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Collection of Data Pertinent to the EPA's Development of Guidelines for Government Procurements of Paper Products Containing Recycled Materials

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and State Solid Waste Management Agencies

COLLECTION OF DATA PERTINENT TO THE EPA'S DEVELOPMENT OF GUIDELINES FOR GOVERNMENT PROCUREMENTS OF PAPER PRODUCTS CONTAINING RECYCLED MATERIALS

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PREFACE

This final report was prepared by Franklin Associates, Ltd., Prairie Village, Kansas, for the Environmental Protection Agency, Office of Solid Waste, Resource Recovery Division, under Contract No. 68-01-4765. The report is presented in two parts. The first part is a summary of the findings and analyses of the study. This is followed by the appendices, which contain technical details, data used in the analyses and other background information.

This project relied heavily on interviewing people knowledgeable about the procurement of paper and paperboard products. We are indebted to the numerous individuals in government service which contributed information to this project, as well as the representatives of fifteen paper and paperboard companies that shared their knowledge and experience with us. Special recognition is made to members of trade associations, particularly the American Paper Institute, which provided assistance throughout the study.

Finally, appreciation is due John M. Heffelfinger, who served as the EPA project monitor. His active involvement in this project was invaluable.

COLLECTION OF DATA PERTINENT TO THE EPA'S DEVELOPMENT
OF GUIDELINES FOR GOVERNMENT PROCUREMENTS
OF PAPER PRODUCTS CONTAINING RECYCLED MATERIALS

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Chapter 1

INTRODUCTION

BACKGROUND

In the eight years since the passage of the Resource Recovery Act of 1970, EPA has devoted much of its resources to the area of making recovered materials more readily available from waste streams. A wide range of possibilities have been explored, which include resource recovery from solid waste by technologically sophisticated plants to voluntary source separation programs. However, much emphasis has been on the "supply-push" concept that abundantly available raw materials derived from waste will be more economical for industrial users than virgin materials.

In the recently passed Resource Conservation and Recovery Act of 1976, however, there is a mandate from Congress for EPA to explore the possibility of the "demand-pull" side of recovered material markets. The concept is that Federal procurement can provide leadership in creating a market for products utilizing materials recovered from waste streams.

In order to carry out this mandate, EPA has matched components of solid waste with products that the Federal Government purchases. EPA has been mandated to provide a mechanism through which the government can create demand for the materials recovered from waste streams through the product procurement process.

The plan to do this will proceed in stages. First, a data base must be assembled on the recovered material-product matchups to determine how appropriate procurements can proceed within the confines of the four "reasonables"--competition, cost, availability, and technical performance. The data base will then be used to write guidelines for the procurement processes. EPA will then assist procuring agencies at all levels of government in implementing the guidelines.

OBJECTIVE OF THIS STUDY

The primary objective of this study is to prepare a base of numerical data and quantitative information relating to the writing of guidelines for government procurement of paper and paperboard products containing recovered materials. Franklin Associates, a private independent contractor, was engaged for this effort in order that independent and impartial technical expertise could be brought to bear on this problem.

Specifically, the following kinds of information are to be provided to EPA.

1. Past, current and projected quantities of paper and paperboard used by the Federal Government.

2. Past, current and projected quantities of paper and paperboard used by non-Federal sources that may look to the Federal Government for guidance in writing procurement specifications. This covers state and local governments (including schools) as well as private businesses.

3. Relationship and importance of government purchases to the paper and paperboard industry.

4. Availability of recycled products.

5. Problems in defining recycled or recovered materials.

6. Economic, energy and environmental impacts of procurement guidelines.

7. Procedures for certifying recovered material content.

8. Viewpoints of the paper and paperboard industry relating to the procurement guidelines.

Analysis, assessment and policy implications of the information obtained in this study are provided to EPA.

RESEARCH PLAN

The objectives of this study were met by using several information gathering techniques. Most important were numerous personal interviews supplemented by library research. People contacted included employees of the Federal Government, state and local governments, and representatives of private industry. Included in the latter category are the staff of the American Paper Institute, individual paper companies, and the National Association of Recycling Industries.

The Federal Government agencies contacted include the General Services Administration, the Department of Defense, the Government Printing Office, the Joint Committee on Printing of the U.S. Congress, the National Bureau of Standards, and the Office of Solid Waste in the Environmental Protection Agency. At the state and local level, 12 state purchasing agencies were contacted as well as 10 local school boards and 2 state energy offices. In private industry, 15 paper companies were interviewed, as well as high level members (vice presidents and division managers) of the American Paper Institute. These individuals provided information and insight in relation to the objectives stated previously.

REPORT OVERVIEW

The results and findings of the study are presented in this report. Chapter 2 provides a summary of the quantitative supply and demand statistics, which outline the government's purchasing history and industries' ability to supply the products in question. Chapter 3 is a discussion of various guideline issues along with facts and possible solutions to problems. Chapter 4 relates the paper and paperboard industry's views. Chapter 5 presents the options available to EPA based on the findings of this study. The appendices which follow Chapter 5 contain the numerical detail and background information.

Chapter 2

SUPPLY AND DEMAND ISSUES

FEDERAL GOVERNMENT DEMAND FOR PAPER AND PAPERBOARD PRODUCTS

The Federal Government employs approximately 2 million civilians and another 2 million military personnel for which work-place supplies and in some cases living supplies must be provided. The task of government employees is to provide services to the rest of the population, rather than supplying material goods. This means that the employee force, except for the combat troops in the military, is primarily engaged in office and clerical type duties. The result is that the Federal Government must purchase paper products for the various tasks which involve filing and processing forms, printing and writing informative material, collecting and analyzing statistics, and performing studies on problems in the nation's interests. In addition, the government must supply personal paper products for the employees' health and convenience. It is quite evident, then, that the Federal Government must be a large customer of paper and paperboard packaging products.

The products purchased by the government are purchased to a large extent through centralized purchasing agencies. The largest such agencies are the General Services Administration (GSA), the Government Printing Office (GPO, which is the paper contracting agent for the Joint Committee on Printing), and the Defense Supply Agency (DSA, but now known as the Defense Logistics Agency) of the Department of Defense. In this study it was necessary to focus only on GSA and GPO, as DSA purchases almost all of its paper products through the other two agencies. GPO purchases printing and writing papers, primarily for the Washington, D.C. area, while GSA purchases many kinds of products and makes them available at depots located throughout the country.

The data base for government paper consumption used in this study was derived from GPO and GSA reports made available to Franklin Associates. GPO reports all of their paper purchases and can provide a detailed breakdown of the specific kinds of paper purchased. GSA has accurate and complete statistics for most of the rest of the paper and paperboard purchased by the government through their "stores" programs. Some additional products are purchased by government agencies but not reported in detail to any central agency. These products include items that cannot be easily or economically stored, or involve quite small orders. An accurate estimate of the annual purchases of paper products by these methods is not available, but is believed by GSA to be much smaller than the GSA "stores" purchases. For purposes of this study, the amounts of paper and paperboard reported by GPO and GSA were assumed to be approximately equal to the total government purchases.

The government also receives and uses other paper and paperboard products which are presently, or could be, under the influence of government specifications. One such area is paper and paperboard secondary packaging, which is packaging of products purchased by the government. The only sec-

ondary packaging which is potentially of significant tonnage is corrugated containers. Data on the amount of corrugated shipped to the government are not collected, but Franklin Associates has developed a technique for estimating the quantities. The details of this estimation technique can be found in Appendix A. In that appendix, corrugated boxes received by the government are calculated for defense and non-defense expenditures by the government for 47 product categories.

The results were tabulated for one year for which complete data are available. The results are that 143,000 tons of corrugated containers were received by the government in that year. Of that total, 28,000 tons were consumed for non-defense uses while 115,000 tons were consumed by the military agencies. By far the dominant categories were communications equipment and motor vehicle parts. By contrast, in that year GSA purchased 25,000 tons of boxes directly. Thus, far greater amounts of corrugated came into the governments' hands by way of secondary packaging.

Another area where there are significant receipts of paper by the government is the purchase of printed matter. Examples include reports to the government other than those on printed forms (such as this research report); and contract printing done for the government, such as is done for GPO. The magnitude of the reports submitted to the government is difficult, if not impossible, to estimate, but data are available on contract printing. In 1977, GPO spent $300 million in contract printing. It is estimated by GPO that one-half of this amount represents the cost of the paper, which translates to a possible 190,000 tons of paper. These purchases were made through 15 different offices and represent 257,500 individual purchases, with the typical purchase being $1,400.

Whether these indirect purchases of paper and paperboard are to be included under the procurement guidelines is a matter of interpretation of the law.* However, even if they are included, EPA cannot recommend recovered material levels unless they determine that such requirements would allow a satisfactory level of competition--price, delivery and performance standards considered. In the indirect purchases where the paper and paperboard is not the item being purchased directly, more difficulty would be experienced by suppliers in meeting recovered material specifications, which raises questions as to their inclusion in recovered material requirements. Thus, because it is uncertain as to whether these categories would be included in EPA recommendations, only direct purchases of paper and paperboard are included in the data that follow, but it should be borne in mind that the quantities of materials reported may be understated if indirect purchases are included.

The specific categories of direct purchase paper and paperboard studied are listed in Table II-1, which is a listing of the GSA categories. For purposes of discussion, the detailed categories are grouped into four main categories--high grade bleached papers, tissue products, unbleached paper and paperboard, and miscellaneous converted items. The last category

* There are two aspects of the law that could lead to exclusion. One is a $10,000 minimum purchase rule, and the other relates to definitions of terms.

Table II-1

MAJOR PAPER AND PAPERBOARD PURCHASE CATEGORIES

High Grade Bleached Papers

- Fine and Printing (including newsprint)
- Mailing Envelopes
- Memo Columnar Pads
- Tabulating Paper
- Tabulating Cards
- Xerographic/Copy

Tissue Products

- Sanitary Products (toilet tissue, towels, napkins, etc.)
- Industrial Wipers

Unbleached Paper and Paperboard

- Coarse Paper
- Corrugated Boxes
- Fiber Sheets and Boxes

Miscellaneous Converted Items

is very diverse, difficult to track,and changes in composition from year-to-year. As shown in Table II-2, in recent years, the volume of products in that category has been declining so that it now accounts for 11 to 16 percent of the products purchased. Therefore, that category will not appear in the subsequent analysis.

An historical series of the amount of paper and paperboard purchased annually by the government is tabulated in Table II-2, and graphically displayed in Figures II-1, II-2, and II-3.

The total amount of paper and paperboard purchased directly each year varies, but since 1970 the volume has ranged from a high of 437,000 tons in 1971 to a low of 308,000 tons in 1977. There are large variations from year-to-year as can easily be seen on the graphs. These large variations probably represent fluctuations in inventory rather than large variations in actual use, although this cannot be documented.

By far the largest major category is high grade bleached paper, which accounts for 46 to 59 percent of the paper and paperboard purchases. This category is dominated by the fine and printing papers, which accounts for one quarter to one third of all purchases.

The figures show that not only do the totals purchased in quantities show great year-to-year variations, but the quantities of each subcategory also vary unpredictably from year-to-year. However, there appears to be a gradual down trend for most of the products purchased. To examine these trends more closely, a statistical analysis of the data was made. A direct analysis of the numbers did not result in a usable analysis of the purchased products. However, it is reasonable to expect that the paper purchases are related to the number of Federal employees. When these ratios are calculated and plotted, Figure II-4 is the result. Simple curve fitting techniques did not allow a reasonable presentation of the data which can be readily extrapolated to 1985. However, by inspection it can be seen that the use of pounds of paper per employee is fairly constant for most categories, except for envelopes (for which there has been a considerable decline), and for Xerographic/copy paper, for which there has been a significant increase. The general decline in the total pounds of paper purchased per year appears to be related to a decline in Federal employment of about one percent a year.

We conclude that the Federal government direct purchases of paper and paperboard are declining at an overall slow rate, but that large year-to-year variations exist. There is no reason to suspect that this will not continue in the near future.

Table II-2

SUMMARY OF FEDERAL GOVERNMENT DIRECT PURCHASES OF PAPER AND PAPERBOARD, 1970 TO 1977

	1970		1971		1972		1973		1974		1975		1976		1977	
	10^3 tons	% Total	10^3 tons	% Total	10^3 tons	% Total	10^3 tons	% Total	10^3 tons	% Total	10^3 tons	% Total	10^3 tons	% Total	10^3 tons	% Total
High Grade Bleached Papers																
Fine and Printing *	147.9	35.3	131.1	30.0	129.5	29.7	127.8	32.8	136.0	32.3	113.6	29.3	70.9	22.1	88.2	28.6
Mailing Envelopes	43.5	10.4	43.8	10.0	50.0	11.5	37.5	9.6	33.5	7.9	31.9	8.2	28.1	8.7	14.3	4.6
Memo Pads	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25.0	5.9	8.4	2.2	7.5	2.3	10.2	3.3
Tabulating Paper and Cards	15.5	3.7	50.2	11.5	53.0	12.2	45.0	11.5	43.0	10.2	48.5	12.5	27.4	8.5	37.4	12.1
Xerographic/Copy	N/A	N/A	N/A	N/A	N/A	N/A	20.8	5.3	4.2	1.0	18.4	4.7	14.7	4.6	38.6	12.5
Subtotal	206.9	49.4	225.1	51.5	232.5	53.4	231.1	59.2	241.7	57.3	220.8	56.9	148.6	46.2	188.7	61.2
Tissue Products	59.5	14.2	53.0	12.1	56.0	12.9	46.1	11.8	50.0	11.9	54.0	13.9	56.6	17.6	35.9	11.6
Unbleached Paper and Paperboard																
Coarse	40.7	9.7	35.4	8.1	31.0	7.1	36.4	9.3	35.8	8.5	39.4	10.2	33.6	10.5	21.3	6.9
Boxes	19.0	4.5	25.3	5.8	30.0	6.9	32.5	8.3	39.0	9.3	24.0	6.2	30.7	9.5	19.7	6.4
Subtotal	59.7	14.3	60.7	13.9	61.0	14.0	68.9	17.7	74.8	17.7	63.4	16.3	64.3	20.0	41.0	13.3
Miscellaneous Converted Items	92.5	22.1	98.6	22.5	86.2	19.8	44.0	11.3	55.0	13.0	49.6	12.8	52.0	16.2	42.8	13.9
Total	418.6	100.0	437.4	100.0	435.7	100.0	390.1	100.0	421.5	100.0	387.8	100.0	321.5	100.0	308.4	100.0

* Includes newsprint in the following amounts: 1970, 7,000 tons; 1971, 7,000 tons; 1972, 7,000 tons; 1973, 7,000 tons; 1974, 8,600 tons; 1975, 8,600 tons; 1976, 8,700 tons; 1977, 8,700 tons.

Source: GSA and GPO private communications and American Paper Institute, "Statistics of Paper and Paperboard, 1978."

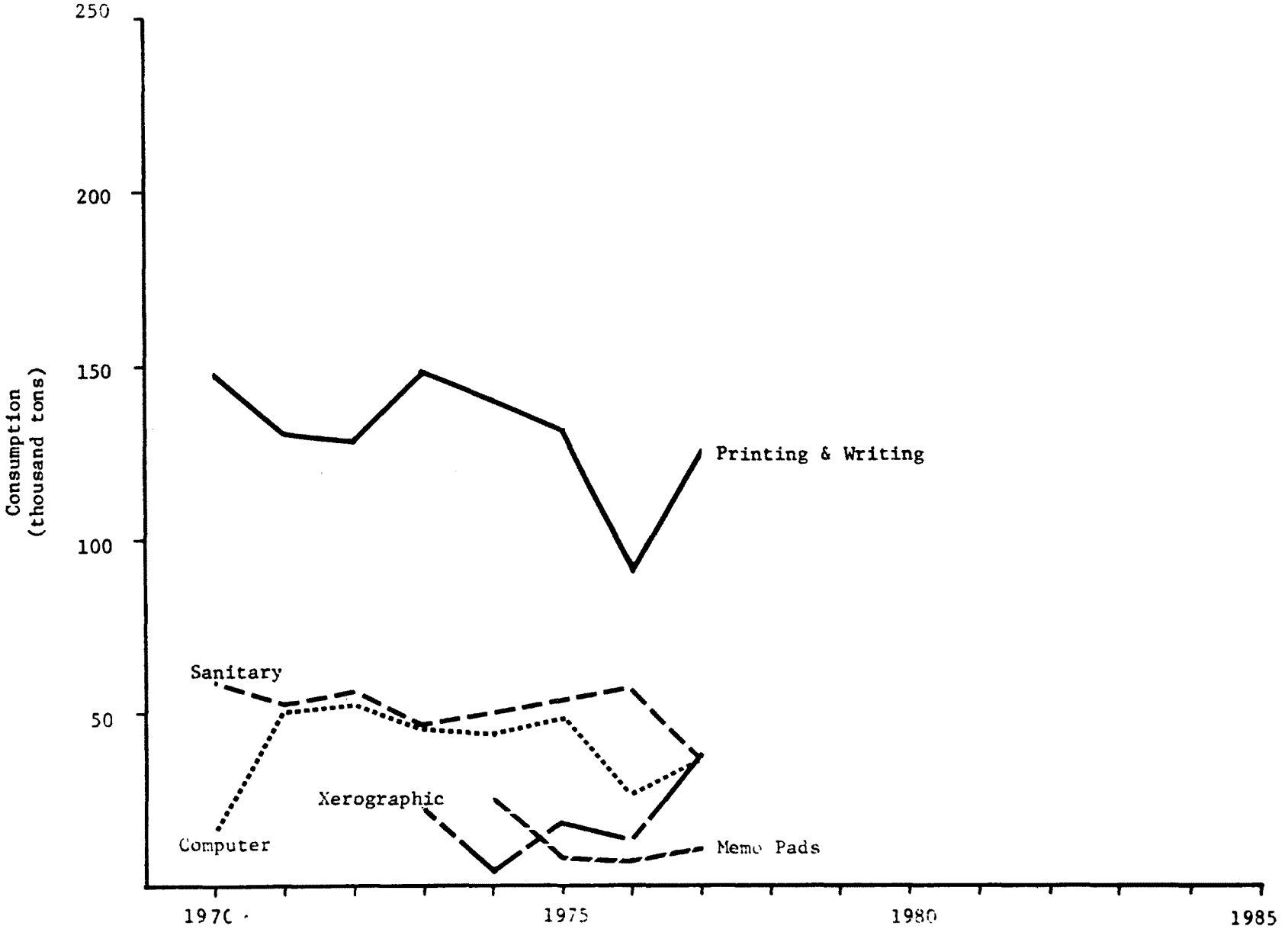

Figure II-1. Federal purchases of selected paper products.

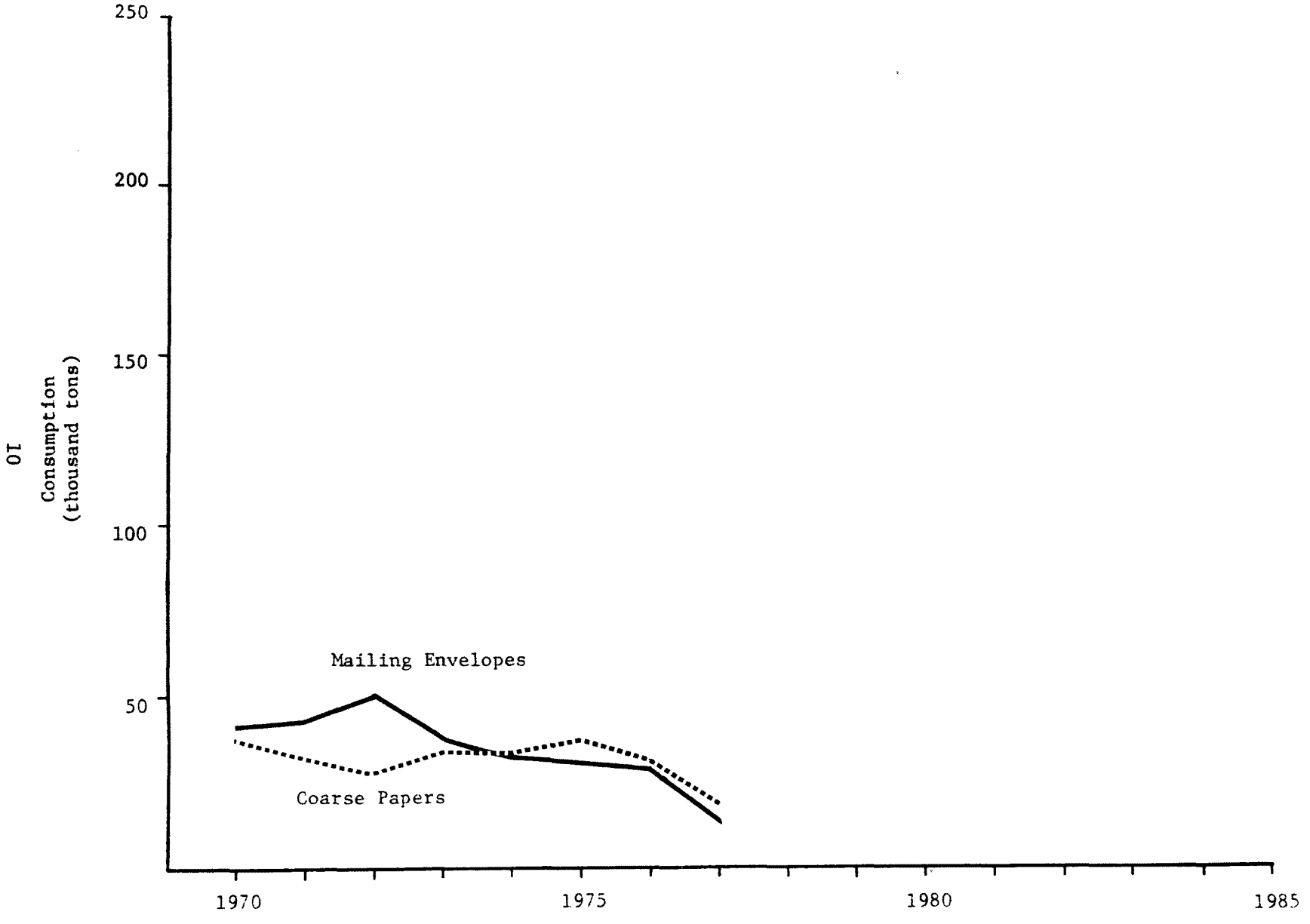

Figure II-2. Federal purchases of selected paper products.

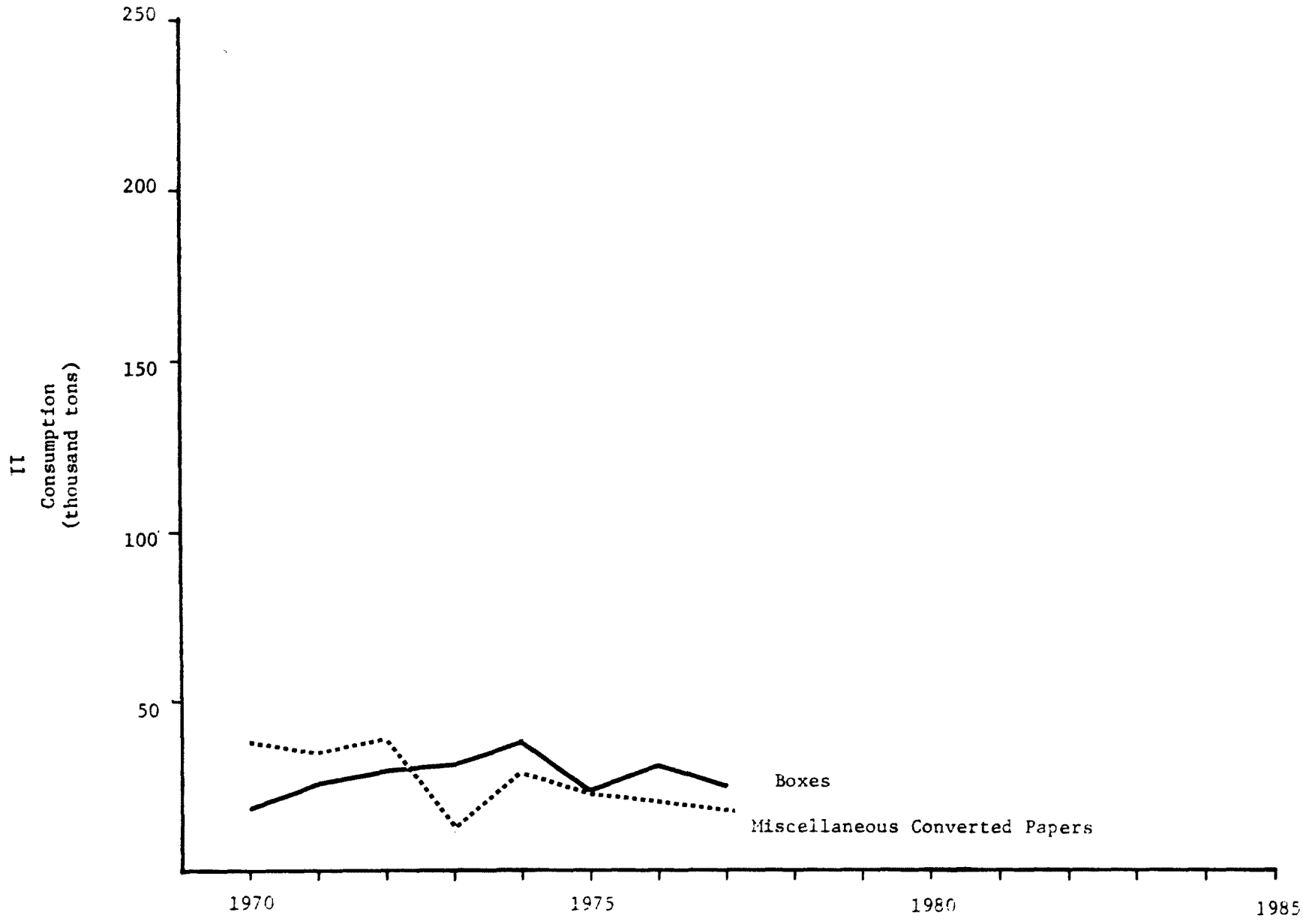

Figure II-3. Federal purchases of selected paper products.

