable pallets through inspection, repair and component replacement to enable further reuse.

Pallet Standardization The establishment of a limited number of specified designs and sizes required for all use within this company.

Paperboard General term descriptive of a sheet made of fibrous material (woodpulp, straw, paper stock or any combination thereof) on a paper machine.

Photodegradable A process whereby the sun's ultraviolet radiation attacks the link in the polymer chain of plastic. The breaking of this link causes the plastic chain to fragment into smaller pieces, losing its strength and ability to flex and stretch. As the photodegradable plastic is subjected to the effects of the natural environment, the material is flexed, stretched and disintegrated into plastic dust.

Pigment A solid substance which is used to give color to other materials.

Pipeline Pipeline (sometimes called inventory pipeline) is often expressed in units of time (usually days). It defines the number of days of worth of reusable items, at a given point in time. Pipeline describes the number of items needed to support all parts of a reusable program (e.g., work-in-process, out & return shipping, inventory, and repairs).

Polymeric A substance made of plastic.

Post-consumer waste Any waste product that has gone through its useful life, served the purpose for which it was intended and has been discarded by the user. This is in contrast to pre-consumer waste or scrap from manufacturing.

Primary Package The first layer of packaging that comes in direct contact with the part.

Reclamation The recovery of a usable product from a waste following extensive pre-treatment.

Recyclable Waste material which is capable of being processed for subsequent use. Materials are only recyclable if there is a widely available economically viable collection, processing and marketing system for the material.

Recycled Material which has already been reclaimed from a waste product and processed in order to regain material.

Recycled Materials Broker Negotiates contracts for the purchase of processed material for resale to those who manufacture new products.

Recycling The conversion of an item or material from its existing state for reuse as a similar or different item or material.

Repalletization The transfer of materials from a pallet deemed to be unacceptable for further use because of damage, inferiority, or unusable size or design for the distribution system to a pallet of an acceptable design and condition.

Resins Usually polymers which are of a high molecular weight. Resins can be solid or semi-solid and can be either natural or synthetic in origin. In ink, a resin is the main ingredient which binds the various other ingredients together. It also aids adhesion to the surface.

Returnable The terms returnable and reusable are often used synonymously. In this guide they will be used interchangeably and have similar meanings.

Reusable When applied to packaging, reusable means a container, package, or component of the container or package (e.g., a foam cushion, plastic bag, etc.) is capable of being used more than one time, without being significantly changed (i.e., used in its same physical form, requiring only minor repair or cleaning).

Reuse life Reuse life is the life of a reusable item. The life may be expressed in time (e.g., months or years) or in number of reuses, before the item can no longer be reused.

Scrap Any solid trim, cutting or reject material which may be suitable as feedstock to the primary operation. In-plant or pre-consumer waste.

Secondary Material Resultant material of a processed recyclable.

Secondary Package The second layer which contains one or more primary packages.

Secure Landfill A landfill designed to receive treated industrial wastes. It differs from a conventional sanitary landfill in the degree to which the site is engineered to diminish the migration of pollutants.

Segregation Separation or sortation into common groups.

Shredding A method of grinding or breaking down of a material to desired sized particles or fibers.

Slipsheet A material handling device usually made of solid fiber or plastic with about a 1/2" thickness on which the product or materials are loaded and usually stretch wrapped for movement. This unit load is best handled with special handling equipment such as squeeze trucks or push/pull devices for loading, stacking and unloading.

Sludge A mixture of liquids and solids which flows under normal conditions and can be pumped using standard pumping equipment or vacuum equipment.

Sludge Farming A process whereby waste sludges are spread onto land and ploughed into the soil. Nutrients are added and the deposited sludges are turned at frequent intervals to ensure continuing bacterial decomposition of the biodegradable wastes.

Soil Amendment An additive placed in the ground to enhance its performance or stabilize it to enhance crop growth or control.

Solid Waste Management The systematic administration of activities which provide for the collection, source separation, storage, transportation, transfer, processing, treatment, and disposal of solid waste.

Solid Waste Stream The flow of trash and scrap materials from industry, and consumers for disposal usually through burning in incinerators or burial in sanitary landfills or dumping at sea.

Solvent The liquid part of a solution existing in a larger amount than the solute (the substance being dissolved). A solvent can dissolve or disperse other substances. In inks, a solvent is the volatile part of a ink composition that evaporates during drying. In industrial usage, solvent usually refers to organic solvent, and as such refers to the class of volatile hydrocarbons used as dissolvers, viscosity reducers and cleaning agents.

Source Reduction The design and manufacture of products and packaging with minimum toxic content, minimum volume of material, and/or a longer useful life.

Suppliers Organizations who provide parts, products and components to an IBM site. This can include other IBM sites as well as independent vendors.

Teratogen An agent or substance that may cause physical defects in the developing embryo or fetus when a pregnant female is exposed to that substance.

Tertiary Package This includes the shipping container and all additional internal dunnage materials if any.

Thermal Destruction A group of waste disposal technologies using heat to break down hazardous organic wastes into less toxic constituents, ideally carbon dioxide and water. The two broad categories of thermal destruction technologies are incineration and pyrolysis.

Tipping Fee The charge for processing trash or solid waste at an incinerator or sanitary landfill. This is usually done on a weight basis but can also be on a volume or worst case basis.

Trace Quantities Usually, parts per million (PPM). One PPM is equivalent to one milligram per liter.

Violation Deviation from or noncompliance to specified requirements.

Water-Bone Inks, Coatings
Coatings which contain substantial amounts of water with up to 80 percent of the volatiles being water. The polymers used to make the solids component can be dissolved, dispersed or emulsified. In industrial water-borne coatings, the formulations commonly contain 40 to 50 percent water, 10 percent organic solvents and 40 to 50 percent solids.