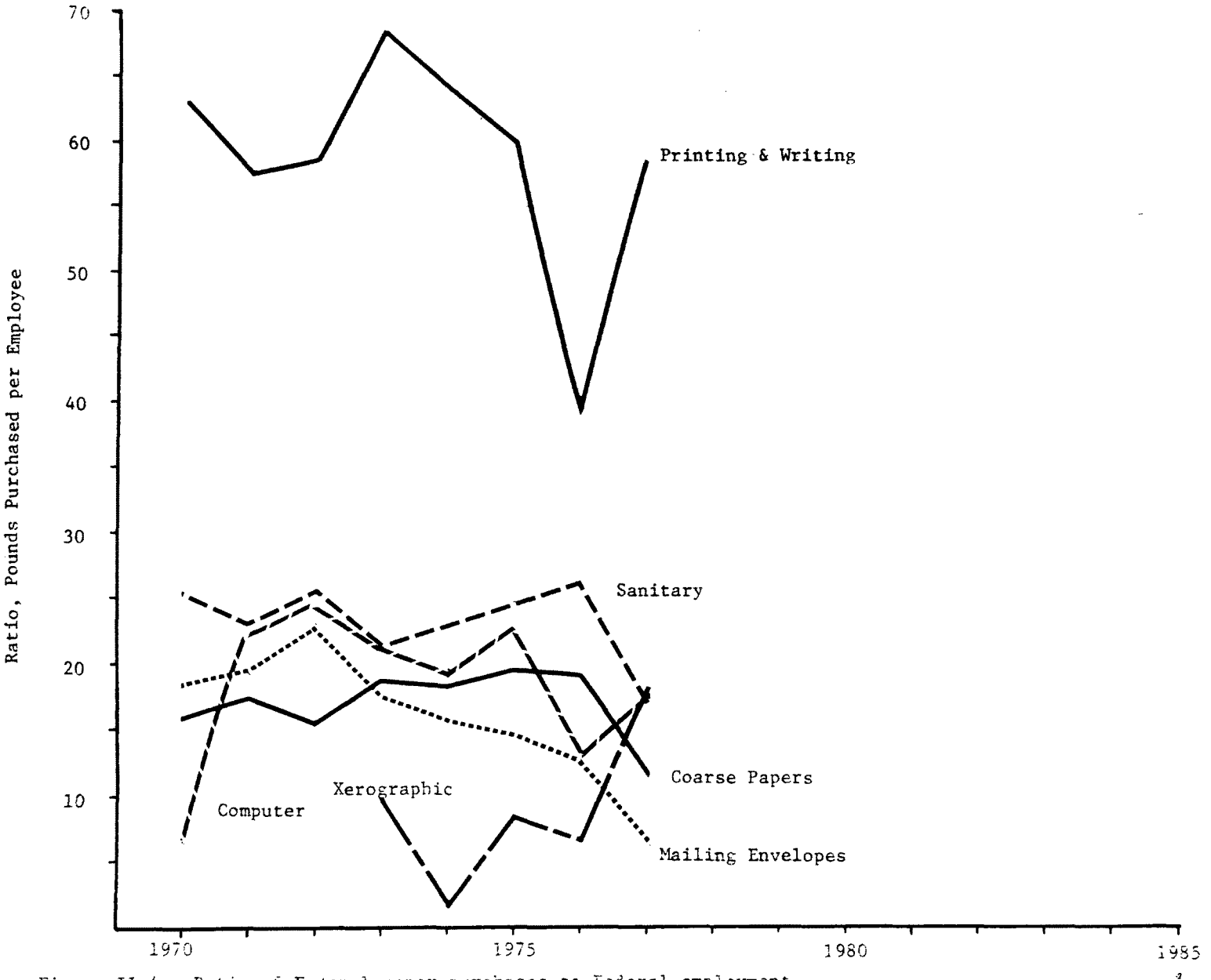

Figure II-4. Ratio of Federal paper purchases to Federal employment.

U.S. CONSUMPTION OF PAPER AND PAPERBOARD

The Federal Government is clearly a large single customer of paper and paperboard, as its central purchasing agency procures products for a civilian work force approximately two times as large as the nation's largest private employer (American Telephone and Telegraph employs 950,000 people), in addition to supplying the military establishments. Thus, the government is undoubtedly the largest single customer for paper in the U.S. and could possibly wield considerable influence in markets with paper companies. However, it is important to also analyze the market from the companies' points of view in terms of government purchases in relation to companies' sales. A detailed derivation of pertinent data on this subject may be found in Appendix A.

The size of the government market in relation to total paper and paperboard sales is given in Table II-3 (obtained from Appendix A). Taken as a whole, government paper and paperboard direct purchases are quite small when compared to U.S. production. For the years 1970 to 1977, government sales ranged from 0.55 percent to 0.88 percent of the total output of the paper industry. In terms of the major categories of paper and paperboard, the government purchases a small fraction of paperboard ranging from 0.25 percent to 0.53 percent. The percentage of paper ranges from a high of 1.3 percent in 1970 to a low of 0.86 percent in 1977. The paper data are further broken down by grade in Table II-4. Even on a grade-by-grade basis, government purchases are a small percent of the total, ranging from less than one percent for coarse papers to a range of 1.9 to 6.6 percent for envelopes.

Thus, government direct purchases are a small fraction of the total paper and paperboard products manufactured in this country.

Table II-3

COMPARISON OF GOVERNMENT PURCHASES TO TOTAL U.S. PAPER AND PAPERBOARD PRODUCTION

	Government Purchases (Thousand Tons)			U.S. Production (Thousand Tons)			Government Share (Percent)		
	Paper 1/	Paperboard 2/	Total	Paper	Paperboard	Total	Paper	Paperboard	Total
1970	314.9	103.7	418.6	23,371	25,383	48,754	1.35	0.41	0.86
1971	299.3	138.1	437.4	23,736	26,037	49,773	1.26	0.53	0.88
1972	307.2	128.5	435.7	25,371	28,502	53,873	1.21	0.45	0.81
1973	304.5	85.6	390.1	26,796	29,572	56,368	1.14	0.29	0.69
1974	322.5	99.0	421.5	26,898	28,915	55,813	1.20	0.34	0.76
1975	306.3	81.5	387.8	23,305	24,756	48,061	1.31	0.33	0.81
1976 3/	237.9	83.6	321.5	26,611	28,440	55,051	0.89	0.29	0.85
1977	236.7	71.7	308.4	27,381	28,953	56,334	0.86	0.25	0.55

Source: GSA and GPO Private Communication. American Paper Institute, "Statistics of Paper and Paperboard, 1978."

1/ Paper category includes printing and writing papers, memo, columnar pads, mailing envelopes, sanitary papers, teletype papers, carbon papers and Xerographic paper.

2/ Paperboard category includes disposable mess equipment, miscellaneous converted items, boxes, tab cards and index card stock.

3/ Adjusted for transition quarter.

Table II-4

COMPARISON OF GOVERNMENT PAPER PURCHASES OF SELECTED GRADES OF PAPER TO TOTAL U.S. PRODUCTION
(Thousand tons and percent)

	Printing & Writing[1]			Sanitary			Computer[2]			Mailing Envelopes[3]			Coarse Papers[4]		
Year	Gov't. Purch. (000 tons)	U.S. Prod. (000 tons)	Gov't. Share (Percent)	Gov't. Purch. (000 tons)	U.S. Prod. (000 tons)	Gov't. Share (Percent)	Gov't. Purch. (000 tons)	U.S. Prod. (000 tons)	Gov't. Share (Percent)	Gov't. Purch. (000 tons)	U.S. Prod. (000 tons)	Gov't. Share (Percent)	Gov't. Purch. (000 tons)	U.S. Prod. (000 tons)	Gov't. Share (Percent)
1970	147.9	9,067.5	1.63	59.5	3,494.0	1.70	15.5	1,234.6	1.26	43.5	655.7	6.63	37.5	4,865.5	0.77
1971	131.1	9,278.5	1.41	53.0	3,604.3	1.47	50.2	1,259.5	3.99	43.8	644.5	6.80	39.1	4,862.0	0.80
1972	129.5	10,133.5	1.28	56.0	3,746.2	1.49	53.0	1,394.4	3.80	50.0	716.5	6.98	33.7	5,046.3	0.67
1973	148.6	10,994.2	1.35	46.1	3,771.8	1.22	45.0	1,630.6	2.76	37.5	784.9	4.78	40.8	5,060.4	0.81
1974	140.2	11,067.2	1.27	50.0	3,823.2	1.31	43.0	1,672.2	2.57	33.5	733.7	4.57	40.1	5,224.8	0.77
1975	132.0	9,056.4	1.46	54.0	3,771.9	1.43	48.5	1,321.0	3.67	31.9	620.4	5.14	42.2	4,233.7	1.00
1976 5/	85.6	11,022.2	0.78	56.6	3,954.6	1.43	27.4	1,496.1	1.83	28.1	723.9	3.88	40.9	4,907.2	0.83
1977	126.8	11,587.6	1.09	35.9	4,069.0	0.88	37.4	1,502.5	2.49	14.3	757.7	1.89	24.6	4,934.1	0.50

1/ Includes GPO and GSA purchases of printing and writing papers except computer form bond, envelopes, and tab cards.
2/ Includes teletype and computer form bond papers and tab cards.
3/ Includes white wove and kraft envelopes.
4/ Includes bleached and unbleached kraft papers and industrial wipers.
5/ Adjusted for transition quarter effects.

Source: GSA and GPO private communications and American Paper Institute, "Statist ..s of Paper and Paperboard, 1978."

AVAILABILITY OF PAPER AND PAPERBOARD MANUFACTURED FROM RECOVERED MATERIALS BY REGION

The issue being considered here is the stimulation of the use of recovered materials in the manufacture of paper and paperboard products via government procurement practices.

Government purchases of these products are dependent on availability. To be practical, specifications should be set so that the recovered material levels called for are low enough that adequate supply is available, but high enough to stimulate private companies to consider additional use of recovered materials in their products. The products must be available in the general vicinity of the points of use, or extra transportation costs may be incurred.

As an aid to determining appropriate recovered material levels in different regions of the country, a special study of the paper and paperboard industry was conducted to determine the availability of broad grades of paper and paperboard at various reuse rates in different regions of the country. The results of that study are detailed in Appendix G, but a summary is presented here.

Recovered materials will be considered in two broad categories in this study. The first is forest and forest product manufacturing residues. These are discarded wood fibers resulting from tree harvesting and wood processing operations. The other category is waste paper, which includes paper recovered after being discarded by the final consumers as well as paper recovered from any paper manufacturing and converting operations once the paper has been discarded at the paper mill. The reuse of paper and paperboard is generally known as recycling, and that term will be used in this report.

Data for this presentation were provided by the American Paper Institute through a special analysis of their annual capacity survey, where companies report detailed information on their use of recovered materials. The information available is for the use of forest and manufacturing wood residues used as a percent of the total wood fiber consumed in the manufacture of paper. Wood is the primary raw material from which virgin paper is manufactured. Wood fiber is converted to water slurry called wood pulp, which becomes paper. The following data were given in terms of the fiber content of wood pulp.

Figure II-5 summarizes the data. Wood pulp is available in significant quantities at any level of use of recovered materials, including wood pulp made from 100 percent recovered materials. Fifty percent of the wood pulp manufactured is 40 percent or more recovered material, with 11 percent of the wood pulp containing 95 percent or more recovered materials. Reference to the regional data detailed in Appendix G shows significant variation in the use of residues. The west leads in residue use with a median level of 95 percent residues in the wood pulp being manufactured. The northeast, central, and southern regions have median levels of 34 to 38 percent residue in the wood pulp manufactured. As a result, paper and paperboard products manufactured from wood residues are conveniently available at any level of residue use, but the availability of high percentages of residues is much greater in the west, particularly in the Pacific Northwest, where there is a significant concentration of wood pulp manufacturers which derive their raw materials principally from lumber and plywood mills.

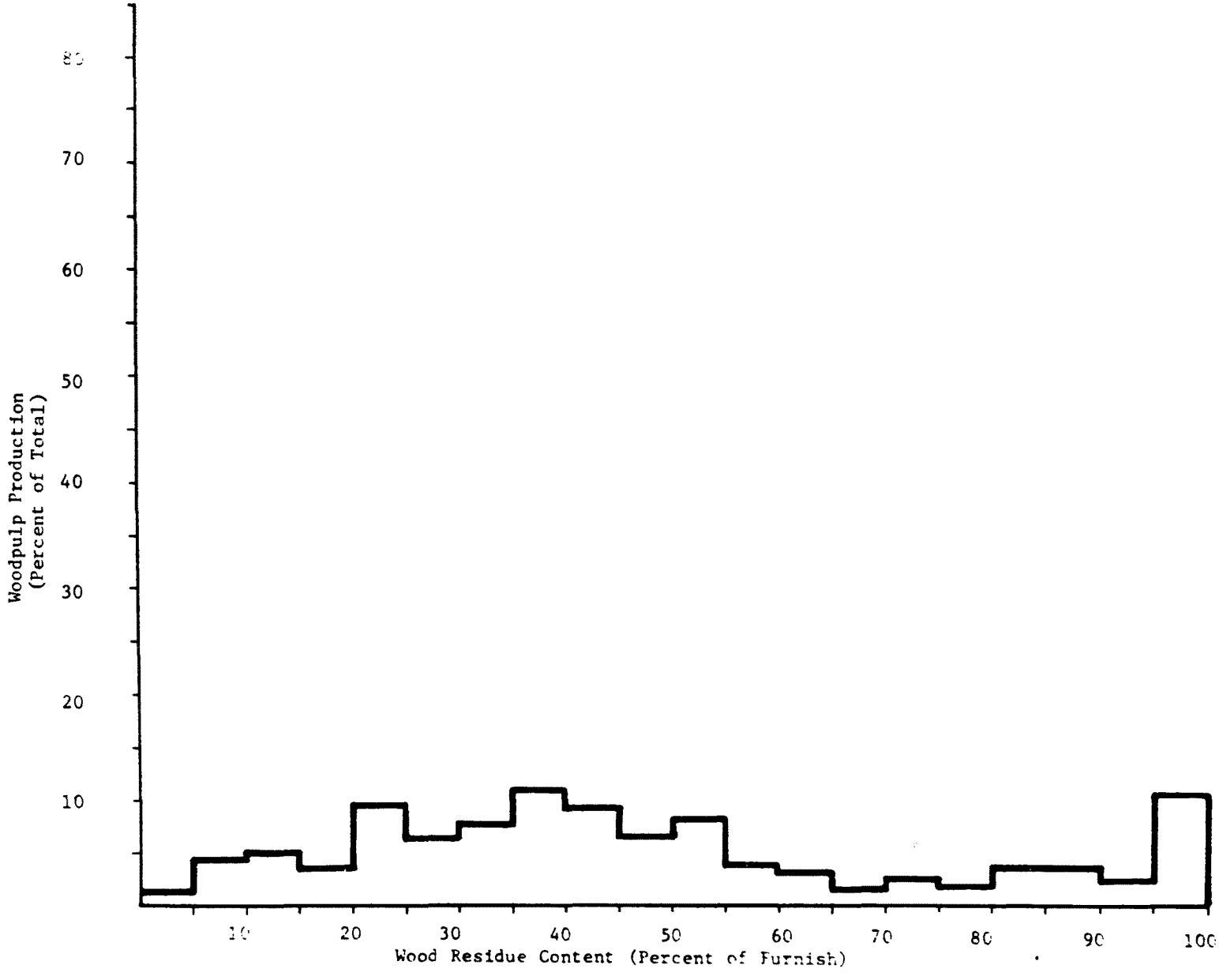

Figure II-5. Wood residue consumption in woodpulp production.

Turning to the more commonly known examples of paper recycling, various categories have been examined in Appendix G. Data there show waste paper usage as a percent of paper products produced. Details found in Appendix G show that 77 percent of paper produced contains less than 5 percent recycled fiber, and only 3 percent of the paper produced contains 50 percent or more recycled fiber, and only one percent is produced at recycling rates of 90 percent or more. Thus, the relative availability of recycled paper compared to virgin paper is quite low. However, there is still 170,000 tons of fine and printing paper produced at the 90 percent or higher recycling rate and 400,000 tons at 50 percent recycling or higher, which is more than adequate to supply the Government. But, it is likely that much of that tonnage will not meet the other Government specifications which relate to product performance. Much is not readily available for Government purchases as it is already committed to more profitable private markets.

Table II-5 shows the regional results which can be calculated from data in Appendix G. The overall recycling rate is 6.6 percent, but most recycling takes place in the northeast and central regions of the country. Very little recycling occurs in the south, and almost none in the west, where only 49,000 tons of waste paper are consumed.

The conclusion which can be drawn from this is that fine and printing papers with high recycling content comprise a very small percent of the paper available. This means they are not nearly as readily available as virgin paper, and in the north and west only quite small tonnages are manufactured. Thus, to purchase high recycled fiber content fine and printing papers will frequently mean special orders as many suppliers will not have appropriate grades in stock, and special efforts will often be required. This is consistent with the experience of many of the government entities at all levels interviewed in the course of this study.

Table II-5 shows that there is considerably more recycling in tissue products than for the fine and printing papers. Overall, the recycling rate is 30 percent, and in Appendix G it can be found that 50 percent of the tissue products contain approximately 12 percent or less recycled fiber. On the other hand, over 30 percent of all tissue products contain 30 percent or more recycled fiber, with a significant tonnage (nearly 10 percent of the U.S. total) containing 90 percent or more waste paper. Regionally, we once again find a wide disparity in regard to recycling. The large majority of waste paper is used in tissue mills in the northeast and central region. Only 15 percent of the waste paper consumed by tissue mills is used in the three-quarters of the country included in the west and south regions.

We conclude that recycled fiber is more readily available in tissue products than in fine and printing paper, but once again there are sizeable differences between regions, making it doubtful that tissue made from waste paper is readily available in the south and west from nearby mills.

Table II-5

AVERAGE USE OF WASTE PAPER IN PAPER AND PAPERBOARD MANUFACTURE BY REGION, 1976

	Northeast		Central		South		West		Total U.S.	
	10^3 tons	Percent of Production	10^3 tons	Percent of Production	10^3 tons	Percent of Production	10^3 tons	Percent of Production	10^3 tons	Percent of Production
Fine and Printing Paper	281	6.4	455	11.5	84	2.2	49	5.0	869	6.6
Tissue	484	32.4	590	51.9	88	10.3	107	15.1	1,269	30.3
Semichemical 1/	48	29.2	301	26.0	520	22.7	110	19.1	979	23.8
Linerboard 1/	-	-	-	-	-	-	-	-	-	8 2/
Coarse Paper (Kraft and Special Industrial Paper)	74	15.4	124	24.7	69	2.0	3	0.3	270	4.9

1/ These are the components of corrugated boxes.

2/ Estimates based on unpublished data.

Source: American Paper Institute, private communication (see Appendix G for details).

Recycling levels for corrugated boxes could not be directly determined from the data, but the amount of recycling can be estimated from the box components. A corrugated box is made by sandwiching a piece of paperboard which has been fluted (or "corrugated") between two outer sheets, or liners. The inner material is called "corrugating medium" and is manufactured from semichemical paperboard or recycled paperboard. The two outer liners are usually made from unbleached kraft linerboard. The composition of a corrugated container varies depending on the type and style of containers being manufactured, but the average composition derived from the Fibre Box Association Statistics for 1976 is 69 percent linerboard and 31 percent medium.

Table II-5 shows that the average level of recycled materials in corrugating medium is 24 percent. The regional effect is much less pronounced for the medium than for the other grades discussed so far, ranging from a high of 29 percent in the northeast to a low of 19 percent in the west. Therefore, substantial tonnage of recycled material is generally available. It is important to realize that if the linerboard is 100 percent virgin fiber, then the average recycled fiber content of 24 percent in the medium alone leads to an overall box content of 7 percent waste paper-derived fiber.

An estimate of use of waste paper in linerboard cannot be made accurately because the data are not reported separately for the various kinds of kraft paperboard, only for a general category of bleached and unbleached paperboard. However, interviews with the paper industry reveal that there is a growing use of waste paper in linerboard mills, generally in the range of 5 to 30 percent, although many linerboard mills are still 100 percent virgin fiber operations. There is also a limited amount of 100 percent recycled linerboard available. Unpublished data indicate that the current utilization of waste paper results in an average waste paper fiber of 8 percent in linerboard, but no regional data are available. However, the regional distribution is apt to be similar to that of medium. This combined with 24 percent recycled medium would result in an average corrugated container which is 13 percent waste paper fiber.

The final paper product category to be considered is coarse paper. As in the case of printing and writing papers, the recycling average level is quite low at about 5 percent. Eighty-five percent of the tonnage contains 5 percent or less recovered paper, and about 3 percent of the tonnage is 50 percent or more recycled. The regional data in Table II-5 show that almost all of this recycling occurs in the northeast and central regions of the country. Consequently, it appears that very little recycling occurs for coarse papers, and virtually none occurs in the south and west, but significant quantities may be available in certain locations.

POTENTIAL DEMAND UNDER RIPPLE EFFECTS

Specifications for goods are often quite complex and difficult to construct so that the buyer and seller communicate precisely. This leads to frequent sharing of purchase specifications by entities purchasing similar items. On a complex matter such as the use of recovered materials

in products, it is expected that Federal Government specifications would be studied, and in some cases copied. As a result, it is expected that the Federal specifications will result in a ripple effect, which means that some state and local jurisdictions and private businesses would apply the Federal specifications to their own needs.

In order to assess the possible magnitude of this effect, paper and paperboard purchases by state and local governments were estimated. A survey of state and local governments was undertaken to establish use patterns and amounts of purchases. These are detailed in Appendix B. The conclusion reached is that all state and local government purchases of fine and printing papers as well as tissue products (napkins, towels, toilet tissue) in the country considered as a whole amount to approximately twice the Federal Government totals. The use of Federal specifications in private sector purchases is not common, so the potential ripple effect would be considered quite small. Also, state and local government direct purchases of boxes and coarse paper are insignificant, so that category is not considered further.

State and local governments purchase products packaged in boxes, so there is some corrugated in the form of secondary packaging received by the states. An examination of the detailed data in Appendix A shows that most of the corrugated received by the Federal Government is for defense-related purposes. For the types of goods purchased by state and local governments, the secondary packaging is much less. Because of the lack of detailed state and local purchase data, it is necessary to rely on the Federal experience to estimate the values of secondary packaging by analogy. State and local government activities are similar in nature to non-defense-related Federal activities, so the use of products should be similar. As reported above, we know that the fine and printing papers and tissue for state and local are double the Federal purchases. Based on these facts, we estimate that secondary packaging is in a range close to that of the non-defense Federal category, or about 40,000 to 60,000 tons per year.

The values quoted here are maximum potential ripple effect values. In the past, the actual ripple effect of recovered material procurement specifications has been small. Many states and localities have shown interest in the Federal specifications, but our survey of states indicated that little action had been taken. At the local level, governmental bodies and public school boards try to buy locally if possible (see Appendix C). The lack of general availability of recycled paper products precludes purchases in many cases. It was also apparent at this level of government that budgets are frequently quite limited, and significant use is made of special purchases of products which are slightly off specifications which companies make available at reduced prices. Our impression is that the ripple effect to the local government and public school level would probably be dependent on universal availability of recycled products at competitive prices. Consequently, the primary ripple effect is expected to be purchases by state governments, although isolated cases of local entities and private businesses using Federal guidance to procure recycled products will undoubtedly occur.

We conclude that the maximum potential ripple effect in printing and writing papers and in sanitary papers is approximately equal to the size of Federal Government purchases. If guidelines would be extended to include packaging of products purchased by governments, the potential ripple effect would be equal in size to the Federal Government civilian purchases. However, the ripple effect in coarse papers and direct purchases of corrugated boxes is probably insignificant.

This maximum potential ripple effect would probably never be realized because the non-Federal Government purchases tend to be much smaller than Federal purchases. The result is that purchase of recycled products will depend more on local availability than for the Federal Government. Nevertheless, California, Maryland, and Florida* have had success in purchasing some recycled products and there is reason to assume that at least some other states will have similar success. However, we estimate that total purchases of recycled products for states under special procurement programs designed to purchase recycled products will not exceed 1,000 tons of products in 1978.

* Private communications have been received from these states.

Chapter 3

PROCUREMENT GUIDELINE ISSUES

PURPOSE OF GUIDELINES

The Resource Conservation and Recovery Act of 1976 (RCRA), (PL94-580), Subtitle F, Section 6002(c) requires that procuring agencies of the Federal Government, and certain other entities receiving funds from the Federal Government, must procure items composed of the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition. In addition, procuring agencies must undertake a review and revision of specifications to eliminate exclusion of recovered materials and require recovered materials to the maximum extent practical.

Section 6002(c) of the Act requires the Environmental Protection Agency to prepare, and from time to time revise, guidelines for use by procuring agencies in complying with the above requirements.

The intent of Congress as set forth in the Act is clear. It is their desire that use of materials recovered from waste streams be stimulated, and that one way of doing this is for the government to set an example in the purchase of products consumed. However, the requiring of products which are composed of recovered materials, either entirely or partially, is a very complex task. In the case where the procuring agency has not had experience in purchasing such products, it means altering existing purchasing policies. For the agencies that have had experience in this area, it means insuring that their policies are consistent with the principles outlined in RCRA. This involves determining how to define recovered materials, and how to obtain the maximum amount of recovered materials usage consistent with acceptable business practices. Those practices must include procuring products that are available at a fair price; they must be readily available in terms of quantity and delivery times at all geographical locations; an acceptable number of bids must be received to insure competitiveness; and products must meet all performance criteria.

The EPA guidelines will serve several purposes. The basic usefulness will be that they are the vehicle through which a policy will be implemented. Thus, the basic attribute of the guidelines will be to stimulate the use of recovered materials. Ideally, this would occur through a "demand-pull" type of mechanism, where the demand for goods by the government will increase the marketability of recycled materials. If the demand by the government is large enough, it will bring about a basic change in manufacturers' raw materials policies. That is, if the government were viewed as an important customer by the paper mills, they would install manufacturing capacity for the use of recovered materials in order to meet government requirements.

As discussed later, our analysis shows that government demand is not large enough to bring about this result for almost all paper mills. Instead, government purchase is viewed as marginal business, typically accounting for one percent or less of any given paper mill's output. Thus, the results of implementation of the guidelines will likely be modest in nature. As a practical matter, government business is viewed as desirable by many mills because they are a large customer, although not purchasing a significant fraction of the mill's production. Thus, there is some incentive for paper mills to comply with government specifications, so there is a possibility that government specifications could play a part in company raw materials policy decisions.

The paper industry has been a growth industry for many years. Production of paper is continually being expanded. This fact, coupled with the normal obsolescence of equipment, means that new production capacity is being continually installed. In order to remain competitive, each company must review their own economic situation before new equipment is installed. There is always the choice that new production equipment be designed to require either virgin or recycled raw materials. Part of the economics relates to probable customers for the new capacity. Thus, if the government requires the use of recovered materials, this fact must be taken into account by any mill doing business with the government. Therefore, to the extent that a company desires to engage in government business, it would have to consider using recovered material. It is highly likely, then, that in some cases, government procurement guidelines could be a factor in the installation of recovered material capacity at paper mills.

Another purpose of the guidelines is more philosophical in nature. It is a proper function of government to bring about actions for the public good. RCRA was enacted as part of a national resource policy. In that regard, the government must determine which natural resource policies are in the public good. In RCRA, Congress has reflected their will by stating that the maximum use of recovered materials is a natural resource policy which should be encouraged. A purpose of the guidelines is to reflect this national policy by laying out specific ways in which this policy may be implemented. Irrespective of how successful the guidelines are at this point in time in stimulating increased use of recovered materials, it is important that the government lay the framework for materials policies which are deemed to be in the nation's best interest for the long term.

Finally, an important purpose of the guidelines is to provide a blueprint for procuring agencies to implement RCRA. The guidelines must give specific instructions as to how agencies can procure paper composed of recovered materials. Because each agency cannot (and should not) engage in a comprehensive analysis of the paper industry, the guidelines must contain information on the industry's ability to make paper available at various recycling levels, sources of supply, the effects of recycled fiber on product performance, and must highlight significant problems which a procuring agency may encounter in purchasing recycled products which are not encountered in purchasing other products.

In summary, the procurement guidelines will serve three purposes. The basic purpose is to enunciate government policy in natural resource conservation. The policy established by Congress is that use of recovered materials conserves natural resources. Another purpose of the guidelines is to implement the policy by providing a framework through which natural resources are conserved by stimulation of recycling. Finally, the guidelines serve as an information source for procuring agencies by providing detailed information on which agencies can base procurement decisions.

DEFINITION OF RECOVERED MATERIALS

RCRA uses the term "recovered materials" throughout in the mandate to EPA. It is necessary that a specific and detailed definition of this term be set forth by EPA. Over the past few years, this term has meant different things to different people, and in some cases has come to mean different things to the same people at different times. In this report, three possible definitions will be discussed along with possible implications for government procurement.

Historical GSA Definitions

Since the early 1970s, the General Services Administration (GSA) has been active in the procurement of paper products made wholly or in part of recovered materials. After much consideration of appropriate definitions of recovered materials, GSA adopted their well-known two tier definitions of recovered materials. These are reproduced in Appendix J. Part I of the GSA definitions was "postconsumer" waste, while Part II was wastes from commercial, industrial, and agricultural processes. The Part I included two major categories labeled A and B. Category A was paper and paperboard wastes which had passed through their end-use, but had not entered the municipal solid waste stream. These are the "source separated" wastes. Category B includes all paper, paperboard, and fibrous wastes that enter and are collected from municipal solid waste.

Part II of the GSA definitions is more complex, and has five major categories. Categories A and B include waste from the paper manufacturing operations such as trim and cuttings. Categories C, D, and E relate to fibers prior to paper manufacture or to non-wood fibers. Category C is agricultural wastes such as forest residues, and by-products of manufacturing processes, such as sawdust. Category D is wastes generated by conversion of fibrous material to goods, such as waste rope from cordage manufacture. Finally, Category E includes fiber recovered from waste streams, particularly in paper mills.

GSA has utilized these definitions to encourage use of recovered materials in paper purchases. Recovered materials were specified in terms of a given percent of Part I material and a given percent of Part II material. As of the end of the fiscal year, September 30, 1978, recovered material recycling was specified by GSA as shown in Table III-1. We estimate that 50,000 to 100,000 tons of recovered materials were used in government purchases nationally that year, with 20,000 to 30,000 tons being Part I postconsumer waste. The postconsumer waste paper in products purchased by the Federal Government amounts to less than 0.5 percent of the amount of waste paper used in this country over that time period, and may have been as low as 0.2 percent.

Table III-1

GSA REQUIRED MINIMUM PERCENTAGES OF RECOVERED FIBER IN PAPER AND PAPERBOARD PRODUCTS, 1976

	Part I*	Total***
Fine and Printing		
Paper, Looseleaf	0	30
Paper, Blotting	0	35
Columnar Pads	0	25
Backing (Pads)	0	100
Backing (Col. Pads)	0	100
Memo Columm Pads	0	20
Mailing Envelopes		
White, Bond, Rag	0	25
Light Colors	0	20
Dark Colors	0	30
Sanitary Papers		
Paper, Toilet Tissue	20	50
Towels, Paper	40	95
Napkins, Table, Paper	30	60
Tissue, Facial	5	20
Paper, Doily	40	50
Coarse Papers**		
Trays, Prepacking	0	30
Paper, Wrapping, Waxed	0	10
Bags, Paper, Grocers	0	25
Tags, Shipping, Blank	0	13
Bags, Paper, Waxed	0	10
Boxes, Paperboard Lunch	40	80
Bags, Paper, Kraft & Foil	0	15
Bags, Paper, Mench.	0	15
Paper, Wrapping, Freezer	0	20
Industrial Wipers		
Towels, Wiping, Paper	0	20
Industrial, Institutional	0	20
Towels, Paper, Plastic Wiping	0	20
Disposable Food Service		
Plates, Paper	0	15
Cups	0	15
Butter, Chips	0	25
Fiber Boxes	10	35
Miscellaneous Converted Papers		
Graph Paper	0	50
Paperboard, Drawing	15	85
Labels	10	25
Cardboard, Paper	0	10

Source: General Services Administration, private communication.

* Postconsumer waste.
** These are primarily "brown" paper.
*** Part I plus Part II recovered fiber.

EPA's Mission

In order to assess the usefulness of the GSA definitions, it is necessary to determine EPA's mission and see what definitions are consistent with that mission. The specific charge given to EPA in RCRA is to promote the use of recovered materials. Recovered materials are defined in the act in broad terms as any material collected or recovered from solid waste; and solid waste is defined basically as any solid or semi-solid discarded from households, businesses, industries, mining activities, or agricultural operations.

These definitions are broadly worded and can be interpreted in different ways. One interpretation could be that recovery of all kinds of solid wastes is equally important. If this interpretation is adopted, then EPA should proceed to stimulate recovery of all kinds of solid waste, without preference to the various materials. Another point of view is that recovery of some materials is more important than the recovery of others. For example, substitution of recycled aluminum for virgin aluminum results in significant energy savings, which can be as high as 80 to 90 percent of the energy to manufacture virgin aluminum. On the other hand, use of forest residues in place of harvested trees may result in little or no energy savings at all.

Recovery of materials also has many other impacts. Not only are energy resources affected, but material resources as well. To use the two examples cited above, recovery of aluminum from waste, and using the recycled product as a substitute for virgin aluminum avoids the use of bauxite. This is clearly an advantage to the country, as bauxite is a virgin mineral of finite extent. In addition, this ore is found primarily in foreign countries, which makes this country more dependent on other countries. In the case of forest residues, their use as a replacement for harvested trees represents a wise use of agricultural resources, and extends the life and potential usefulness of the nation's forests.

Another important aspect of recovering materials is the impact on land resources. Avoidance of disposal results in less land area being used for waste disposal. These impacts are greatly different for the two examples cited. For aluminum, the typical mode of disposal is to use it as landfill. Landfill sites are becoming a valuable and scarce resource in most urban areas, so that avoidance of disposal is an important national goal. However, disposal of forest residues occurs in areas where land availability is not nearly as serious a problem. In addition, residues of this type degrade naturally and return to the environment. Thus, disposal of aluminum poses a much greater problem to the nation.

The examples given here were for aluminum and paper products. However, the same principles hold true for other products made from other materials, such as steel, glass, plastic, and textiles. In each case, different impacts exist on natural resources. These variations exist between each product, and also between various locations where impacts occur.

It can be readily seen from the examples given that recovery of different materials can have widely varying impacts. The determination of which materials are the most important to resources is a very complex and difficult task. However, one important reason for the existence of EPA is to consider issues such as this and render policy recommendations. Thus, EPA should view their mission in these matters in that context. EPA can and should exert leadership in this area to identify the areas of resource recovery which are in the nation's best interest. This would appear to be consistent with the intent of Congress and the President.

Optional Definitions

The task of adopting appropriate definitions for recovered materials is a necessary basic step before writing guidelines for procurement specifications. These definitions must be consistent with EPA's mission. If EPA can show it is in the nation's best interest to recover and reuse postconsumer waste, then the procurement specifications should reflect that view.

One option is for EPA to adopt the old GSA definitions (see Appendix J). These definitions were used to encourage the use of recovered materials at two levels. Minimum percentages of recovered materials were specified as Part I and Part II separately. This has the effect of stimulating both postconsumer (Part I) and non-postconsumer (Part II) waste recovery. It is probable that recovery of both is desirable for the country.

EPA may decide that Part II type materials are being adequately stimulated by normal economic processes, and choose to provide only for Part I requirements in procurement specifications. If this route is chosen, then a definition similar to the GSA Part I definitions of recovered materials should be adopted. This would have the advantage of focusing on the postconsumer wastes which have long been the primary concern of the EPA Office of Solid Waste, and would be simpler to administer than requiring levels for all recovered materials. However, it has the adverse effect in that the government would be taking a position of not seeming to be interested in the use of other recovered materials, even though their use may have a favorable impact on natural resource utilization.

Another option is to define recovered materials in terms of the GSA Part I postconsumer wastes and Part II, categories A and B, which includes wastes from paper manufacturing operations. This has the advantage over requiring use of only postconsumer wastes in that there may still be some small amounts of waste from paper product manufacture, such as small printing establishments, which is not used. In addition, this definition would include all grades of waste paper now recognized in the waste paper trade and would make it much easier for paper mills to identify recovered materials, rather than trying to keep separate records on postconsumer and non-postconsumer waste paper. This definition is also consistent with current widespread use of the term "recycled paper." Grades of paper popularly known as "recycled paper" often are made of the previous GSA Type II, category A and B waste papers. This suggested reorganization of the previous GSA definitions is shown in Table III-2.

Table III-2

SUGGESTED DEFINITIONS OF RECOVERED MATERIALS

PART I - WASTE PAPER

(A) Paper, paperboard, and fibrous wastes from factories, retail stores, office buildings, homes, etc., after they have passed through their end-usage as a consumer item, including: used corrugated boxes; old newspapers; old magazines; mixed waste paper; tabulating cards; and used cordage.

(B) All paper, paperboard, and fibrous wastes that enter and are collected from municipal solid waste.

(C) Dry paper and paperboard waste generated after completion of the papermaking process (i.e., those manufacturing operations up to and including the cutting and trimming of the paper machine reel into smaller rolls or rough sheets) including: envelope cuttings, bindery trimmings, and other paper and paperboard waste, resulting from printing, cutting, forming, and other converting operations; bag, box, and carton manufacturing wastes; and butt rolls, mill wrappers, and rejected unused stock.

(D) Finished paper and paperboard from obsolete inventories of paper and paperboard manufacturers, merchants, wholesalers, dealers, printers, converters, or others.

PART II - OTHER FIBROUS RESIDUES

(A) Fibrous by-products of harvesting, manufacturing, extractive, or woodcutting processes, flax straw, linters, bagasse, slash, and other forest residues.

(B) Wastes generated by the conversion of goods made from fibrous material, i.e., waste rope from cordage manufacture, textile mill waste, and cuttings.

(C) Fibers recovered from waste water which otherwise would enter the waste stream.

There is also the possibility that use of recovered materials under this definition (Table III-2) would increase the use of postconsumer waste. This would occur because of a "domino" type of effect. If the guidelines stimulate use of waste paper, the Type I C and D materials (the non-postconsumer grades) would be the waste paper in highest demand for the paper products purchased by the government. This increase in demand would raise the price of waste paper and stimulate other users of waste paper who could conceivably use lower grades of postconsumer waste paper to examine that option. If the price of the higher grades increases too much, it might bring about a situation where potential users of lower grades would find it economically feasible to make capital commitments for cleaning equipment to utilize more postconsumer waste.

Perhaps the real advantage in this option is that it would indicate the government's approval of using the Part I C and D type wastes and would give recognition to the paper industry for using higher grades of scrap paper such as converting scrap. Certainly, EPA would not want to give any appearance of being opposed to the use of those wastes.

Finally, another option is the one recently adopted by GSA. They have interpreted RCRA as meaning that no distinction can be made between categories of recovered materials, so that all must be treated equally. This means that postconsumer wastes cannot be specified separately. The impacts of this is that all secondary materials are viewed as being equal. This is contrary to EPA's position, and as discussed above is inconsistent with the information which has been developed by EPA over the past few years. This option would seem to be inconsistent with EPA's goals.

Paper Industry Positions

To our knowledge, the paper industry as a whole will not take a position on the recovered material definitions. Some individuals within the industry would favor one approach, while others may favor another approach. However, it is important to realize that the old GSA definitions were worked out over a long period of time in consultation with the paper industry, and they have by and large been accepted in the paper industry. Perhaps the paper industry's greatest concern is for long-term stability in the definitions and specifications of procuring agencies. This stability has been recently destroyed by the changes in the GSA procurement specifications.

ECONOMIC IMPACTS

Government Issues

Economic impacts on the government may occur as a result of government procurement of recycled products. These impacts could occur by either the government incurring additional administrative costs as a result of the procurement program or as a result of increased costs of products.

The costs of administration of the program could range from nearly zero to a large amount, depending on how the procurement guidelines are written. The GSA experience has been that additional costs of their program in procurement specifications requiring recovered materials in products has been minimal. In actual fact, the recovered material specifications is one

of a great number of specification items which must be checked and monitored by GSA. They report that any additional cost would be difficult to pinpoint, but in any case, the incremental cost of the recovered material specification is small.

On the other hand, if the procurement guidelines are written so as to require close monitoring on the part of the government, the expense could become quite large. This program might include training of groups of field inspectors to monitor and inspect paper manufacturing operations. If the guidelines are written so as to require this, the costs could become quite high. However, an accurate estimate can not be made without reference to specific requirements.

A possible economic impact on the government would be an increase in the price of purchased products. If government purchase requirements result in increased use of waste paper, it could drive up the cost of products to the government. However, the cost of waste paper represents only about 5 to 10 percent of the cost of the finished product purchased by the government, so an increase of 10 percent in the price of waste paper would result in a cost of product increase of only one-half to one percent.

Another possible added cost would be the cost of new processing facilities to accommodate more contaminated waste paper. However, the cost of added cleaning and processing will have an effect on final product purchase price in the same range as increases in waste paper prices.*

In addition, we project that the new waste paper capacity in paper mills will be only in the form of incremental capacity. For the paper industry as a whole, this would be at a quite small growth rate. Thus, any adjustments which have to be made in long term markets will be slow, which will minimize the economic impact.

We conclude that the economic impact to the Federal Government of these procurement guidelines will be insignificant in terms of increases in prices caused by the policies. The exceptions to this will be if the government tries to purchase paper in a "seller's market." That is, if recycled paper is in short supply, attempts by the government to purchase significant quantities will drive up prices. However, if the government gauges its purchases to the supply situation, and stimulates growth in recycled products by providing a stable market for recycled products, increases in product prices will be minimal.

* The effect on the paper mills alone is more significant because the added costs are a larger fraction of the value of the paper at the mill.

Industry Issues

Adverse economic impacts on the paper industry could occur if government policies would stimulate a product shift in the paper industry from virgin products to recycled products. This impact would be caused by inefficient use of virgin fiber mill equipment, added capital costs caused by purchases of recycling capacity to replace the idled virgin capacity, and a shift of labor from virgin mills to recycling mills (or from virgin capacity to recycling capacity at the same mill). However, our assessment is that government purchase policies can do no more than stimulate a growth in recycling of one percent per year, and that growth will be in the form of added paper manufacturing capacity rather than replacement of virgin paper manufacture. In this case, there are no adverse economic impacts of the nature cited above. The capital costs incurred will be for added capacity, and the labor needed will be new labor requirements. The only difference is that the added capacity will be for production of recycled products rather than virgin products. Thus, we conclude that there will be no significant adverse economic effects on the paper and paperboard industries.

ENVIRONMENTAL IMPACTS

Manufacture of paper results in effluents to the environment in the form of air pollution, water pollution, and solid wastes. The potential impact of the guidelines will be a conversion of government purchases from use of virgin materials to use of recovered materials. The guidelines will not cause an increase or decrease in demand for products. Thus, the net impact on the environment will be the result of shifting from virgin paper manufacture to recycled paper manufacture.

An accurate comparison of virgin and recycled paper mill effluents is difficult to assess at the present time, as discussed in detail in Appendix I. The effluents from mills are subject to considerable change as new pollution control devices are installed. Basically, the wastes discharged to the environment by virgin and recycle mills are of the same type. That is, one type of mill does not discharge products inherently more damaging to the environment than the other type of mill. As discussed in Appendix I, recycling mills tend to discharge less air pollution than virgin mills. Recycling mills also tend to discharge less water pollution, but this is not always so. It depends on the particular raw materials used by the mill and the practices of the individual mills. Finally, solid wastes from recycling mills may or may not be less than solid waste from virgin mills. Generally, the solid waste from recycling mills is less, but if low yield waste paper such as old magazines is used, the solid waste from a recycled mill can be quite high. Postconsumer waste is always reduced to the extent that postconsumer wastes are used in recycling.

The important point to remember, however, is that the government influence on the paper industry will not bring about a switchover at a rate greater than one percent per year. This rate of government stimulated change in production, coupled with the fact that virgin and recycling mills have environmental impacts not greatly different, means that the environmental impacts of the government actions will produce changes in environmental impacts which are insignificant.

ENERGY IMPACTS

Energy is required in the paper and paperboard manufacturing sequence at all stages, which includes logging and wood residue procurement, paper manufacture, conversion of paper to product, and transportation between all steps. If recycling of paper occurs, the logging and wood residue procurement steps are eliminated, and instead, waste paper procurement is substituted. Also, recycled paper manufacture requires a substantially different amount of energy than virgin paper manufacture.

As shown in Appendix D, the question as to whether recycled products require less energy to manufacture is not clearcut. Generally, the fossil energy for manufacture of corrugated containers and their components is the same whether they are virgin or recycled. So, no energy savings occur with that replacement. The same is true for unbleached kraft coarse papers.

The situation for tissue and the fine and printing papers is much more complex. The complexity arises because the industry frequently uses as a raw material for paper manufacture a commodity known as market pulp. Market pulp is essentially a virgin wood pulp which is manufactured similarly to paperboard, dried and baled, and sold to a mill with recycling facilities. The market pulp is then mixed with water, and frequently blended with waste paper in the making of recycled paper products. However, market pulp is also purchased by virgin paper mills to supplement their own pulp. This occurs when a particular mill does not produce a pulp of the desired characteristics for certain products. To remedy this situation, market pulp may be purchased to upgrade the mill's self-produced pulp. The problem is that market pulp is an energy-intensive product, primarily because it must be dried before shipment. As shown in Appendix D, use of market pulp can result in fossil energy use of 40 to 50 percent higher than if normal manufacturing methods were used, and from 60 to 110 percent higher than 100 percent recycled products.

Unfortunately, market pulp is frequently blended with recycled waste paper in order to meet performance and or aesthetic requirements. Whether recycled paper now on the market represents energy conservation or not depends on whether market pulp was used in its manufacture. Reference to material in Appendix D may help in determining this in specific instances.

Nevertheless, in mills using market pulp, encouraging more use of waste paper could realistically result in an energy conservation of 5 to 10 percent over the next ten years if a reduction of market pulp in the range of 10 to 20 percent could be brought about.

Recent energy consumption data made public by the American Paper Institute and reproduced in Appendix D show that in some cases use of recycled paper may result in conservation of energy, while in other cases it may actually result in use of more purchased energy being used than for virgin paper. These data are based on a sample of existing mills.

Some data indicate that recycling mills that are quite old and lack modern energy conservation technology are primarily the ones responsible for high energy consumption. However, if new recycling mills are compared to new virgin mills, the recycling mills are in many instances less energy-intensive. We conclude that the energy picture is very complex and difficult to interpret. It appears that there is no convincing evidence that government procurement of paper containing recycled material will necessarily result in conservation of purchased energy.

In summary, simply buying recycled products now on the market may result in some energy conservation, no energy conservation, or even an increase in energy when compared to virgin products, depending on particular situations. However, any stimulation of growth in the use of waste paper as a percent of furnish, particularly at the expense of market pulp, will generally result in energy conservation.

CERTIFICATION OF RECOVERED MATERIAL CONTENT

An important part of any purchase process is the verification of what has been purchased. In the case of purchasing paper with specified recovered material content, this includes verification that the recovered materials are present in the product in the quantities specified.

This verification may be difficult to obtain with 100 percent assurance. It is not possible to perform quantitative tests on the final product to determine whether the specified materials are present. Recycled paper fibers are identical to virgin paper fibers in chemical composition and form. Recycled fibers tend to be shorter and to differ in microscopic appearance from virgin fibers, but it is only a tendency. Some virgin fibers are also quite short, and have the same microscopic appearance as recycled fibers. Thus, it is not possible to perform chemical, microscopic, or other scientific examinations to determine secondary material content.

The only way to determine secondary material content is to know what raw materials are used in the manufacturing process. This means that verification of content relies on individuals being present at the time of manufacture to see what raw materials are used. A certification as to content then can be made by the individuals present.

At the present time, GSA has been specifying recovered material certification by the manufacturing companies. Thus, mill operating personnel observe the raw materials mix and report it accordingly. This self-certification relies on the veracity of the companies for accuracy.

This system is simple and inexpensive for the government to monitor. All indications are that the system works well, but the government has no guarantee that the certifications are accurate, and there is presently no independent way of checking on this. This simple self-certification procedure is open to honest misinterpretations of the recovered material definitions, and also open to dishonest misrepresentation.

In order to provide more assurance to the government, independent inspections would be needed. These inspections could take many forms, including on-site inspections while paper is being manufactured for government consumption or inspections of mill raw materials records. These inspections could occur for each government purchase, or selected mills could undergo occasional inspections.

A program of independent inspections would be costly and difficult to administer. It would mean hiring new staff and training them to inspect paper manufacturing facilities, which is a complex and difficult procedure. There is also the problem of creating greater inconvenience for the paper mills, and in creating extensions of a bureaucracy to which the paper mills already object. A further disadvantage to the on-site inspections is that there are still possibilities of error and dishonesty by individual inspectors, so the problem of reliable certification is not entirely eliminated.

Difficult decisions need to be made to determine the optimum means of recovered material use verification. The costs and benefits of self-certification need to be weighed against the more complex and expensive independent inspection systems that may be more accurate, but will certainly be more distasteful to the suppliers. Perhaps a self-certification approach with more intensive efforts in education of suppliers as to recovered materials definitions would be sufficiently effective to meet the government's needs and minimize disruptions of suppliers.

PRODUCT PERFORMANCE SPECIFICATIONS

Pulp prepared from waste paper and pulp prepared from virgin wood are both basically cellulosic wood fibers of similar chemical composition. However, waste paper pulp contains contaminating materials which arise because of the inks, adhesives and other materials which were necessary to the functions performed by the paper before discard. These contaminants are difficult to deal with, and the upgrading of waste paper pulp is expensive and requires energy. The result is that some paper products prepared from waste paper have difficulty in competing with virgin products. It is important that the government examine procurement specifications to insure that they are entirely functional and do not act to inhibit the use of recycled products.

Brightness

Manufacturers of recycled paper products have mentioned brightness specifications in printing and writing papers as being an area which should be studied for functionality. The question as to whether lower brightness paper would function as well as paper presently being purchased is an important one. Manufacturers of virgin paper products as well as those that manufacture recycled products have indicated even a fairly small lowering in brightness specifications so that hypochlorite bleaching of pulp would be eliminated would result in monetary savings to the government, and reduce energy consumption of paper manufacture by as much as 5 to 7 percent. In the case of recycled paper, the highest levels of brightness are reached not only by intensive bleaching, but also by adding a bright, white substance (usually titanium dioxide) to the paper surface. This is quite expensive, and titanium dioxide manufacture is quite energy-intensive.

Manufacturing paper of lower brightness will save money and energy. Recycled paper manufacturers believe that they could more easily meet government specifications if brightness is lowered. However, certain problems may arise if the government lowers brightness standards. If only a minimum brightness is specified, only one or a small number of suppliers could be utilized at any one location in order that paper match from one printing run to the next. This is because some suppliers may find it easier to supply the government with brightness higher than the minimum (as now happens with toilet tissue). On the other hand, if brightness is set a a value lower than the commercial norm, some companies may simply lower the brightness by adding carbon black or other darkening agents to their product. In any event, this would subvert the purpose of obtaining paper more inexpensively and at lower energy requirements.

It is observed, then, that if the government lowers brightness specifications, it may or may not have the desired effect immediately. However, in the long term, it may be important for the government to provide leadership in use of lower brightness paper. Procurement specifications allowing for the use of lower brightness paper might be a leading factor for companies deciding to devote a certain fraction of their capacity to lower brightness paper. In this way, the goals desired by the government could be achieved, including a possibility of enhancing the competitive position of recycled paper manufacture for government bids. Nonetheless, this all must be predicated on the ability to use lower brightness paper without sacrificing its functional utility.

Cleanliness

As a result of the contaminants inherent in the use of waste paper, recycled paper using postconsumer raw materials frequently contains specks in the finished products. This is also an inherent problem in virgin paper products because small bundles of wood fibers can find their way into finished paper products. Nevertheless, the specks are more easily prevented by removal from the virgin pulp than from recycled pulp. Cleanliness is a troublesome problem for products made from recycled products.

It is important for some applications that paper be free from specks. However, government specifications should be examined for situations where specks do not significantly affect the paper's function. Examples might be computer printout, note pads, and other uses where aesthetic impact is of lesser importance. A relaxation of speck requirements for government purchases would make it easier for recycled products to be more competitive with virgin products by reducing the need for stringent pulp cleaning procedures which do not enhance the functionality of the paper products.

Curl in Copier Papers

One of the large single product items purchased by the government is paper for copying machines. There is also considerable interest in the use of recycled paper in copying machines. Contact with virgin and recycled paper manufacturers, with manufacturers of copying machines, and with large volume users of copying machines has revealed that there is nothing inherent in recycled paper which prevents it from performing as well as virgin paper in copying machines (see Appendix F). Nevertheless, a unique problem does arise in the newest generation of copying machines which are designed for high speed and high volume copying. These machines use a very hot stage in the processing sequence, which puts a curl into the paper. If ordinary copier paper is used, this curl will result in machine jams, and make use of high speed collators virtually impossible. To combat this problem, a special paper is manufactured with a carefully built in "reverse curl," so that when the paper curls in the copying process, it merely takes out the "reverse curl" and comes out straight.

The manufacture of the "reverse curl" paper requires that special runs be made in the paper mills. At present, only two companies manufacture the paper. Because neither uses secondary fibers as raw materials, recycled paper is not available for the new generation of copiers.

Specifications for recycled copier paper do not need to be avoided for technical reasons, except for the new generation of high speed copiers. But the paper must be of good quality and be cut properly whether it is recycled or not.

POSSIBLE IMPACTS ON WASTE PAPER SUPPLIES

Increased use of recycled products will bring about an increase in waste paper demand. Historically, increased demand of waste paper has increased prices in the short-term. There is a transitory effect as demand increases faster than supply, which drives up prices sharply. This stimulates the exploitation of new waste paper supply, which eventually lowers prices as supply and demand move into balance. However, the exploitation of new supply usually requires some additional costs above the level that existed before the demand increase. This is because new supply comes from suppliers at greater distances, or from suppliers that must receive higher prices than they previously were able to obtain. Thus, a permanent increase in demand for waste paper eventually causes a permanent increase in waste paper prices, although historically this increase has been small, in the range of $1 to $3 per ton on a long-term basis.

Another aspect of the increased demand for waste paper is that new supply is frequently more contaminated than old supply. This means that costs to waste paper dealers are increased because additional processing is needed. Also, more processing may be needed at paper mills, which would increase costs to the mills. Thus, the increase in waste paper demand will cause increased costs to the paper mills by increasing operating costs, and/or by increasing the costs of raw materials.

The potential exists that increased requirements in recovered materials for government purchases of printing and writing papers would cause some shifts in the grades of waste paper consumed by paper mills. The immediate effect would be an increased demand by printing and writing paper mills for the higher priced grades of waste paper which they require in their operations. This would first drive up the price of those grades. Other types of paper mills which use some higher grades, such as tissue or paperboard mills, would have to pay the new higher prices for those grades, or perhaps invested capital equipment which would allow use of lower grades of paper. Thus, stimulation of use of the higher (more expensive) grades of waste paper could have a ripple effect, which would increase the use of lower grades of waste paper, including postconsumer waste.

The basic nature of the waste paper market is that it is very volatile, being characterized by short-term swings in supply and demand. As discussed earlier, it is our contention that increases in use of recycled products by the government would amount to no more than increases in new recycling capacity, at a slow growth rate. At slow growth, the disruptions in waste paper markets would be minimal, avoiding sharp price changes and rapid changes in supply. Thus, the effect of government purchases on waste paper markets would be minimal, although new levels of supply may bring about slightly higher prices for the reasons cited above. Unfortunately, the dynamics of waste paper markets are not well enough characterized to allow a precise calculation of this effect.

Chapter 4

VIEWPOINTS OF PAPER INDUSTRY REPRESENTATIVES

INTRODUCTION

As a part of the background data and information base of this study, managers in fifteen paper companies were interviewed to learn more about possible impacts on paper companies of possible procurement guidelines requiring secondary fiber content in products. These companies represented a cross-section of the industry, including large companies with large timber holdings, small companies with little or no timber holdings, virgin fiber-based companies, recycling companies, companies that do both virgin and recycling manufacture, companies that used to recycle but no longer do, companies which plan to add recycling capacity, companies which do business with the government, and companies which no longer bid on government contracts. Information was elicited concerning the companies' abilities and desires to meet possible secondary fiber requirements, as well as their past experience in these matters with the GSA requirements. It is important that the government have detailed knowledge of these matters, particularly because of the bid method of purchasing used by the government. If guidelines are set in a manner deemed unrealistic by the companies, they will not (or cannot) bid for government contracts. This chapter is a summary of the findings of the industry interviews.

IMPORTANCE OF THE GOVERNMENT AS A CUSTOMER

The ability of government purchases to alter raw materials policies of a paper company depends on the importance of the government as a customer. Fourteen of the fifteen companies interviewed stated that government purchases accounted for less than 2 percent of their annual production, and in most cases the value was less than one percent. Not only was this true of companies as a whole, but was also true of individual mills within large companies. The one remaining company sold most of their production to governments at all levels.

The fact that government purchases are such a small percent of a company's business is an important consideration in regard to the effectiveness of the procurement guidelines. For the fourteen companies not relying substantially on government business, their decisions are based on their private markets. Thus, they make raw materials decisions and capital investment decisions consistent with their private customer specifications. At present, they bid on government business because they can accommodate government purchases within the framework of their private business.

Most companies interviewed have been able to meet all government specifications, including GSA recovered material definitions. However, these have been met within the context of their on-going operations. In some cases, special purchases of waste paper were made specifically for a government order, but no permanent raw materials or capital expenditure decisions have been made based on the government specifications. The fourteen companies without exception said that if recovered material specifications exceed their present capacity to comply, they would simply not bid for government contracts rather than significantly alter their operations or make new capital investment. Some companies pointed out the special runs they now must make to meet existing government specifications result in extra costs to them, and this frequently is reflected in their bid price.

Another point made by many companies was that government business tends to be viewed as marginal business. That is, government business is sought only after all commercial sales are executed. Then, if unused capacity exists, government business is sought. This effect can be seen when paper supplies are short, because under those conditions the number of companies bidding is small, and prices are probably higher than for the commercial market. On the other hand, when paper supplies are abundant the number of bidders are much more numerous, and prices are closer to the commercial market prices. The companies report that this effect is caused primarily by the special conditions which are placed on government purchases (discussed later) combined with the fact that the government purchases are a small fraction of their sales.

The point to be made here is that while government business is desired by the companies that sell in the bid markets, it is far down on the list of preferred customers. This means that there is a limit to special specifications which the government can make and still receive bids. Thus, levels of recovered fiber required by the government must be set at levels reasonably attainable by the companies.

OPTIMIZATION OF RAW MATERIALS ON ECONOMICS OF PAPER MANUFACTURE

The basic goal of any paper company is to make a profit. If a company does not make a profit, it will not exist for long. Toward that end, operations are subject to constant change so as to minimize costs. Thus, raw materials decisions are studied carefully to determine what raw materials policies will maximize profits. A particular raw materials mix is chosen by each company after assessing their particular situation. For example, a company with extensive timber holdings would likely utilize that resource in their paper manufacture. On the other hand, if a company has no timber holdings, they may choose between baled virgin wood pulp (market pulp) and various grades of waste paper.

Each company carefully optimizes their raw materials choices so as to maximize profits. The companies interviewed all showed sophistication in studying their raw materials policies. Many companies which are primarily virgin material-based have detailed knowledge of recycling operations, but choose the virgin raw materials route for sound economic reasons. Likewise, users of secondary materials are quite knowledgeable of all their options.

As a matter of course, then, raw materials policies of the companies are optimized. This means that governmental activities to change the raw materials mix will most likely create a non-optimal situation and will increase the costs of paper manufacture compared to the status quo. One possible exception to this is if the government provides a market for recycled materials which could be supplied by added capacity. Thus, with that one exception, artificially altering raw materials policies would likely only result in higher prices for paper products.

SPECIAL PROBLEMS WITH GOVERNMENT CONTRACTS

As discussed in a previous section, special provisions in government contracts decrease the desire by many companies to do business with the government. Example items which companies classify as nuisances are things like having to use special colors of inks, mark items in a special way, and the filling out of numerous declarations and forms which are incidental to the function of the product. It is also distasteful to some companies to have their records and premises inspected, especially when the inspections are repeated by each agency with which they are doing business.

The requirements of secondary fiber in products purchased by the government are viewed by the companies as another inconvenience. It cannot be determined to what extent such requirements have on companies' decisions to bid, but two companies listed the recovered material requirements in GSA bids as being one nuisance item too many, and have since declined to bid on government orders. One of those companies indicated also that it would be quite difficult to meet those specifications from an economic point of view.

Another item mentioned by the companies was that it would be easier to bid on government contracts if "off-the-shelf" items, i.e., "commercial grade" products, would be purchased. Although the government is moving in this direction, the requirements of case size, basis weights, sheet size, and other paper properties which are different from accepted commercial practices lead to higher prices and more nuisance for the companies. The companies report that there is still room for progress in that area.

Another special problem with government business is the inability of the government to be able to predict ahead of time how much product will be purchased. As shown in Chapter 2, the year-to-year variations in government purchases seem unpredictable. In addition, even after a contract is won, there is no assurance as to how much product will actually be bought. This coupled with the elusive nature of bid business, means that most companies are not sufficiently assured of government business that they would make significant changes in their business patterns for government business.

The special problems listed by the companies are a deterrent to doing business with the government. It is difficult to assess the precise costs to the government because of the fact that industry has to deal with these problems, and to assess the number of companies which decline to bid because of them. However, there can be little doubt that specifications to require inclusion of recovered fibers are viewed as another nuisance item by many companies.

IMPACTS OF PREVIOUS GSA EXPERIENCE

Since 1972, the fifteen companies interviewed have participated in GSA bids with recovered material specifications. The companies were asked their views on the success of the GSA specifications and to relate their experience with them.

Perhaps the most important finding is that none of the fifteen companies interviewed felt that the specifications had resulted in a basic change in raw materials policies by any company. Two of the companies have ceased being suppliers to the government as a result of the recovered materials requirements. For the thirteen companies continuing to supply the government, the specifications were met by making special purchases of waste paper and by making special runs. The companies perceive that this results in extra costs to them.

It is not easy to determine the effects of the specifications on price and competitiveness in the bidding process. In the normal course of business, the number of bidders varies greatly from quarter to quarter, depending on the number of companies with excess capacity at a particular time. Likewise, the prices bid vary greatly depending on excesses or surpluses of paper. Consequently, it is not possible to easily determine the effect of the specifications on price and competition. However, the companies feel that the specifications have led to higher prices and fewer bidders. Certainly in cases where companies had frequently won government bids but subsequently withdrew from bidding, it would seem possible that there would be some effect on price. Also, if the companies perceive that there are increased costs of meeting the specifications, it would be expected that these costs would be reflected in price.

It was also ascertained that some problems existed as to the definitions of recovered material, particularly for the postconsumer grades. Not all companies interpret the definitions in the same way. As a result, it is possible that companies felt they were using postconsumer waste paper in some instances when in fact they were using grades that EPA would not classify as postconsumer. Perhaps a more intensive educational campaign could resolve these problems.

To summarize the companies' comments, it can be said that they generally feel the GSA specifications have not significantly increased the use of waste paper; that they have reduced competition and raised prices; and that they represent a new nuisance item in contracting with the government; and that government is not a valued enough customer for them to consider alterations in their manufacturing processes, or making new capital investment to meet government specifications for purchased products.

Chapter 5

OPTIONS AVAILABLE TO EPA AND CONTRACTOR RECOMMENDATIONS

INTRODUCTION

Since the mid-1960s, there has developed a history of procurement procedures aimed at stimulating the use of recovered materials in products. The aim is to reduce consumption of finite materials, reduce solid waste, conserve energy, and alleviate pollution. Many of the procurement efforts were disastrous because of poor planning caused primarily from a lack of awareness of the complexity of such procurements, and because a dearth of knowledge about these matters existed.

By far the most successful attempts in paper product procurement have been made by GSA. Since 1972, significant purchases of products containing recovered materials have been made, and GSA has evolved workable procedures. Therefore, the possibility that such procurements can be successfully made has been proven, although the possibility does exist that the procedures can be optimized further.

This chapter is a summary of the factual findings by the contractor concerning options available to EPA concerning the implementation of a recovered materials specifications program. Recommendations are made on the various issues which reflect the best judgment of the analytical team. It should be carefully noted that these recommendations are advisory only, and do not necessarily reflect the judgment of EPA or of anyone else.

GENERAL ISSUES

Definitions

As discussed in Chapter 3, EPA must select definitions of recovered materials consistent with their mission. It appears that the most useful and potentially most successful approach would be to adopt generally the wording and structure of the original GSA definitions, as they have been accepted by all parties involved. However, an important change in structure should be made with the Part II A and B categories. These categories include paper fiber scrap or discards from converting, printing, and manufacturing operations. These categories are not "postconsumer" in the sense that EPA uses the term, but are closely linked to the term "waste paper" in the minds of most people in the affected industries, the government purchasing entities, and the general public. It is also clear that EPA wishes to encourage the use of those materials, although they are presently recovered routinely at very high levels for reuse. Therefore, we recommend that Part II A and B become Part I C and D. This will neatly split the definitions into two categories which may be called waste paper, and wood and other fibrous residues.

Certification of Recovered Material Content

An important part of any purchase process is the verification of what has been purchased. In the case of purchasing paper with specified recovered material content, this includes verification that the recovered materials are present in the product in the quantities specified.

This verification may be difficult to obtain with 100 percent assurance. It is not possible to perform quantitative tests on the final product to determine whether the specified materials are present. Recycled paper fibers are identical to virgin paper fibers in chemical composition and form. Recycled fibers tend to be shorter and to differ in microscopic appearance from virgin fibers, but it is only a tendency. Some virgin fibers are also quite short, and have the same microscopic appearance as recycled fibers. Thus, it is not possible to perform chemical, microscopic, or other scientific examinations to determine secondary material content.

The only way to determine secondary material content is to know what raw materials are used in the manufacturing process. This means that verification of content relies on individuals being present at the time of manufacture to see what raw materials are used. A certification as to content then can be made by the individuals present.

At the present time, GSA has been specifying recovered material certification by the manufacturing companies. Thus, mill operating personnel observe the raw materials mix and report it accordingly. This self-certification relies on the veracity of the companies for accuracy.

This system is simple and inexpensive for the government to monitor. All indications are that the system works well, but the government has no guarantee that the certifications are accurate, and there is presently no independent way of checking on this. This simple self-certification procedure is open to honest misinterpretations of the recovered material definitions, and also open to dishonest misrepresentation.

In order to provide more assurance to the government, independent inspections would be needed. These inspections could take many forms, including on-site inspections while paper is being manufactured for government consumption or inspections of mill raw materials records. These inspections could occur for each government purchase, or selected mills could undergo occasional inspections.

A program of independent inspections would be costly and difficult to administer. It would mean hiring new staff and training them to inspect paper manufacturing facilities, which is a complex and difficult procedure. There is also the problem of creating greater inconvenience for the paper mills, and in creating extensions of a bureaucracy to which the paper mills already object. A further disadvantage to the on-site inspections is that there are still possibilities of error and dishonesty by individual inspectors, so the problem of reliable certification is not entirely eliminated.

Difficult decisions need to be made to determine the optimum means of recovered material use verification. The costs and benefits of self-certification need to be weighed against the more complex and expensive independent inspection systems that may be more accurate, but will certainly be more distasteful to the suppliers. Perhaps a self-certification approach with more intensive efforts in education of suppliers as to recovered materials definitions would be sufficiently effective to meet the government's needs and minimize disruptions of suppliers.

Another important issue concerns the scope of application of the certification. Under GSA practice, the certification applies only to the actual product received by GSA. An alternative would be to require specified annual use of recovered material by the supplying mill. The impact of this would be that a mill in compliance would be using recovered materials for an entire year, rather than for only a special run for Government purchases. Thus, the potential impact on recovered material use would be much greater. However, because of the smallness of a Government purchase it is unlikely that most mills would alter their entire raw materials structure for purposes of supplying the Government. Instead, they would most likely decline the invitation to bid, and the competitiveness of Government bidding would be seriously affected. Consequently, it appears that the only practical approach is to require certification of specific products received.

A practical problem arises in the reporting of recovered material use in terms of units which are to be used. The most convenient approach to use is to specify recovered material content in terms of the way the supplying mills measure quantities. Perhaps the easiest way to specify recovered materials is the following: recovered material content is expressed as a percent, derived by dividing the weight (as received) of recovered materials used by the weight of the product transferred to the converting operation, and multiplying by 100 (to convert to percent).

We specifically recommend that the EPA guidelines contain provisions for a simple certification system such as is presently used by GSA, which consists primarily of a simple declaration by company officials for the products actually received by the processing agency. The level of recovered material should be in terms of percent, as defined above.

Competition

The level of competition on government bids varies dramatically from quarter-to-quarter, and also depends heavily on business conditions. Therefore, it is not easy to determine the effect on competitiveness of the GSA actions in regard to recovered materials, although GSA has been able to maintain competition on their bids. Nevertheless, the secondary fiber requirements obviously cut some former suppliers who had been low bidders from the bid process, so the competition is most likely reduced to some degree by the recovered material specifications. In some regions of the country where recycled products are not manufactured by several companies, the competitive situation would be expected to be less than in other areas.

It would be expected that any added specification which is not met by all manufacturers will reduce competition to some extent. Consequently, EPA will need to include in the guidelines carefully selected recovered material levels so that an acceptable level of competition exists. GSA has found levels acceptable to them by a trial and error approach. If recovered material levels are too high, an insufficient number of bids will be received. A provision should be made by EPA to determine if the reason for non-bidding was the recovered material specifications, either by follow-up letter or phone call to non-bidders. If the recovered material level is the reason, then the levels can be reduced and the bidding procedure could be repeated.

Preferences

In 1978, the State of California established a provision for giving certain recycled product procurements a 5 percent monetary preference over non-recycled products. For the first eight months of 1978, they purchased $1.2 million of recycled paper products, with $1.1 million being purchased only because the 5 percent preference was allowed. However, they report that the additional cost to the state was only $15,000.* This is the only documented evidence that we found for this procedure.

The GSA approach is different. It has been to set recovered material levels and simply take the low bidder. The California approach is to allow bidding irrespective of fiber source, but grant the possible preference for products defined as "recycled." Apparently, both approaches have been successful to a certain extent. Another possible approach is to create a "recovered material set aside," where an open bidding would be allowed, but some specified amount of products containing certain levels of recovered materials would be purchased irrespective of price.

In interviews with paper and paperboard companies, even those manufacturing recycled products, they expressed the opinion that premiums or preferences would increase the prices paid by the government as the sole effect of such programs. They felt that such action would not result in increased use of recovered materials.

As mentioned in numerous other places in this report, we feel it would be advisable to build on the successful aspects of the GSA program. It has been successfully implemented without preference or premiums. However, the California experience is worthy of consideration. Very little recycling is done in the western half of this country in fine and printing papers, yet California has been successful in making purchases. We recomment that EPA study the California approach to see if it offers any advantages to the Federal Government. However, the Federal Government must

* State of California, private communication. See Appendix K.

weigh such a program against the policy to purchase products at the lowest prices. The situation remains that the California approach may have resulted in more competition and may have resulted in lower prices while encouraging the use of recovered materials. Perhaps Government purchasing agents could experiment with the "preference" approach at a minimum of three selected locations in the U.S. for one year and carefully study the results to see if general application would be feasible.

Under such a program, the preference would be reserved for those products containing as a minimum the levels of recovered materials now required by GSA, or the levels recommended later in this report. In addition, bidders would be required to furnish information as to the recovered material content of the products they are proposing to deliver to the government. This information could then be used as a data base in revising the levels of recovered materials for which the preference would be allowed.

This program appears to be an innovative approach to procurement. It allows full and open bidding by not excluding virgin material manufacture, which presumably allows the government to purchase products at the lowest possible price. At the same time it serves notice that the government encourages use of recovered materials, and in fact gives preference to products containing recovered materials. This should stimulate any company interested in bidding on government contracts to use recovered materials. On the other hand, it helps insure that the government will receive bids, even for cases where products containing recovered materials are periodically scarce. Another advantage to this system is that it removes the necessity of the government to accurately determine correct levels of recovered materials to be specified. If initial estimates used to set recovered materials prove either too high or too low, the government should still be able to purchase products in an acceptable way.

Perhaps one of the greatest advantages is that it facilitates the inclusion of indirect purchases into the system. It no longer places a burden on the government to determine whether the levels of inconvenience of specifying recovered materials for secondary packaging and purchased printing materials would be so great as to deter bidding. By using the preference, it encourages the use of recycled products in a real way, but does not discourage open bidding.

Another example where the preference would help solve a difficult problem is the purchase of products where only one or two manufacturers produce recycled products. In some years, these manufacturers may choose not to bid. Thus, the government would have to set the recovered material level at zero in order to purchase products. On the other hand, if the preference approach is used, the purchase of the recycled products would be stimulated in years when recycled materials are potentially available, but when they are not, the government could still purchase products. Thus, the recovered material specifications could remain at reasonably high levels and would likely stimulate use of recovered materials.

In summary, use of a preference would seem to possess many advantages, such as maintaining high levels of competition, encouraging the use of recovered materials, and broadening the base of products for which recovered materials could be actively encouraged.

Wood and Other Fibrous Residuals

In the remainder of this report, it is assumed that recovered materials will be considered in two categories--waste paper, and wood and other fibrous residuals. The complex issues which must be resolved apply only to waste paper. The reason for this is that wood and other fibrous residuals used in paper manufacture consist almost entirely of forest residues and wastes from wood product manufacturers. These residues are used as a replacement for logs in virgin mills. They do not significantly affect product quality, availability, or cost. Therefore, the following discussions of the complex issues will relate to the use of waste paper only.

Program Success

At some point, the EPA guidelines will be evaluated as to their success as a raw materials policy as well as their effect on the purchasing of products. In the short term, the program will be a success if the Government can purchase acceptable products that contain recovered materials for its use on a competitive basis. In the long term, the program will be a success if the basic raw materials policies tend to increase the recovery of materials from solid waste. It is unreasonable to expect that Government purchasing policies will bring about a rapid or significant change in the near future. However, we project that the Government efforts can encourage installation of recovered material processing in plants as part of their normal new capacity additions. This effort will be enhanced by the recent allowance of a recycling equipment tax credit which is a part of recently enacted energy legislation.

Accurate projections of this effect are not possible, but even stimulation of a one percent per year increase in the use of waste paper in Government purchased products would eventually amount to a significant increase, and this level of stimulation seems possible.

The decisions to add new capacity at a paper or paperboard mill are very complex. It would be difficult to relate such capacity expansion directly to government actions of any kind. Nevertheless, we recommend that EPA monitor these activities each year as a matter of background interest. We also urge EPA to monitor Federal activities in the area of product purchases to document the amounts of recovered materials purchased. Finally, we recommend that a simple formal procedure be adopted to monitor state purchases annually to document progress of secondary material use in that area. These items will assist EPA in documenting the success of this program.

ISSUES SPECIFIC TO PRODUCT CATEGORIES

Introduction

In this section, the following product categories will be analyzed separately: high grade bleached papers, sanitary tissue products, unbleached paper and paperboard, and combination (recycled) paperboard. The issues treated for these grades (except combination paperboard) are as follows: technical equivalency of products containing recovered materials with products containing virgin materials, availability, cost, performance specifications, and recovered material levels.

High Grade Bleached Papers

Description. This category represents the largest tonnage of Government purchases, and includes printing and writing papers, envelopes, pads, tabulating paper and cards, and copier paper. It is generally a very attractive paper, frequently white, and bright and free from dirt. Its composition is typically bleached kraft and/or sulfite paper. When made from waste paper, it is generally made from high grade paper manufacturing wastes or deinked ledger grades of waste paper.

When the bleached kraft and/or sulfite paper is made in the virgin form, it is manufactured in the sequence shown in Figure V-1. Wood is harvested and shipped to a wood pulp mill, where the logs are generally debarked, chipped, and placed in a digester. The wood chips are mixed with water and chemicals and cooked under pressure in the digester in order to break down the lignins and natural adhesives which bind the wood fibers together. The wood fibers are then removed from the digester in the form of a water slurry forming kraft or sulfite wood pulp, depending on the nature of the particular digestion process. In some cases, a pulp is made by simply grinding logs in the presence of water, producing a "groundwood" pulp that is more brown in color than the kraft and sulfite pulps. In any case, pulp is washed, cleaned, bleached, and processed through a series of stages until it is suitable for paper manufacture.

The paper is usually manufactured at the same site as the pulp mill. Pulp is spread on a traveling screen through which the water drains, leaving the fibers on the screen to form the sheet of paper. The sheet is then passed through rollers and steam heated dryers to remove additional water, and finally is wound into large rolls. The large rolls are subsequently trimmed and sent to a converting plant where the final product is manufactured.

Recovered materials can be used as a partial or a complete replacement of the virgin materials. If recovered wood or other fibrous residues are used, they are simply used to replace virgin logs with no other major changes in the manufacturing sequence being necessary. If waste paper is used, the manufacturing sequence is shown in Figure V-2.

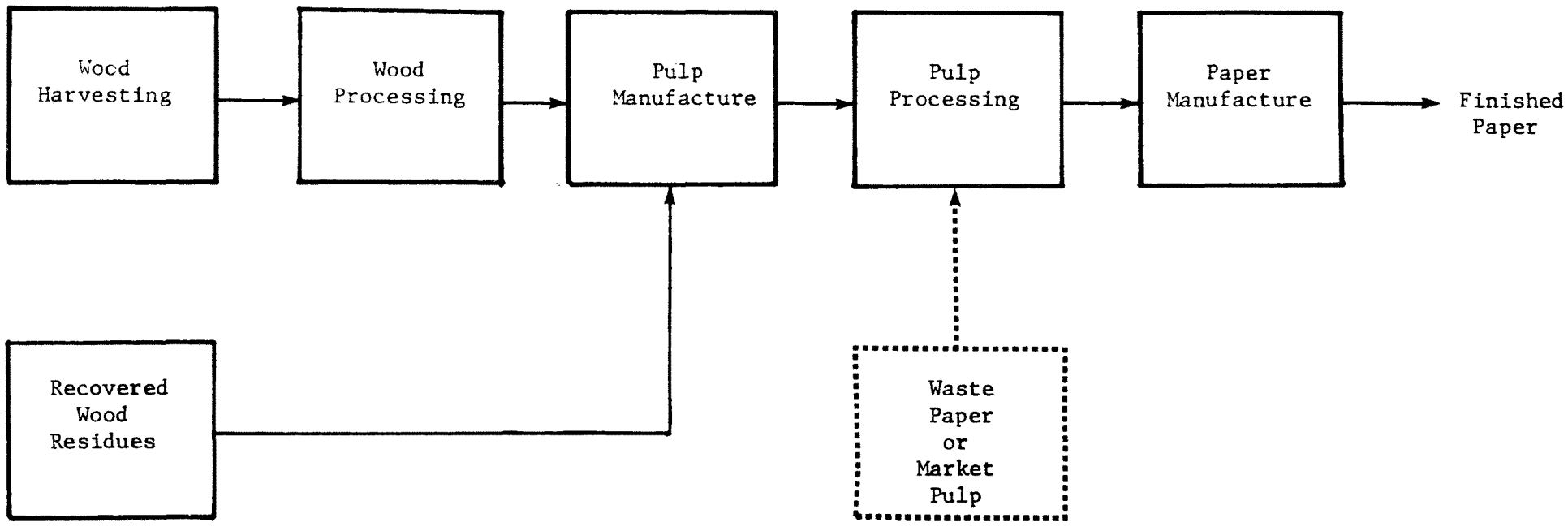

Figure V-1. Manufacturing sequence for paper starting with virgin wood and/or recovered wood residues.

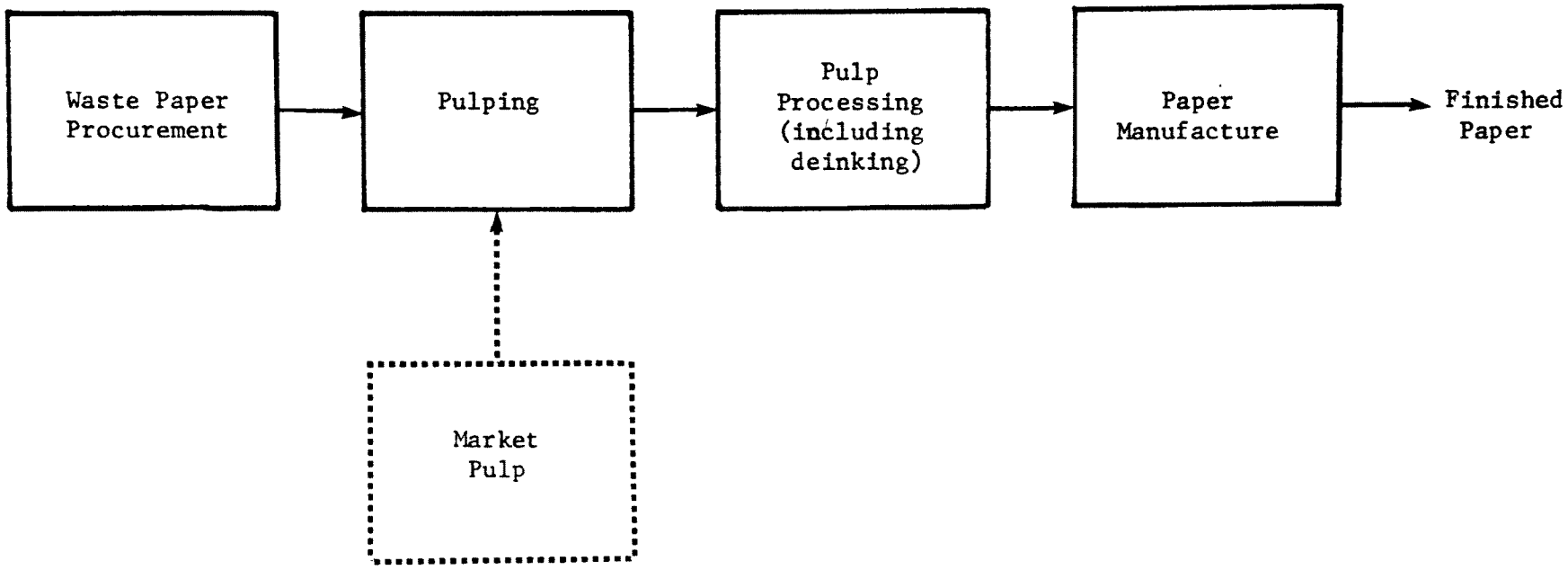

Figure V-2. Manufacturing sequence for paper starting with waste paper.

The steps in paper recycling are similar to virgin paper manufacture, differing primarily in the choice of raw materials. In recycling mills, waste paper is mixed with water in a machine called a pulper, which is similar in operation to a kitchen blender. The waste paper pulp which results from this operation undergoes ink removal (deinking) if necessary and is then cleaned, bleached, and processed similar to the processing of wood pulp in the virgin manufacturing sequence. Paper is then manufactured and converted to products in exactly the same way as for virgin paper.

A common alternative is for virgin and recycled fibers to be mixed. This can happen at facilities described in either Figure V-1 or Figure V-2. In mills such as described in Figure V-1, waste paper may be pulped and mixed with virgin pulp prior to paper manufacture, thus producing paper with recycling rates which may range from near zero percent to near 100 percent.

In a related fashion, mills of the type described in Figure V-2 may use virgin fiber to produce a range of recycling rates. They utilize virgin fibers in a form called "market pulp," which is a dried pulp product of a virgin paper mill quite similar to a thick sheet of paper. Virgin market pulp is interchangeable with waste paper in recycling mills.

Technical Equivalency. Papers in this category containing waste paper are manufactured within a range of qualities in the same way that virgin papers are manufactured. However, for any set of performance specifications, both virgin and recycled paper can be manufactured. In one study* a "blind" set of printing and writing papers were sent to laboratories for examination of performance of characteristics. The results showed that recycled paper was generally indistinguishable in quality from virgin paper, although there was a wide range of quality in both virgin and recycled paper. Perhaps more importantly, recycled paper currently is competitive in commercial markets with virgin paper. There is little doubt that EPA can assure prospective purchasers that recycled paper which meets performance specifications is technically equivalent to virgin paper.

Availability. As discussed in Chapter 2, recycled paper is not as widely available as the competitive virgin paper. The high grade bleached papers containing waste paper are move available in the east and central portions of the country than in the south and west. Thus, if difficulty is encountered in obtaining delivery to some depot locations, EPA should consider allowing exceptions in the areas of scarcity. However, GSA has successfully obtained bids without having to resort to regional exceptions.

* Franklin, William E., Robert G. Hunt and Sally T. Sharp, "Paper Recycling, The Art of the Possible 1970-1985," Midwest Research Institute for the Solid Waste Council of the Paper Industry, published by the American Paper Institute, New York, March 1973.

Another problem with availability is the fact that the recycling mills tend to be small and do not produce individually all grades of paper. Paper merchants prefer to do routine business with only two or three companies which can supply them all grades. Thus, recycled papers are special order items for most paper merchants. This can further complicate availability. This is especially troublesome to state and local governments who deal more with paper merchants than does the Federal Government. Federal purchases generally involve working with the mills on a special order, although typically a paper merchant is involved.

Cost. Paper of all grades is available at a range of costs, and this includes paper with recycled fiber content. However, since the early 1970s the Government has regularly purchased some grades of paper products with recycled fiber content through the competitive bid process. Because of large variations in prices from quarter to quarter it is not possible to tell accurately whether the Government is paying a premium for recycled fiber or not, but the opinion of the purchasing agencies is that they are not. This opinion is reinforced by the recent experience by the state purchasing agencies of California and Maryland, as documented in Appendix K. In addition, it is of interest to realize that the recycled paper grades purchased by Government agencies are generally in competition in the commercial market and must be priced competitively. Thus, it appears that recycled grades of paper are generally cost competitive, although there may be isolated situations where this is not true.

Performance Specifications--Brightness. One of the most well known and controversial issues associated with high grade bleached papers is brightness. Brightness is important in these products because they are primarily products which are written or printed on and thus must have appropriate visual characteristics. The controversy surrounds the proper specification of the visual characteristics.

Two important aspects of the paper in question are that they must provide appropriate contrast with the printed or written matter, and they must provide an appropriate background when color printing is used. The use of brightness and/or color specifications is an attempt to provide those attributes.

Brightness is a term that is widely used in the paper industry, and refers to a test in which blue light of a specific wavelength is used to illuminate paper while a light meter measures the reflected light from the paper. Typical brightness values for printing and writing papers fall in the 80s, with some brightness values in the low 90s and some in the 70s or occasionally below that for manila or "groundwood" papers.

One criticism of this measure is that it is made in blue light while the paper is always viewed in white light. In an attempt to remedy this situation, the Joint Committee on Printing (JCP) and the Government Printing Office (GPO) are experimenting with measuring the reflectance of paper under white light. An additional criticism of the brightness measure is that it does not relate directly to the print contrast and color compatability, which are the functional attributes of the paper. The JCP and

GPO are also experimenting with chromaticity measures, which are directly related to the functional aspects of the paper. Although the JCP and GPO experiments are one logical approach to the specifications problem, it presently suffers from a practical consideration. The reflective and chromaticity measurements can not be easily made. In fact, the equipment to make these measurements is quite expensive and very few, if any, paper companies can make the measurements. Thus, accurate quality control during production runs is not possible, although many companies have had success using trained personnel to visually compare production paper to standard sheets provided by GPO.

At the present time there are no Government specifications for brightness of printing and writing paper. However, a standard sample of paper (adopted by JCP) is submitted to prospective bidders, and paper must in most cases conform to the standard sample in regard to color, finish, formation and cleanliness. Chromaticity and luminance values of the standard sample are given to prospective bidders for their information, although bidders generally are not able to make these measurements on their own paper.

The standard sample is presently a key item in the Government specifications. The standard samples are drawn from actual production runs of large companies selling in highly competitive commercial markets. As such, these samples should be as close to typical as could be hoped for. Paper received by GPO is compared to the standard sheets. Deviations from standard sheets are converted into demerits based on each measurement taken. When demerits accumulate to 31, the shipment is subject to rejection. A serious deviation on any one of more than 22 tests can result in as many as 36 demerits and rejection, although lesser deviations can result in 4 or less demerits. Nevertheless, it is possible to have shipments rejected on the basis of luminance and chromaticity measurements which do not match the standard sample.

It should be noted that standard specifications, such as brightness, color, etc., are necessary, at least to some extent. Every ream of paper opened in the printing of a single book should match, or the results would be displeasing. It is also desirable to have all reams of one type of paper match in a single warehouse to reduce the necessity of keeping track of different kinds of paper. Thus, it is important to have standard specifications for all of the sources of paper for a single end user. In terms of color and brightness, it is apparent that matching is important. That is, minimum or maximum standards alone would not be sufficient.

The relevance of this discussion to recycling issues becomes apparent when we examine the methods used to make paper "bright." One way in which paper is brightened is to bleach the wood pulp or waste paper pulp prior to papermaking. However, this is frequently not sufficient and chemicals may be added to the paper to further enhance its appearance. These chemicals include brighteners such as titanium dioxide, but in some cases dyes are used to change the color, but not necessarily the brightness.

It is clear that to achieve high degrees of "whiteness" or "brightness" is difficult. Wood pulps have an advantage in producing bright and white paper because they can generally be raised to high levels of brightness more cheaply than waste paper pulps. Thus, use of lower brightness paper enhances the competitive position of recycled papers. The color issue is also an important one, because recycled paper may more easily reach color standards for "whiteness" than brightness, and the color is a better measure of visual appearance.

Another facet of this problem is the cost and energy requirements associated with the manufacture of high brightness paper. It is clear that less bright papers are generally cheaper to make and require less energy than high brightness papers. Based on conversations with paper mills, we estimate that a lowering of brightness from current levels of 80 to 90 brightness, which are common in purchases of Government printing and writing paper, by 5 to 10 percent could result in 5 to 10 percent overall energy savings. In addition, the untrained eye has difficulty differentiating between two sheets of paper which differ in 5 percent brightness unless the two sheets are compared side by side.

On the surface, then, it appears that it would be desirable for the Government to lower its standards. But it is not that simple. Remember that it is not feasible to set only minimum standards because of matching problems in individual print shops. Recall also that the standard sheets are selected from production runs from large companies serving commercial markets. These sheets are consistent with current commercial requirements. Thus, we see that if the Government specifies items not now commonly used in the commercial markets, it is possible that competition will go down and cost will go up.

It is clear that the brightness and color issue is a very complex one, and no simple answers exist. While it is clear that it would be desirable in some ways for the Government to use lower brightness paper, there may be compensating disadvantages.

We recommend that localized experiments be performed for selected depots. For those specific depots, the Government procuring agencies should work with paper manufacturers to obtain sample sheets for selected paper products with luminance values approximately 5 units below the current JCP approved sample sheets. The experiments should then be monitored to see if price, competitiveness, availability, and technical quality are consistent with Government needs. After evaluation of at least three local experiments of this nature, a decision can be made about wider implementation.

In some ways, state governments may be in a better position to purchase low brightness papers. Their purchases are frequently much smaller than Federal Government purchases, and the formal procedures are much less extensive and more flexible. In many states the decisions are made by a single purchasing agent, and he has flexibility in working with the users and can readily experiment with the low brightness papers. Thus, the states may present an opportunity for leadership in this regard.

Cleanliness. An important visual aspect of high grade bleached papers is cleanliness in appearance. All papers have some specks visible in the sheet which are called dirt. They are usually small clumps of wood fiber, bark or foreign materials. Dirt is a particularly troublesome problem in recycled papers because of contaminants present in waste paper which are difficult to remove completely.

The standard samples approved by JCP generally have dirt counts of 10 parts per million as measured by a standard method of measure. GPO personnel report few problems with demerits or rejections because of dirt counts.

It has been surmised that because dirt is particularly troublesome for recycled paper, a relaxation of the specifications would make recycled paper more competitive for Government bids. While the researchers found no positive evidence that this is true, experiments in relaxing dirt count specifications at a minimum of three depot locations in different parts of the country would enable a determination to be made as to whether such relaxation is consistent with Government needs.

Other Specifications. EPA should also request an examination of other specifications. Industry sources report that the government could save significantly if "off-the-shelf" products were used. Considerable progress in the bleached paper area has been made, but the feeling is that even more progress could be made. Use of standard case sizes and marking as used for industrial sales are examples where specifications could be improved. These changes might encourage more competition for government bids and increase the ability of the government to affect industry operations.

Recovered Material Levels. If recovered material levels are set too high, no bids will be received. If set too low, no stimulation of recovered materials can occur. A table showing the GSA levels of recovered fiber for 1976 was presented on page 25. From that, we can see that the levels of recovered materials are generally quite low, with no requirements in the Part I category. Data presented in Chapter 2 show that on the average, only 6.6 percent recycling of waste paper occurs in these paper grades. The value would probably be far under 6.6 percent for the old GSA definition of Part I recovered materials, which includes only postconsumer wastes.

We recommend that the total requirements for recovered materials used previously by GSA be retained in the guidelines. For waste paper, we recommend a trial at the national average level of 7 percent. We further recommend that suppliers be asked to report the level of recovered materials actually supplied in order to have a better idea of what can be achieved in specific products.

If bids are not received at the proposed levels, a follow-up examination of non-bidders should be carried out. If the recovered material levels are too high, they can be lowered and the bidding process repeated. When a workable level is found, EPA should require that a program of steady increases of the levels be required as a means to stimulate the maximum use of recovered materials possible. As a trial, the increase should be one percentage point above the previous year's level.

Sanitary Tissue Products

Description. This category includes primarily toilet tissue, towels, napkins, facial tissues, doilies and industrial wipers. The quantities of paper purchased in this category are substantially less than for the previous category, amounting to only one-fifth to one-third as much. The products purchased are generally of the commercial or institutional variety as opposed to the consumer products seen in grocery stores. Substantial quantities of waste paper are used in the manufacture of these goods. On Table II-5 (page 18), we see that the average waste paper use is 30 percent.

Tissue is manufactured in almost precisely the same manner as are high grade bleached papers discussed previously. For virgin tissue, wood is converted to bleached kraft and sometimes sulfite pulps. These pulps are then processed and formed into tissue in the same way as previously discussed. Tissue made from recycled waste paper is also made in a manner similar to high grade bleached papers. In addition, waste paper pulps are mixed with virgin pulps in many mills at levels which range from near zero to near 100 percent. The raw materials differ from high grade bleached papers slightly in that different grades of waste paper are used. Both product classes utilize the premium grades of waste paper known as pulp substitutes and deinking waste paper. But, in tissue manufacture, there is also a significant use of old corrugated boxes, newspapers, and mixed waste papers.

Technical Equivalency. For the tissue products purchased by the Government, there can be no question of technical equivalency. Many companies use substantial quantities of recovered materials and compete directly with virgin materials in the commercial market. EPA needs to make no special provisions in this area.

Availability. As with high grade bleached papers, there is substantially less recycling in the south and west than in the remainder of the country. These values are detailed in Table II-5 (page 18) and Appendix G. Consequently, recycled products are locally less available in the south and west than they are in the rest of the country. However, one recycled tissue manufacturer in the midwest is known to sell on competitive bids on both coasts. In addition, the state of California, where little tissue is manufactured from waste paper, was successful in receiving competitive bids under their purchasing program, as documented in Appendix K. We conclude that tissue products made at least in part of recovered materials are available at all locations in the U.S., although there may be more competition in some areas. EPA needs to make no special provisions in this regard.

Cost. Tissue products with recovered material content are common in the commercial market place and are competitively priced. As mentioned previously, the industry average for waste paper use in all tissue products is 30 percent. In addition, both state and Federal governments have had experience in purchasing tissue products on a cost competitive basis. Thus, the requirement of recovered material content in tissue products should not result in higher prices to the Government.

Performance Specifications. Industry sources felt that in most cases, the Government is buying products appropriate for their intended uses. But, frequent comments indicated that toilet tissue was being specified at substantially heavier basis weight than the commercial standard (11 to 11.5 pounds). We recommend that commercial standards be adopted by the Government.

There is also the matter of non-performance-related specifications such as non-standard case sizes and markings. We recommend that EPA urge an evaluation of the specifications in this area.

Recovered Material Levels. A review of the table on page 25 shows that substantially greater levels of recovered materials have been specified for the tissue products than for the bleached papers. The average use of waste paper (see page 18) is 30 percent, which compares well with the Part I requirements listed on page 25. We recommend that EPA adopt the most recent levels of Part I and total recovered materials specified by GSA for the waste paper and total categories. However, an examination of those categories at or below 30 percent for waste paper should be made. It is possible that our recommended redefinition of Part I wastes as waste paper could result in upgrading the specifications. One way of doing this is to increase the percent specified levels of recovered materials by one percent each year until maximum feasible levels are found.

Unbleached Paper and Paperboard

Description. Direct purchases by the government in this area are roughly equivalent in size to the tissue products category. Primarily, the purchases are fiber boxes, which are mostly corrugated boxes, although some solid fiber boxes and sheets are purchased. Lesser amounts of "brown" paper are also purchased.

Paperboard* from which solid fiber boxes and sheets are made and from which brown paper is made, is manufactured in the same way as the high grade bleached kraft papers except the kraft pulp is not bleached. Corrugated boxes are more complex, as they represent a union of two different grades of paperboard. Corrugated is composed of corrugating medium and paperboard. Corrugating medium is the fluted interior, and the two outer sheets, or liners, are linerboard. The two outer sheets of linerboard and the corrugating medium are glued together to form the material from which corrugated boxes are fabricated. Linerboard is unbleached kraft paperboard, while corrugating medium is made from semichemical or recycled paperboard. Semichemical paperboard is manufactured in the same way as kraft paper and paperboard, except different wood species are used for the raw material, and different chemicals are used in the digesters, and the digestion process is not carried to completion.

* Paperboard is the term used by the paper industry to describe the heavier and thicker grade of paper. This includes the materials popularly known as cardboard.

Technical Equivalency. Waste paper has long been used in the manufacture of corrugated containers, especially for the corrugating medium. Virgin and recycled fibers are not entirely equivalent in regard to some measured qualities, so that in some cases recycled sheets may be made heavier than virgin sheets to compensate. However, the finished boxes are technically equivalent and compete directly in commercial markets.

Brown kraft paper is used because of its strength in a variety of applications. One hundred percent recycled paper may contain sufficient short fiber so that it is not technically equivalent to virgin paper. However, recycled fiber can be used at less than the 100 percent level to make a technically equivalent sheet. Thus, for most applications, a sheet containing some recycled fiber should be available in a form which is technically equivalent to a virgin sheet.

Solid fiber boxes are made from the same type of fiber as is brown paper and linerboard. In fact, solid fiber paperboard and linerboard is frequently made in the same mill and with the same wood pulp as brown paper, differing only in thickness. Thus, the above statements are also true for fiber boxes.

Availability. Semichemical paperboard is typically manufactured with some fraction of the raw materials being waste paper. As shown in Table II-5 (page 18), the national average is 24 percent with significant recycling in all areas of the country. The geographic areas where recycling is greatest are the northeast and central sections of the country. In addition, in 1976, 1.1 million tons of recycled corrugating medium was produced, representing 21 percent of total production. Recycled corrugating medium contains a minimum of 80 percent waste paper fiber.

On the other hand, waste paper use in linerboard occurs at only 8 percent nationwide, with recycled linerboard (80 percent waste paper or greater) accounting for only 2 percent of production in 1976. However, there is a growing trend to use waste paper as a portion of the raw materials for linerboard. Thus, linerboard with some percentage of recycled fiber is available in most areas of the country, but the level of waste paper use is likely to be below 10 percent in any given area. The waste paper content of solid fiber boxes and sheets is unknown, but probably similar to linerboard.

Use of waste paper in the unbleached papers is less than 5 percent nationally. Substantial use of waste paper in these grades is uncommon.

Therefore, we conclude that boxes containing recovered materials are generally available in all sections of the country, although recycling levels tend to be higher in the northeast and central sections. However, availability of brown paper made with significant levels of waste paper is generally not available.

Cost. Linerboard is produced at higher tonnage levels than any other production grade in the paper and paperboard industry. This grade is produced in substantial quantities by a large number of companies. This helps to understand the fact that linerboard and its companion grade of corrugating medium are widely available in large quantities and at prices set by a highly competitive market. This coupled with the fact that corrugating medium generally contains some waste paper fiber implies that procurement guidelines for corrugated boxes with levels of recovered materials specified should not result in increased costs to the Government. The same is also true for solid fiber boxes, although the level of recovered materials may need to be lower than for corrugated boxes. However, similar statements cannot be made for brown paper because of possible problems of availability of products containing waste paper.

Performance Specifications. Corrugated and solid fiber boxes are commonly manufactured to meet interstate commerce shipping package regulations, whether they contain recovered materials or not. The Government generally buys containers consistent with these regulations, except where some special use is required. We recommend no changes in Government procurement policies in this area.

Recovered Material Levels. At the present time, corrugated containers are an average 13 percent* waste paper. We recommend that the 10 percent level shown on page 25 be upgraded to 13 percent with the use of our recommendation for an expanded definition of Part I to include all waste paper, and that the total recovered material level be retained. In the brown papers, we do no see much potential for improvement, but recommend that the national average of 5 percent for waste paper be tried, while retaining the listed total recovered material level on page 25.

COMBINATION PAPERBOARD

This report would not be complete without mentioning combination (recycled) paperboard. This material is generally 90 percent or more waste paper and EPA should encourage its use wherever possible. Combination paperboard is used primarily as a packaging material and is not generally suitable for Government activities. However, tablet backs, memo pad backs, and lunch boxes are three areas where combination paperboard is used by the Government.

However, we recommend that agencies be made aware of the existence of this recycled waste paper product, so that they may be aware of its possible use in other applications. Its use results in recovery of materials from waste streams and it is one of the more commonly available grades of paperboard. We recommend cooperation between the Government and the American Paper Institute in determining new ways in which the Government might expand its use of combination paperboard.

* See page 19 for discussion.

We do recommend one change in the recovered material specifications in Table III-1. Two products (pad backing and columnar pad backing) are generally made from combination board. We recommend that the waste paper specification be raised to 100 percent.

Appendix A

AMOUNT OF PAPER AND PAPERBOARD PRODUCTS PURCHASED BY THE FEDERAL GOVERNMENT

INTRODUCTION

Attempts to increase the supply of a given commodity through "demand-pull" changes, specifically by the Federal government, can be successful only if several basic assumptions are realistic. One of these is that the changes in demand must represent a significant fraction of the total demand. Otherwise, the change in demand will have little effect on total supply. Attempts to influence the type, amount and utilization of paper stock fiber through changes in Federal purchasing practices inherently assumed that Federal purchases of paper products represent a significant portion of the demand for these products.

Even though it is generally assumed* that the Federal and state government bodies are significant consumers of paper and paper products, especially writing paper, research indicates that this assumption is inaccurate. As discussed later in this appendix, Federal government purchases amounted to between 0.55 percent to 0.88 percent of the total U.S. production of paper products during the seven years covered in this study, 1970 through 1976. Even when calculated on a grade-by-grade basis, Federal purchases ranged from 0.67 percent to 3.99 percent of the total domestic production of a given grade. Thus, while the Federal government may be one of the largest single customers for paper and paper products, it does not purchase the great percentages commonly assumed.

METHODOLOGY

This analysis is based upon historical statistics of Federal purchases of various paper products. The General Services Administration (GSA), the Government Printing Office (GPO), and the Defense Supply Agency (DSA), were contacted to obtain these historical statistics and to solicit any agency projections of future purchases which might have been made for planning purposes. The GSA and GPO agencies responded with data for annual purchases by grade for each year from 1970 through 1976 except as noted on the following tables. No data were obtained from the DSA because most of the DSA purchases are made through the GSA and GPO and are reported in their statistics.

* A casual survey of friends and associates suggested that many citizens believe the Federal government to consume between 40 and 85 percent of the total of printing and writing paper produced in this country, and between 20 and 70 percent of all paper products consumed in this country.

These data were analyzed in three principal ways. First, Federal paper purchases were compared to domestic paper and paperboard production for each year of the study, both in total and by selected specific grades. Second, simple graphs were prepared to allow easier visualization of any trends or obvious interrelationships between production and purchases. Third, a statistical analysis was performed to investigate correlations between selected independent variables versus Federal paper purchases. All of these techniques were conducted in an effort to develop a predictive tool to project future Federal paper purchases and to evaluate the impact of Federal paper purchasing policies under various economic scenarios.

DISCUSSION

Comparison of Total Federal Paper Purchases to Total Domestic Production

As mentioned above, total Federal government purchases of paper products represent about one percent or less of the total domestic production of paper products. The calculations supporting this conclusion are straightforward and are shown in Table A-1.

Comparison of Federal Government Purchases to Domestic Paper Production by Grade

While Federal government purchases are a small part of total paper production, such Federal purchases are not uniformly distributed across all grades of paper and paperboard. Table A-2 is similar to Table A-1, but shows the Federal purchases as a percentage of the production, broken down by selected grades. The grades of paper shown in Table A-2 were chosen because both government purchase data and U.S. production data were clearly defined and available. These grades were also selected because of their potential for utilization of significant percentages of recycled fiber. For example, tab cards (computer cards) were not included in this analysis even though data were available, since recycled fiber is considered technically unacceptable in computer tab cards.

Caution is required in interpreting the data shown in Table A-2, however. For example, the Federal government purchases of printing and writing paper amount to between two-thirds and one and two-thirds percent of the total U.S. production over the period of the study. For any year except 1976, approximately half of these purchases were made through the GSA and the remaining half were made through the GPO. The GPO purchases are heavily concentrated in the grades of offset bulk and writing papers, which together comprise about 62 percent of the GPO purchases for a given year. In contrast, the GSA purchases appear to be concentrated in the grades of No. 4 offset, Xerographic, and writing papers.

Table A-1

COMPARISON OF GOVERNMENT PURCHASES TO TOTAL U.S. PAPER AND PAPERBOARD PRODUCTION

	Government Purchases (Thousand Tons)			U.S. Production (Thousand Tons)			Government Share (Percent)		
	Paper 1/	Paperboard 2/	Total	Paper	Paperboard	Total	Paper	Paperboard	Total
1970	314.9	103.7	418.6	23,371	25,383	48,754	1.35	0.41	0.86
1971	299.3	138.1	437.4	23,736	26,037	49,773	1.26	0.53	0.88
1972	307.2	128.5	435.7	25,371	28,502	53,873	1.21	0.45	0.81
1973	304.5	85.6	390.1	26,796	29,572	56,368	1.14	0.29	0.69
1974	322.5	99.0	421.5	26,898	28,915	55,813	1.20	0.34	0.76
1975	306.3	81.5	387.8	23,305	24,756	48,061	1.31	0.33	0.81
1976 3/	237.9	83.6	321.5	26,611	28,440	55,051	0.89	0.29	0.85
1977	236.7	71.7	308.4	27,381	28,953	56,334	0.86	0.25	0.55

Source: GSA and GPO Private Communication. American Paper Institute, "Statistics of Paper and Paperboard, 1978."

1/ Paper category includes printing and writing papers, memo, columnar pads, mailing envelopes, sanitary papers, teletype papers, carbon papers and Xerographic paper.

2/ Paperboard category includes disposable mess equipment, miscellaneous converted items, boxes, tab cards and index card stock.

3/ Adjusted for transition quarter.

Table A-1

COMPARISON OF GOVERNMENT PAPER PURCHASES OF SELECTED GRADES OF PAPER TO TOTAL U.S. PRODUCTION

(Thousand tons and percent)

	Printing & Writing[1]			Sanitary			Computer[2]			Mailing Envelopes[3]			Coarse Papers[4]		
Year	Gov't. Purch. (000 tons)	U.S. Prod. (000 tons)	Gov't. Share (Percent)	Gov't. Purch. (000 tons)	U.S. Prod. (000 tons)	Gov't. Share (Percent)	Gov't. Purch. (000 tons)	U.S. Prod. (000 tons)	Gov't. Share (Percent)	Gov't. Purch. (000 tons)	U.S. Prod. (000 tons)	Gov't. Share (Percent)	Gov't. Purch. (000 tons)	U.S. Prod. (000 tons)	Gov't. Share (Percent)
1970	147.9	9,067.5	1.63	59.5	3,494.0	1.70	15.5	1,234.6	1.26	43.5	655.7	6.63	37.5	4,865.5	0.77
1971	131.1	9,278.5	1.41	53.0	3,604.3	1.47	50.2	1.259.5	3.99	43.8	644.5	6.80	39.1	4,862.0	0.80
1972	129.5	10,133.5	1.28	56.0	3,746.2	1.49	53.0	1,394.4	3.80	50.0	716.5	6.98	33.7	5,046.3	0.67
1973	148.6	10,994.2	1.35	46.1	3,771.8	1.22	45.0	1,630.6	2.76	37.5	784.9	4.78	40.8	5,060.4	0.81
1974	140.2	11,067.2	1.27	50.0	3,823.2	1.31	43.0	1,672.2	2.57	33.5	733.7	4.57	40.1	5,224.8	0.77
1975	132.0	9,056.4	1.46	54.0	3,771.9	1.43	48.5	1,321.0	3.67	31.9	620.4	5.14	42.2	4,233.7	1.00
1976 5/	85.6	11,022.2	0.78	56.6	3,954.6	1.43	27.4	1,496.1	1.83	28.1	723.9	3.88	40.9	4,907.2	0.83
1977	126.8	12,587.6	1.09	35.9	4,069.0	0.88	37.4	1,502.5	2.49	14.3	757.7	1.89	24.6	4,934.1	0.50

1/ Includes GPO and GSA purchases of printing and writing papers except computer form bond, envelopes, and tab cards.
2/ Includes teletype and computer form bond papers and tab cards.
3/ Includes white wove and kraft envelopes.
4/ Includes bleached and unbleached kraft papers and industrial wipers.
5/ Adjusted for transition quarter effects.

Source: GSA and GPO private communications and American Paper Institute, "Statistics of Paper and Paperboard, 1978."

Caution is especially necessary in interpreting the data shown for Federal purchases of mailing envelopes. While it would appear that the Federal government purchases represent between 4 to 6 percent of the total domestic production, it is suspected that this result is an artifact of understated total domestic envelope production data. It seems likely that significant amounts of bleached and unbleached kraft grades and uncoated book grades of paper are sold to small converting plants where they are subsequently converted into envelopes. In such cases the envelope production might not be accurately traced. Unfortunately, the extent to which envelope production is under-reported is unknown. The large number of relatively small converting and printing plants having envelope manufacturing capacity greatly complicates accurate data collection of envelope production.

Determining the Federal Government consumption of corrugated containers presents special problems. The Federal Government purchases containers in two ways. First, some are sold to the government directly. Second, the government also purchases containers indirectly as packaging for the various products purchased by the various Federal agencies. As with the "direct" purchases of containers, these "indirect" purchases are also principally of corrugated, although some solid fiber containers are also purchased.

"Direct" corrugated container purchases by the Federal Government are compared to total domestic container production in Table A-3, below. For the purposes of this analysis, it is assumed that all of the boxes purchased by the Federal Government are corrugated containers. Note that the Federal Government purchases represent between 0.16 percent and 0.28 percent of the total domestic production over the years included in this study.

Table A-3

COMPARISON OF GOVERNMENT PURCHASES OF BOXES TO U.S. CONTAINERBOARD PRODUCTION

Year	Government Purchases (Thousand tons)	U.S. Production* (Thousand tons)	Government Share (Percent)
1970	19.0	11,941	0.16
1971	25.3	12,426	0.20
1972	30.0	13,670	0.22
1973	32.5	14,801	0.22
1974	39.0	13,886	0.28
1975	24.0	12,578	0.19
1976	30.7	14,109	0.22
1977	38.6	14,818	0.26

Source: GSA and GPO, private communication. Fibre Box Association, "Fibre Box Industry, 1977 Annual Report."

* Calculated from box plant consumption minus a 10 percent scrap allowance.

It is suspected that the reported direct Federal Government purchases of corrugated shown in Table A-3 understate the actual levels of direct purchases. Discussions with Department of Defense and DSA purchasing agents indicate that almost all of the DoD and DSA direct purchases are small lots obtained from local converting plants. Essentially no records of such small purchases are kept nor reported to any central agency. In essence, these small purchases are "lost" to the totals considered in this analysis. Further, considering the highly-specialized nature of most packaging, it is quite likely that some GSA and GPO purchases are handled in a similar manner. The degree to which these purchasing practices tend to understate the actual direct purchases of corrugated containers is unknown, but may be significant.

Determination of the indirect Federal purchases of containers presents special problems, but an estimation technique was developed by Franklin Associates using data from the Fibre Box Association and from the 1970 census input-output tables as published by Arthur D. Little, Inc. Virtually every product manufactured in this country employs one or more grades of fiber boxes such as corrugated as a packaging or shipping material. For purposes of simplicity, this analysis assumes that corrugated containers is the principal grade used to package the goods purchased by the Federal Government. This seems a reasonable assumption considering the types of goods purchased by the government, although folding boxboard is probably used extensively as well.

The first step in this analysis was to estimate the amount of corrugated used to package the many products produced in this country. This was done with the aid of the Fibre Box Industry Annual Report, 1970, published by the Fibre Box Association (FBA). In this annual report, the FBA shows the percentage of containerboard shipments consumed in each of several selected standard codes (SIC) categories, by category. The year 1970 was selected because it is the most recent year of complete census data which will be required in subsequent analyses.

These SIC categories were then assigned to a model service number which corresponds to the appropriate sector in Arthur D. Little's (ADL) 147-Industry Input-Output Model of the Economy. Occasionally more than one ADL model sector was closely associated with one or more Fibre Box Association categories. In these instances, subsequent calculations were based upon an average weighted by the value of goods shipped from each sector to the Federal Government. The FBA categories and associated SIC numbers are shown in Table A-4, along with the ADL model service numbers assigned to each of these categories.

The next step in this analysis was to convert both the defense and non-defense government expenditures to a percentage of total domestic output as determined by the ADL input-output economic model. These percentages are also shown in Table A-4.

Table A-4

FIBER BOXES USED AS PACKAGING OF GOODS RECEIVED BY THE FEDERAL GOVERNMENT IN 1972

Manufacturing Industry	FBA Category (SIC)-	Percent of Shipments 3/	Model Service Number 4/	Government Expenditures as a Percentage of Domestic Output		Percent of Fiber Boxes Used by Government		
				Defense	Non-Defense	Defense	Non-Defense	Total
Meat Products	201	6.0	14	.42	.14	.0252	.0084	.0336
Dairy Products	202	2.0	15	.69	.67	.0138	.0134	.0272
Canning & Preserving Fruits, Vegetables & Seafoods	203	7.0	16	.17	.10	.0119	.0070	.0189
Bakery Products	205	1.8	18	.13	.07	.0023	.0013	.0036
Confectionery	207	1.3	20	.03	.02	.0004	.0003	.0007
Beverage	208	4.2	21	.09	.03	.0038	.0013	.0051
Fresh Fruits & Vegetables	950 2/	1.4	5/			-	-	-
Other Food	-	4.9	17,19,22	.07	.50	.0034	.0245	.0279
Tobacco	21	.8	23		6/	-	-	-
Floor Covering Mills	227	.2	24-25	.27	.03	.0078	.009	.0087
Other Textile Mills	-	2.7						
Apparel and Similar Products	23	1.4	26-27	.50	.18	.0070	.0025	.0095
Lumber and Wood Products	2-	1.0	28-35	.63	.16	.0063	.0016	.0079
Household Furniture	251	2.3	36	.23	.27	.0053	.0062	.0115
Other Furniture & Fixtures	-	.7	37	.67	1.26	.0047	.0088	.0135
Paper and Allied Products	26	12.6	38-47	.22	.22	.0277	.0277	.0554
Books	273	.4	50	1.19	(-.88)	.0048	(-.0035)	.0013
Other Printing, Publishing	-	1.1	48-49, 51-55	1.22	(-.38)	.0134	(-.0042)	.0092

Table A-4 (con't)

FIBER BOXES USED AS PACKAGING OF GOODS RECEIVED BY THE FEDERAL GOVERNMENT IN 1970

Manufacturing Industry	FBA Category (SIC)[1]	Percent of Shipments[3]	Model Service Number[4]	Government Expenditures as a Percentage of Domestic Output		Percent of Fiber Boxes Used by Government		
				Defense	Non-Defense	Defense	Non-Defense	Total
Plastics Materials, etc.	282	1.1	63-66	.58	0	.0064	0	.0064
Drugs	283	.5	67-69	.94	.88	.0047	.0044	.0091
Soap, Cosmetics, etc.	284	2.5	70-73	.29	.04	.0073	.0010	.0083
Paints	285	.5	74	.08	.04	.0004	.0002	.0006
Other Chemicals	-	1.6	56-62, 75-83	5.43	.52	.0869	.0083	.0952
Paving and Roofing Materials	295	.1	84	3.35	.31	.0268	.0025	.0293
Other Petroleum	-	.7						
Miscellaneous Plastics Products	307	2.7	89	.53	.09	.0143	.0024	.0167
Other Rubber, etc.	-	1.2	85-88	1.27	.11	.0152	.0013	.0165
Leather and Leather Products	31	.5	90-91	.09	.02	.0005	.0001	.0006
Glass & Glassware	322	8.2	92	.28	.21	.0230	.0172	.0402
Pottery & Related Products	326	.3	93	.34	(-.07)	.0061	(-.0013)	.0048
Nonmetallic Mineral Products	329	.6						
Other Stone, Clay & Glass	-	.9						
Primary Metal	33	1.2	94-99	.25	.06	.0030	.0007	.0037
Fabricated Metal Products, Except Ordanance, Machinery, Cans and Transportation Equipment	34 except 341	3.1	101-103	.44	.13	.0136	.0040	.0176
Metal Cans	341	1.2	100	.29	0	.0035	0	.0035
Machinery, Except Electrical & Service Industry	-	1.9	104-112	2.75	.50	.0523	.0095	.0618
Service Industry Machinery	358	.8	113	1.08	.09	.0086	.0007	.0093

Table A-4 (con't)

FIBER BOXES USED AS PACKAGING OF GOODS RECEIVED BY THE FEDERAL GOVERNMENT IN 1970

Manufacturing Industry	FBA Category (SIC)[1/]	Percent of Shipments[3/]	Model Service Number[4/]	Government Expenditures as a Percentage of Domestic Output		Percent of Fiber Boxes Used by Government		
				Defense	Non-Defense	Defense	Non-Defense	Total
Household Appliances	363	2.4	115	.16	.04	.0038	.0010	.0048
Electric Lighting & Wiring Equip.	364	.8	116	.37	.02	.0030	.0002	.0032
Radio & TV Receivers	365	.4	117-118	21.20	3.08	.2544	.0370	.2914
Communications & Electronics	366-7	.8						
Other Electrical Machinery, Equipment, and Supplies	-	1.2	114,119	5.00	.89	.0600	.0107	.0707
Motor Vehicles & M.V. Equip.	371	1.9	120-122	1.59	.16	.0302	.0030	.0332
Other Transportation Equipment	-	.5	123-124	28.91	4.89	.1446	.0245	.1691
Instruments	38	.7	125-126	5.65	2.16	.0396	.0151	.0547
Toys & Sports Equipment	394	1.8	127	.12	(-.02)	.0115	(-.0019)	.0096
Other Miscellaneous Manufacturing	-	7.8						
Total						.9575	.2368	1.1943

1/ Source: Fibre Box Association, Fibre Box Industry Statistics, 1970. Most of the Fibre Box Association (FBA) categories are based on the Standard Industrial Classification (SIC) Manual.

2/ FBA category 950 is not based on the SIC Manual.

3/ Based on square footage shipped to each end-use by FBA members in 1970. The 27 reporting companies accounted for 57.3 percent of fiber box shipments in 1970.

4/ Source: Milgrom, J., Can Federal Procurement Practices Be Used to Reduce Solid Waste?, Arthur D. Little, Inc., report for Solid and Hazardous Waste Research Laboratory, U.S. EPA, Cincinnati. The model service number designates the sector in Arthur D. Little's 147-industry input-output model. Where there is more than one ADL sector to an FBA category, the government expenditure percentage is the average weighted by the value shipped from each sector. The source of the values shipped is the U.S. Department of Commerce, Annual Survey of Manufacturers, 1970.

5/ Not separately identifiable. Apparently a small part of ADL Sector 2.

6/ ADL Sector 23 was not included in Tables 4, 5, or 6 of the source in footnote 4.

With the simplifying assumption that the cost of containerboard to the government is constant across all uses and grades of corrugated, the percent of fiber boxes used by the government for both defense and non-defense purposes was obtained. These results are also shown in Table A-4, along with the total percentage of fiber boxes used by the government for each of the FBA categories.

The results of this series of calculations is shown at the end of Table A-4. The percentage of corrugated used in each FBA category by the Federal Government was totaled for both the defense and non-defense sectors. The total government indirectly consumed approximately 0.96 percent of the total domestic production of corrugated boxes for defense purposes, and approximately 0.24 percent of the total domestic production of boxes for non-defense purposes. Together the total indirect Federal Government consumption of paper amounts to approximately 1.19 percent of the total domestic production of corrugated containers.

Since the total indirect consumption of containers was approximately 1.19 percent of the domestic production in 1970, and since the reported direct purchases of containerboard amounted to approximately 0.16 percent that same year, it may be concluded that total Federal consumption of corrugated during 1970 was approximately 1.35 percent of the total domestic production that year. Thus, it would appear that the total Federal purchases of containerboard, both direct and indirect, represent about the same percentage of domestic production as does the Federal Government purchases of paper.

Graphic Analysis

The second method of analysis employed in this study was to display the historical Federal purchase data graphically. The reported paper purchases were grouped into loosely-defined "families" of paper products and then graphed. Figure A-1 shows sanitary and office-use paper, Figure A-2 shows packaging-use papers, and Figure A-3 shows miscellaneous papers. To facilitate "overlay" comparisons, these graphs were prepared with coincident axes and identical scales.

Since the GPO could not provide an annualized breakdown of purchases by type of paper, only the aggregate GPO purchases are shown in Figure A-4. Note that two measures are displayed in Figure A-4: tons and sheets. These are not equivalent measures. The "sheets" is a physical count measure, and it is not known how much the reported quantities might weigh. Itis estimated that sheet purchases total no more than three thousand tons per year, however.

Since fiscal year 1976 was followed by a transition quarter 1976, the reported 1976 data were multiplied by 12/15 to adjust the data for a 12-month fiscal year 1976. No other adjustments to the data were made. The data shown in Figures A-1 through A-4 are presented in tabular form in Table A-5.

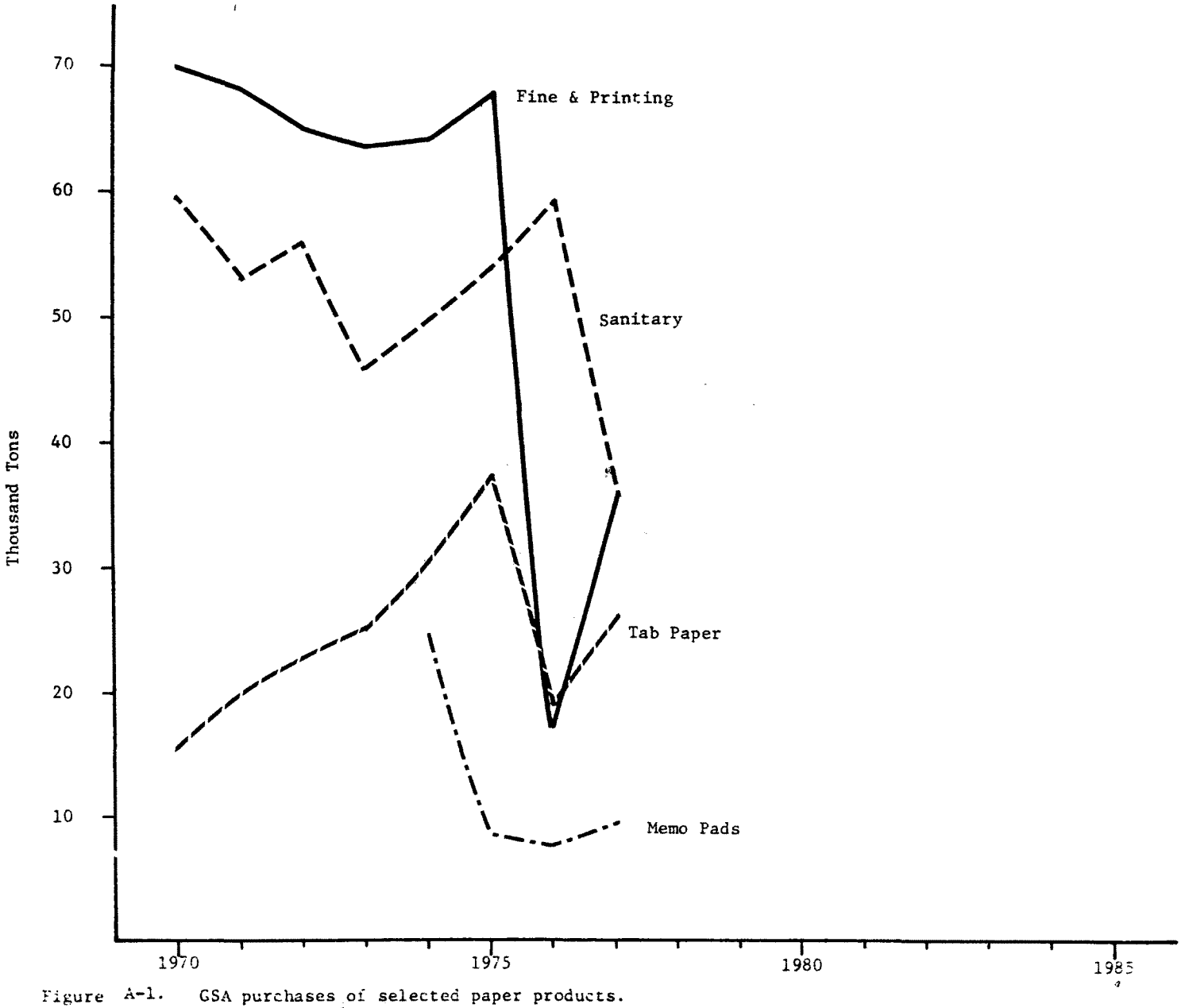

Figure A-1. GSA purchases of selected paper products.

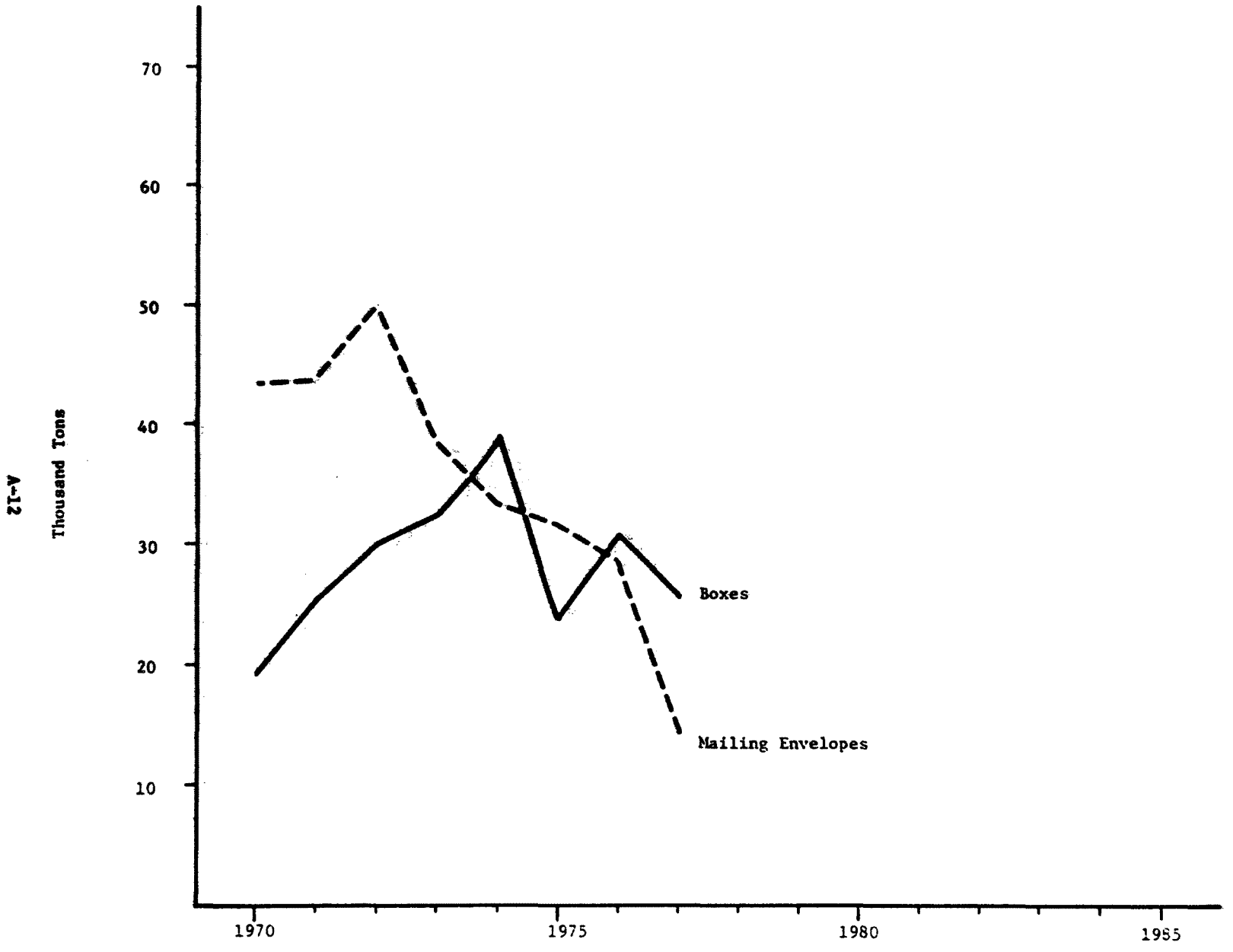

Figure A-2. GSA purchases of selected paper products.

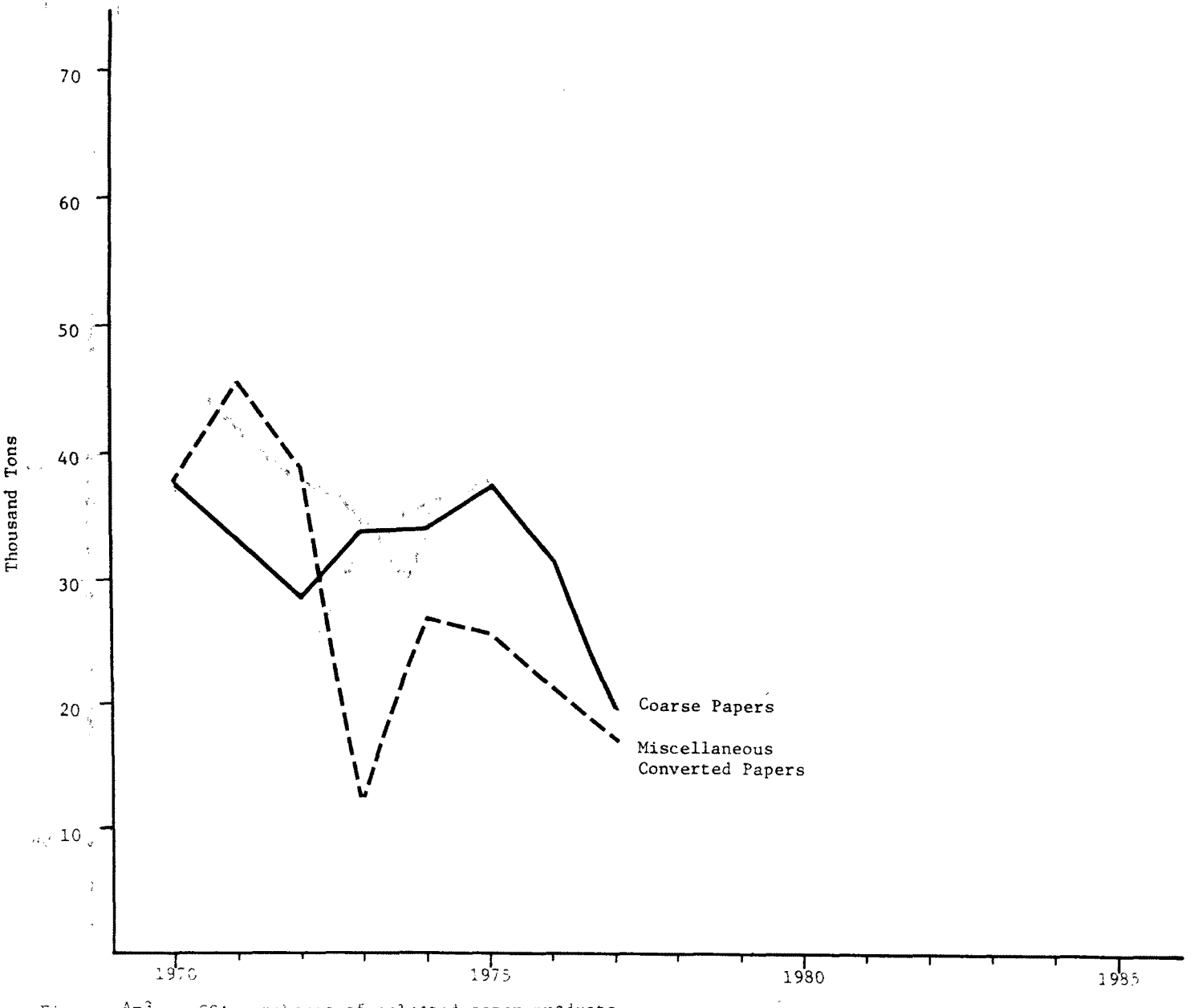

Figure A-3. GSA purchases of selected paper products.

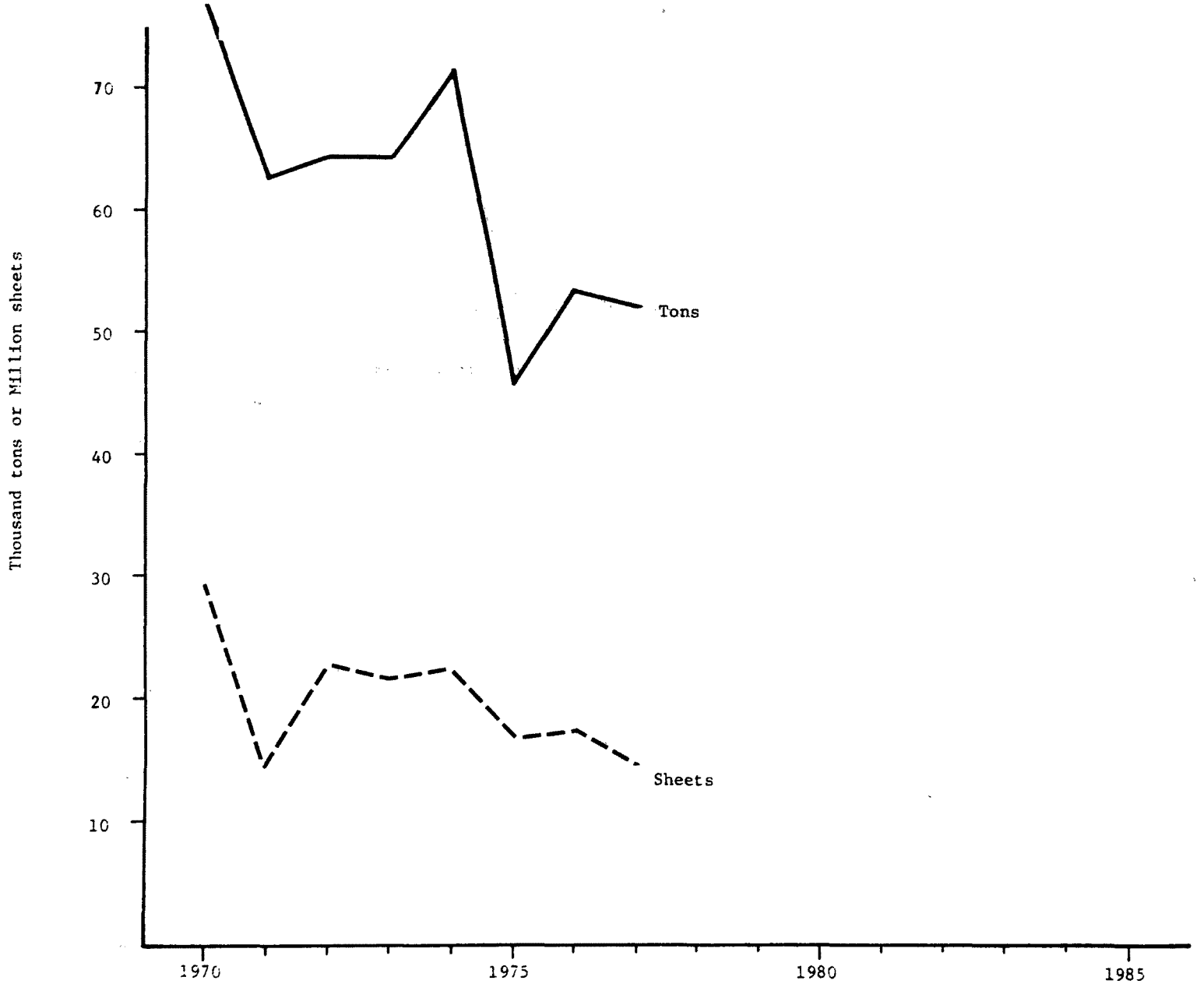

Figure A-4. GPO paper purchases.

Table A-5

SELECTED FEDERAL PAPER PROCUREMENT DATA

Year	Federal Activity: Expenditures (10^9 1972 $)	Federal Activity: Employment 1/ (x 10^3)	GPO Purchases: Paper (x10^3 tons)	GPO Purchases: Sheets (x 10^6)	GSA Purchases (x 10^3 tons): Fine & Printing	Sanitary	Tab	Memo Pads	Boxes	Mailing Envelopes	Coarse Papers	Misc. Converted
1970	220.8	4,688	77.9	29.4	70.0	59.5	15.5	-	19.0	43.5	37.5	38.0
1971	223.0	4,549	62.9	14.9	68.2	53.0	20.0	-	25.3	43.8	33.8	45.6
1972	232.0	4,413	64.4	22.9	65.0	56.0	23.0	-	30.0	50.0	28.5	39.0
1973	233.2	4,330	64.1	21.9	63.7	46.1	25.0	-	32.5	37.5	34.0	12.7
1974	231.4	4,382	71.9	22.5	64.1	50.0	30.5	25.0	39.0	33.5	33.3	27.0
1975	251.9	4,370	45.6	17.0	68.0	54.0	37.6	8.4	24.0	31.9	37.5	25.8
1976	264.4	4,309	53.5 2/	17.6 2/	17.4 2/	56.6 2/	18.7 2/	7.5 2/	30.7 2/	28.1 2/	31.7 2/	20.5 2/
1977	278 (e)	4,300 (e)	52.2	14.8	36.0	35.9	26.4	10.2	25.5	14.3	19.7	17.1

1/ Consists of civilian and shore-based military personnel.

2/ Adjusted for 1976 transition quarter effects.

Source: Statistical Abstracts, 1977; memorandums from GSA and GPO.

Even casual inspection of Figures A-1 through A-4 reveals rather significant year-to-year variations in the Federal purchases of almost every grade of paper. These wide variations contrast markedly with the relatively smooth year-to-year changes in Federal employment and Federal spending as shown in Figure A-5. It is apparent that Federal paper purchases are much more erratic than might be indicated by changes in Federal employment or spending.

Notably, during 1976 unusually dramatic changes in Federal purchases of paper are apparent. Most of these fluctuations may be attributed to the combined effects of a general economic recession and a "fiber shortage" which occurred in the same year. The net effect of these two disruptive influences was to seriously confound the GSA and GPO purchase requisition systems. The sharp drop in Federal purchases of selected grades of paper during 1976 resulted principally from inventory adjustments made that year to correct for the effects of the recession and the "fiber shortage" of the several years previous. Thus, the sharp fluctuations occurring in 1975 and 1976 may be considered aberrations to at least some degree. However, since the annual fluctuations in government purchases are large even in "normal" years, it is not possible to isolate the "abnormal" component of these fluctuations from the "normal" component.

Correlational Statistical Analysis

The third method of anlysis might be considered an extension of the graphic method discussed above. Just as the purpose of the graphic analysis was to assist in revealing correlations and trends in Federal paper procurement, the purpose of this analysis is to reveal such relationships by statistical techniques. A curvilinear regression analysis technique was used to "scout" for independent variables which might be predictors of government paper purchases. Among the independent variables considered were the U.S. population, gross national product, real gross national product (1974 $), Federal civilian employment, Federal military employment, the sum of both Federal civilian and military employment, total non-foreign Federal expenditures, and total Federal contribution to gross national product.

On the basis of these several analyses, it was found that total Federal employment, consisting of both civilian and shore-based military personnel, proved to be the most highly correlated predictor for certain grades of paper, and total non-foreign Federal expenditures proved to be the most highly correlated predictor for the remaining grades of paper. Unfortunately, even in the most highly correlated instances, the independent (predictive) variable was found to explain no more than roughly half of the variations in the independent variables (paper purchases).

Even when the regression analysis indicated a relatively high correlation, it was found that the regression equation coefficients were frequently unrealistic. For example, the regression line equations for total Federal employment indicate that hiring each additional Federal employee

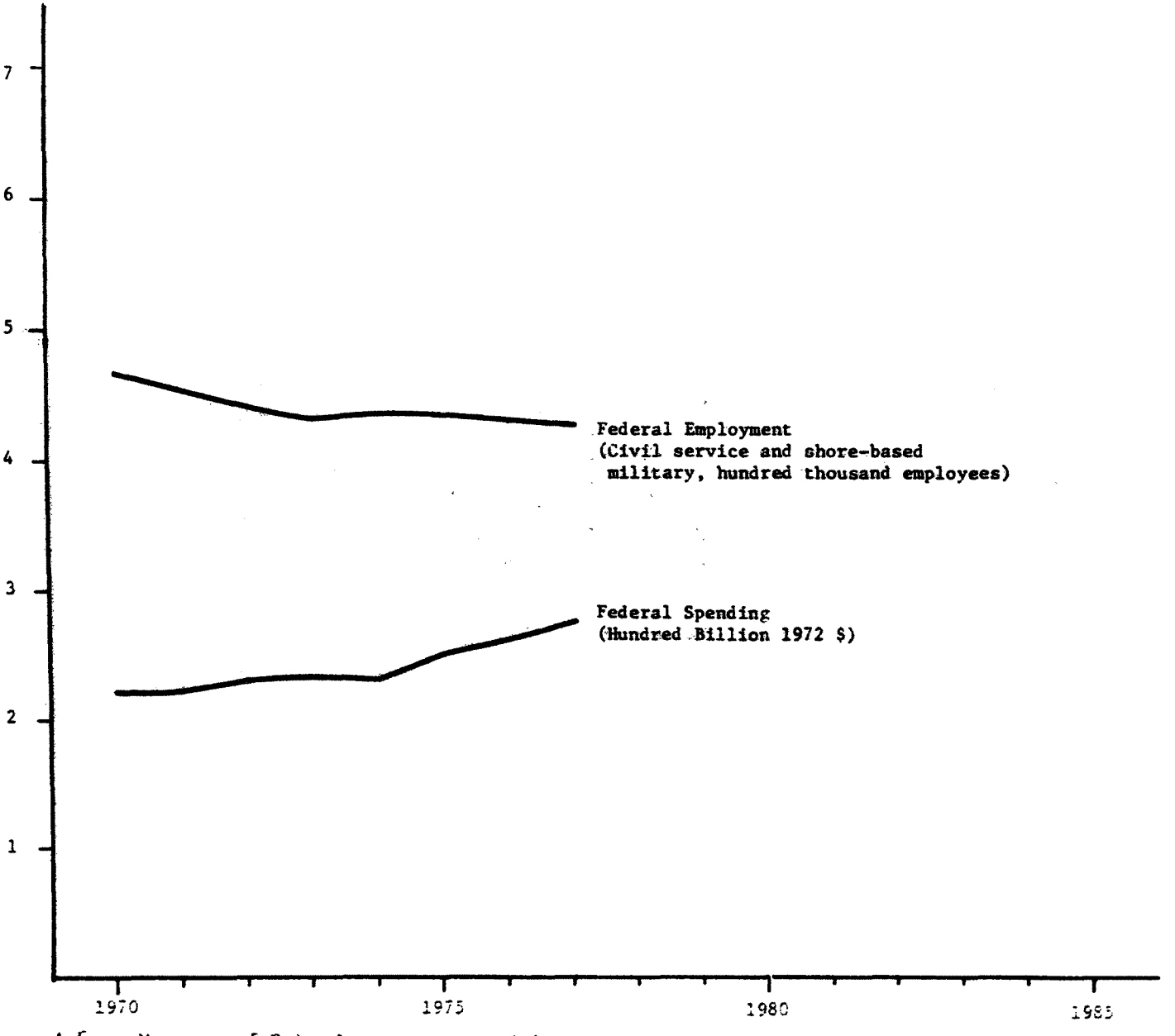

Figure A-5. Measures of Federal government activity.

results in a reduction in tabulating paper purchases of 79.6 pounds per year. This does not seem to be a logical relationship. It would appear that even the more highly correlated statistical relationships may be the result of statistical artifacts rather than functionally correlated relationships.

It is not easy to determine which regression line equations are inappropriate when the statistical result seems reasonable. For example, the regression line equations for total Federal employment indicate that hiring each additional Federal employee is associated with an increase of 27.9 pounds of fine and printing paper purchased. This amounts to approximately 5-1/2 reams of common office paper, apparently a reasonable amount. Of course, this regression equation may also be interpreted as saying that for each 27.9 pound increase in fine and printing paper purchased by the government, one additional Federal employee was required, apparently to handle this additional paper work. In short, remember that correlation does not imply causation.

As was discussed in the previous section of this appendix, the relatively loose relationship between Federal employment or Federal spending versus the Federal purchases of various grades of paper may be easily visualized by overlaying Figure A-5, showing measures of Federal Government activity, over each of the Figures A-1 through A-4, showing Federal purchases of various grades of paper. As may be seen with this simple technique, no readily-apparent relationship presents itself.

Time Series Statistical Analysis

Occasionally when two variables are compared to each other and their correlation is found to be low, it may still be discovered that the relationship between these variables may be changing in a consistent way over time. Several statistical techniques are available to investigate such complex relationships. The most commonly-used technique is known as an analysis of variance (ANOVA), and the technique of a tri-variant factor analysis is also available. Unfortunately, these relatively sophisticated mathematical techniques make rather stringent demands upon the assumptions of normalacy and distribution of the data set. In consideration of the irregularities apparent in the data considered in this analysis, these statistical methods were rejected in favor of a simpler method.

By converting the independent variables most closely associated with paper purchases (as discussed in the previous section of this appendix), to ratios, a relatively simple "least-squares" regression technique was employed to reveal time-related trends in these ratios. While care must be used in interpreting the results of this analysis, this method has the advantage of making fewer demands upon the distribution of the raw data than do the more sophisticated techniques. The first step in this analysis was to divide Federal purchases of each grade of paper by Federal employment (including

shore-based military) for each year of this study. These ratios are presented in Table A-6, along with projections for these ratios through 1985. These projections were obtained with the multi-model curvilinear time series regression analysis technique described earlier in this appendix. The functional relationship showing the highest correlation is noted at the foot of each column, along with the percentage of variation explained by the regression equation coefficients. These data are presented graphically in Figure A-6.

In a similar manner, Table A-7 presents the ratios of Federal consumption of each grade of paper per billion dollars of non-foreign Federal expenditures in 1972 dollars. As in the previous table, the best functional relationship is noted at the foot of the column along with the percentage of variance explained by the regression equation. Figure A-7 presents these data graphically.

As mentioned above, caution must be used in interpreting the results of this technique. Correlation coefficients that are either very high or very low are of interest and have been marked with an asterisk in the tables. Extremely low coefficients (explaining less than 5 percent of the variations in the dependent variable) suggest that time is a very small influence upon the ratio being considered. This may be restated as suggesting that the ratio is essentially constant over time. For example, the ratio of sanitary paper consumption per Federal employee (shown in Table A-6) is essentially constant over time, implying that the consumption of sanitary paper is principally a function only of Federal employment. (Note that the correlation coefficient, r^2 is only 0.027 in this instance.)

Correlation coefficients that are very high (explaining more than about 80 percent of the variations in the dependent variable) are interesting because they indicate that time is a significant factor in the relationship between the variables. For examples, the ratio of printing and writing paper consumption per billion dollars Federal spending demonstrates a very strong linear time trend as shown in Table A-7. This ratio is decreasing dramatically with time, implying that each incremental increase in Federal spending is associated with a larger and larger incremental decrease in printing and writing paper purchases. This might be restated as saying that less paper work is now needed to spend more Federal dollars. Indeed, it would seem likely that the recent increasing rises in Federal spending (even adjusted for inflation) may be principally responsible for these results.

Although Tables A-6 and A-7 present projections of these ratios through 1985, extreme caution must be used in evaluating these projections. They have been included in this analysis primarily to provide a "feel" for how rapidly these ratios are changing over time. There is no clear logical causality between time and these ratios. That is, there is no clear reason to expect that future Federal employment and expenditures will be based upon past Federal employment and expenditures. Both of these measures are largely issues of political decisions and may change dramatically at political whim. The graphic presentations discussed in an earlier section of this appendix clearly demonstrate the volatility of governmental purchases of paper products from year-to-year. It is most reasonable to expect that these gyrations will continue into the future in an equally unpredictable manner.

Table A-6

PAPER CONSUMPTION PER FEDERAL EMPLOYEE,[1/] BY SELECTED GRADE
(Pounds per Employee per Year)

Year	Printing & Writing	Sanitary Papers	Tab Cards	Envelopes	Coarse Papers	Boxes	Xerographic
1970	29.9	25.4	6.6	18.4	15.8	8.1	N/A
1971	30.0	23.3	8.6	19.2	14.8	11.2	N/A
1972	29.5	25.4	10.4	22.6	12.8	13.6	N/A
1973	29.4	21.3	11.6	17.2	15.7	15.0	9.6
1974	29.3	22.8	14.0	15.3	15.2	17.8	1.9
1975	31.1	24.7	17.2	14.4	17.2	11.0	8.4
1976	30.2	26.3	11.6	13.0	14.7	14.3	6.8
1977	30.3	24.7	12.0	13.9	15.8	11.8	17.9
1978	30.4	24.8	15.0	12.0	15.8	15.0	15.4
1979	30.4	24.8	15.6	11.0	16.0	15.4	17.6
1980	30.6	25.0	16.2	10.0	16.0	15.6	19.8
1981	30.6	25.0	16.6	8.8	16.2	16.0	21.8
1982	30.8	25.2	17.2	7.8	16.4	16.2	24.0
1983	30.8	25.2	17.6	6.8	16.4	16.4	26.2
1984	31.0	25.4	18.0	5.6	16.6	16.6	28.4
1985	31.0	25.4	18.4	4.6	16.6	17.0	30.4
Best-fit relationship:	Linear*	Linear*	Log-Log	Linear	Linear*	Log-Log	Linear
r^2:	0.169	0.027	0.729	0.651	0.059	0.369	0.343

1/ Includes shore-based military.
* Most promising predictor.

Source: GSA Memos, Statistical Abstracts, 1977, and FAL projections.

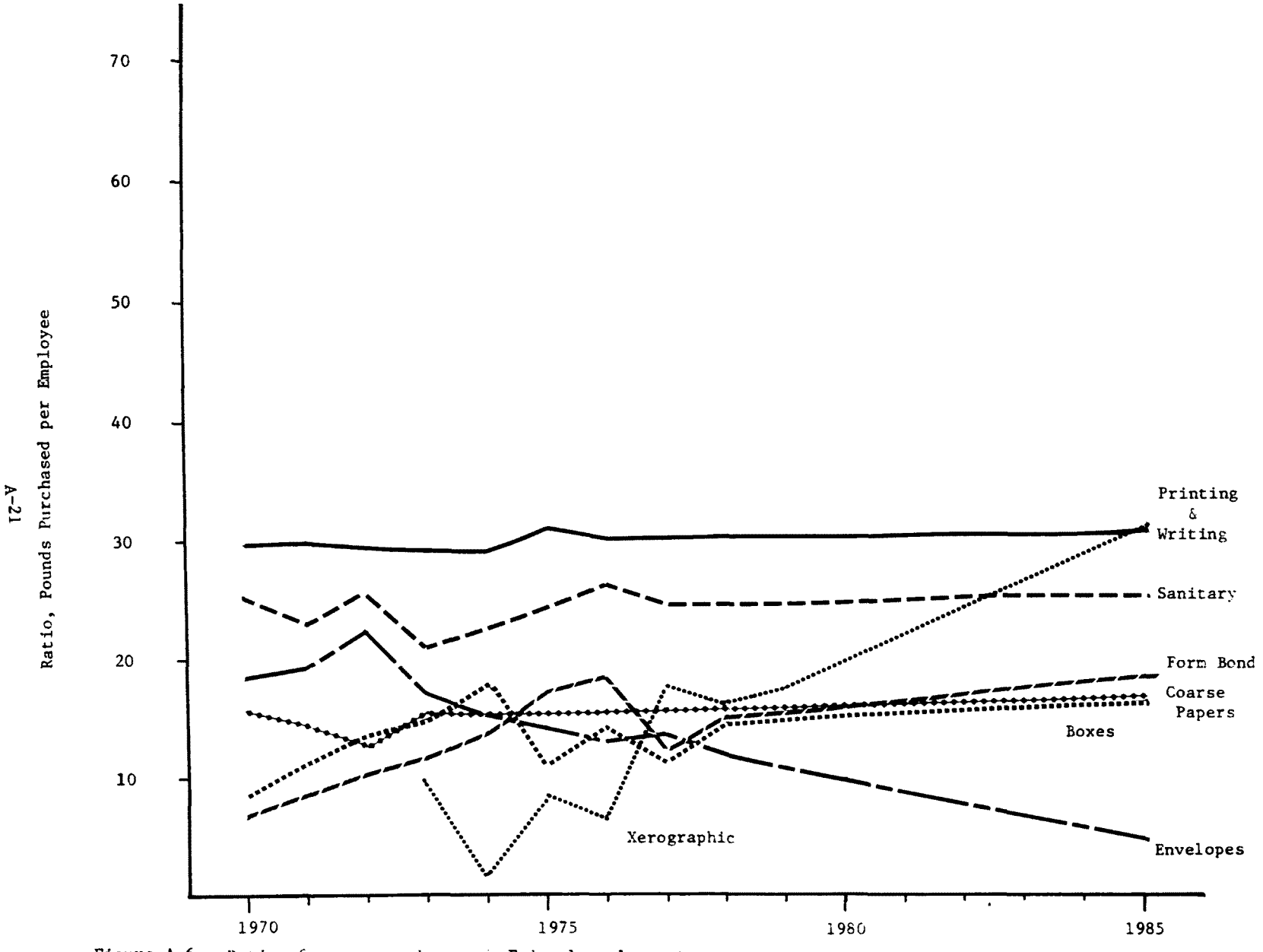

Figure A-6. Ratio of paper purchases to Federal employment.

Table A-7

PAPER CONSUMPTION PER REAL FEDERAL EXPENDITURE,[1/] BY SELECTED GRADES
(Pounds per Million 1972 Dollars)

Year	Printing & Writing	Sanitary Papers	Tab Cards	Envelopes	Coarse Papers	Boxes	Xerographic
1970	63.4	53.8	14.0	39.4	34.0	17.2	N/A
1971	61.2	47.4	17.8	39.3	30.3	22.6	N/A
1972	56.0	48.2	19.8	43.1	24.6	25.8	N/A
1973	54.6	39.4	21.4	32.2	29.1	27.8	17.8
1974	55.4	43.2	26.4	28.9	28.8	33.7	3.6
1975	54.0	42.8	29.8	25.3	29.8	19.0	14.6
1976	49.2	42.8	18.8	21.2	24.0	23.2	11.1
1977	46.8	38.1	18.7	21.6	24.5	18.2	27.7
1978	45.4	38.8	24.2	18.8	25.0	23.2	23.2
1979	43.2	38.2	25.0	16.8	24.6	23.2	25.8
1980	41.0	37.6	25.6	15.2	24.2	23.2	28.6
1981	38.8	37.0	26.0	13.6	23.8	23.0	31.4
1982	36.6	36.4	26.4	12.2	23.6	23.0	34.0
1983	34.6	36.0	26.8	11.0	23.4	23.0	36.8
1984	32.4	35.6	27.1	9.8	23.0	23.0	39.6
1985	30.2	34.2	27.6	8.8	22.8	22.8	42.2
Best-fit relationship:	Linear	Log*	Log-Log	Exponental	Log	Linear*	Linear
r^2:	0.925	0.794	0.395	0.891	0.534	0.001	0.236

1/ Total domestic expenditures, 1972 dollars.
* Most promising prediction.

Source: GSA Memos, Statistical Abstracts, 1977, and FAL projections.

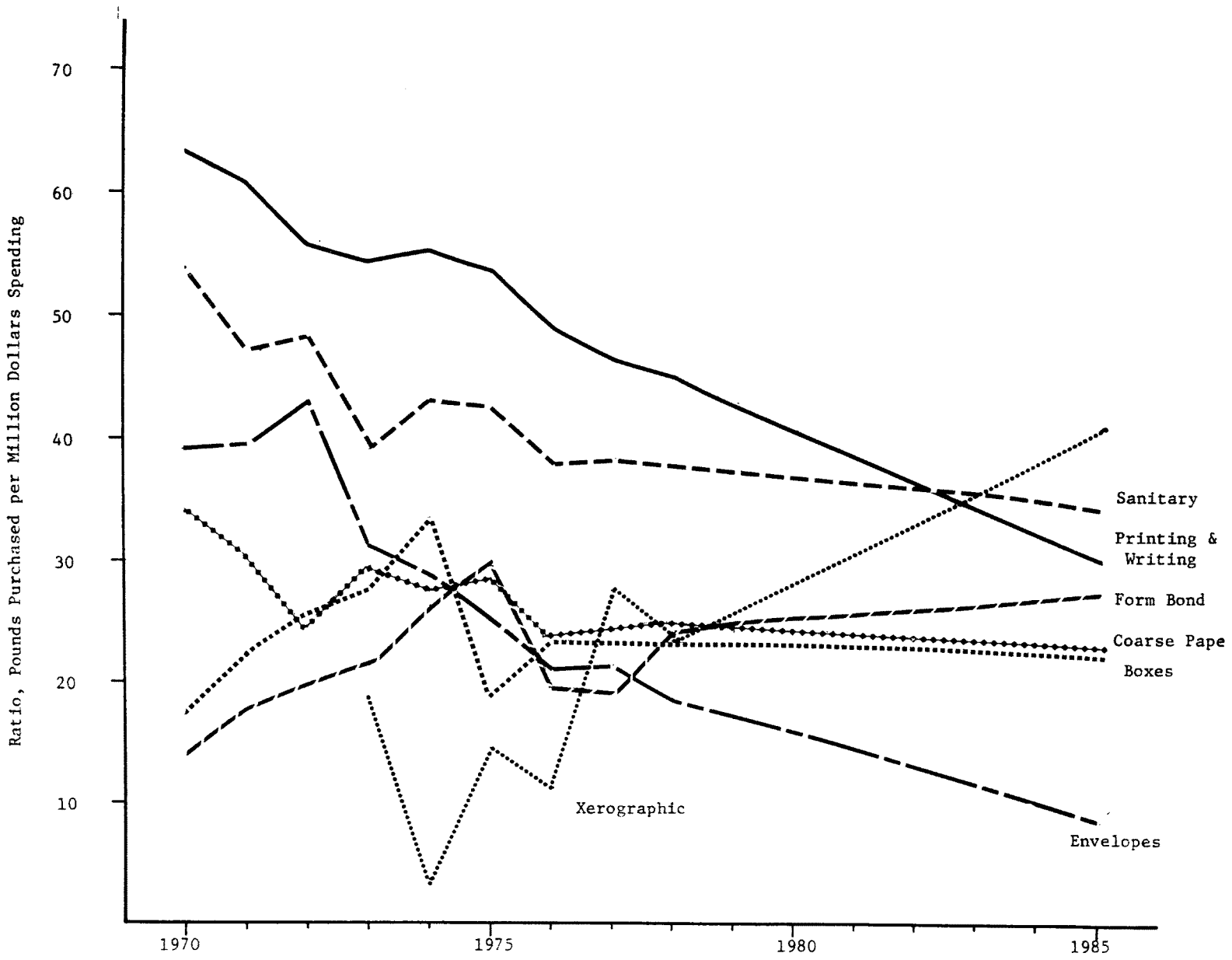

Figure A-7. Ratio of paper purchases to real Federal spending.

In the absence of a clear functional basis for expecting future government purchases to be consistent with historical government purchases, it is likely that the higher correlations obtained in this statistical analysis may be artifacts of the analysis procedure. Significantly, all of the trend analyses considered in this report had to be smoothed somewhat by adjusting the data for the years 1974 through 1976. Before the adjustments were made, the raw data series resulted in clearly absurd statistical results. The implication is that the projected values of these ratios may reflect the "smoothing" more than the historical reality. Thus, the projected ratios must be considered with the utmost caution.

CONCLUSION

The various analyses undertaken and described in this appendix have investigated associations between Federal purchases of paper products and a number of seemingly-related independent variables in an attempt to develop a useful predictive tool for evaluating alternative policy decisions. The raw data were considered as aggregates, graphically by grade, statistically with respect to simple correlations, trends, and a simple multi-variant analysis. Unfortunately, none of the techniques employed (nor even those considered) exposed a definitely superior predictive measure.

Simply, the research discussed in this appendix indicates that the Federal Government purchases a relatively small amount of paper products, both directly and indirectly, with respect to total domestic production of paper products. Further, Federal purchasing policies have historically resulted in dramatic year-to-year fluctuations in purchases of various grades of paper and paper products. These fluctuations are relatively uncorrelated with the predictive measures investigated in this study. The most useful statistical result was that the ratio of Federal paper purchases to Federal employment and/or Federal non-foreign expenditures in real dollars occasionally demonstrated some consistencies. These trends might be used to make rough estimates of future ratios between these independent measures and Federal paper purchases.

Interestingly, the GSA did not furnish any projections for their future purchases, and the projections offered by the GPO are highly suspect. For example, the cover letter attached to the GPO data states that "production demands for printing and binding by the Congress will continue to grow at approximately 5 to 6 percent annually through 1984." This prediction is noteworthy because the GPO purchases of paper have been shrinking by approximately 5.5 percent per year since 1970 (although it is not clear if dollar purchases might have been intended as the basis of the statement in the cover letter). Obviously, the projections offered in this appendix should be used only with the utmost caution.

Appendix B

AMOUNTS OF PAPER AND PAPERBOARD PRODUCTS PURCHASED BY STATE AND LOCAL GOVERNMENTS

INTRODUCTION

EPA guidelines will influence state and local government purchases. It is a matter of law that the guidelines will apply to purchases in excess of $10,000 when made with Federal funds, so to the extent that this will apply to state and local governments, the guidelines will be honored. Perhaps more important will be the voluntary use of the guidelines. Many state and local governments have already expressed interest in the guidelines because of their desire to purchase recycled materials. As a result, it is expected that there will be a ripple effect of the guidelines from the Federal Government level to the state and local government level. Therefore, in order to assess the impacts of the guidelines, it is necessary to determine the potential amounts of paper and paperboard products purchased at these levels.

The research discussed in this appendix investigates the amounts of paper and paper products purchased by state and local governments and local school districts. Purchases of selected grades of paper at these governmental levels is estimated and then compared to the corresponding Federal paper purchases. The maximum potential "multiplier effect" is evaluated, assuming that these lower levels of government would employ paper procurement policies consistent with those of the Federal government.

Whether or not Federal procurement policies might actually be implemented at lower levels of government is discussed more thoroughly in Appendix C of this report. For the purposes of the present investigation, it is assumed that paper procurement policies and procedures would be consistent at all governmental levels.

METHODOLOGY AND DISCUSSION

State Government Paper Purchases

The first step in estimating the potential "multiplier effect" of state government purchases of paper and paper products was to determine the amounts of paper and paper products purchased by selected states. Thirteen states were contacted by telephone or with a personal interview to solicit their cooperation in providing historical records of state paper purchases for a recent year. The states contacted include the following: Florida, New York, Ohio, Minnesota, Wisconsin, Kansas, Missouri, California, Texas, Washington, Arkansas, Oklahoma, and Maryland.

As discussed in detail in Appendix C of this report, not all of these thirteen states were able to provide the requested data in a usable form. In one instance, no records were kept. In four other instances, the state data retrieval systems were so cumbersome as to make collection of the data impractical. In one state the data were clearly erroneous, and in two additional states the copying effort required was overwhelming.

Only five of the thirteen states contacted were able to provide usable data: Washington, Maryland, Wisconsin, Kansas, and Minnesota. Each of these states responded completely, providing copies of their estimated and/or verified purchases for the current or immediately past fiscal or calendar year. These data were stated in physical units of sheets, reams, pounds, or cases. Sufficient physical description of each item was provided to allow an estimate of the item's weight to be made. The data are summarized in Table B-1, showing the consumption of each of eight major grades of paper products for each of the five responding states.

It was originally intended that the raw data for this analysis would be obtained from a representative sample of all of the states. That is, it was intended to solicit data from both large and small states as well as states of medium size. Likewise, it was intended to solicit data from states having many employees, fewer employees, and relatively few employees. Unfortunately, all of the states responding with data for this analysis are approximately the same size and have between 36,000 and 69,000 employees each. This narrow range of state employment does not present the extremes of the range of state employment very well. For example, Wyoming has only 8,000 employees while California has 222,000 employees. However, at least the responding states represent a good sample of the center range of the state employment scale. At least in this sense, the responding states are fairly "typical." (Discussion of some of the problems encountered in obtaining data from the larger and smaller states is discussed in more detail in Appendix C of this study.)

On the basis of the data provided by the five responding states, a simple regression analysis was performed on the purchases of each grade of paper with respect to state employment. It was anticipated that a relationship between state employment level and state purchases of paper would be positively correlated to a significant degree. Unfortunately, no satisfactory significant correlations were found with this technique.

The data from the state of Kansas are especially disconcerting. The data indicate Kansas to be one of the largest consumers of paper and paper products at the same time it is one of the smallest employers. This inconsistency is apparently the result of the purchasing system employed by the state of Kansas, one which has been used as the model for several other state purchasing systems because of its superior performance. It seems likely that the paper consumption reported by Kansas is not unusually high, but rather that the consumption reported by the other states is significantly understated due to "leaks" in their purchasing system.

Table B-1

STATE PAPER PURCHASES, 1976
(tons)

State	Mimeo	Duplicator	Bond	Xerox	Form Bond	Offset	Toilet Paper	Towels	Total
Washington	123	210	1,097	279	550	1,000	125	281	3,665
Maryland	200	108	132	N/A	N/A	351	154	150	1,095
Wisconsin		1,982				2,257	N/A	N/A	4,239
Kansas	185	132	298	340	606	1,457	558	1,618	5,194
Minnesota	136	117	240	292	200	59	167	209	1,420
Totals	Total Printing/Writing Grades: 12,351. Total Sanitary Grades: 3,262								15,613

Source: Franklin Associates, Ltd., based upon private communications.

When no significant statistical correlation between paper purchases by grade versus state employment could be determined, an attempt was made to statistically correlate total paper purchases to state employment. Unfortunately, this effort was also unsuccessful. As shown in Table B-2 (below) there is no apparent relationship between state employment and total paper purchases by the state. These data are presented as a scattergram in Figure B-1.

Table B-2

PAPER PURCHASES OF SELECTED STATES

State	Employment	Total Paper Purchased
Washington	63,000	3,665 tons
Maryland	69,000	1,095 tons
Wisconsin	53,000	4,239 tons
Kansas	36,000	5,194 tons
Minnesota	51,000	1,420 tons
Total	275,000	12,351 tons printing/writing paper 3,262 tons sanitary paper 15,613 tons, total

Source: Franklin Associates, Ltd. and Statistical Abstracts, 1977.

A final attempt to estimate the total amounts of paper purchased by state governments was made by aggregating the reported data into two broad categories: printing and writing paper, and sanitary paper. The purchases in each of these categories was totaled for all five states and then divided by the total number of employees for all five states. This calculation resulted in a consumption of 90 pounds of printing and writing paper per employee per year, and 30 pounds of sanitary paper per employee per year, averaged across the five states reporting.

Using these estimated consumption ratios and the total state employment for the nation (2,799,000 employees), the total consumption of printing and writing paper is estimated at 125,955 tons. Similarly, the total state consumption of sanitary paper is estimated at 41,985 tons per year.

Since a total of 13,149,500 tons of printing and writing paper were produced in 1976, the state consumption of these papers represents approximately 0.95 percent of the total. Correspondingly, since 4,186,200 tons of sanitary papers were produced in 1976, the state consumption represents 1.00 percent of the total U.S. production that year.

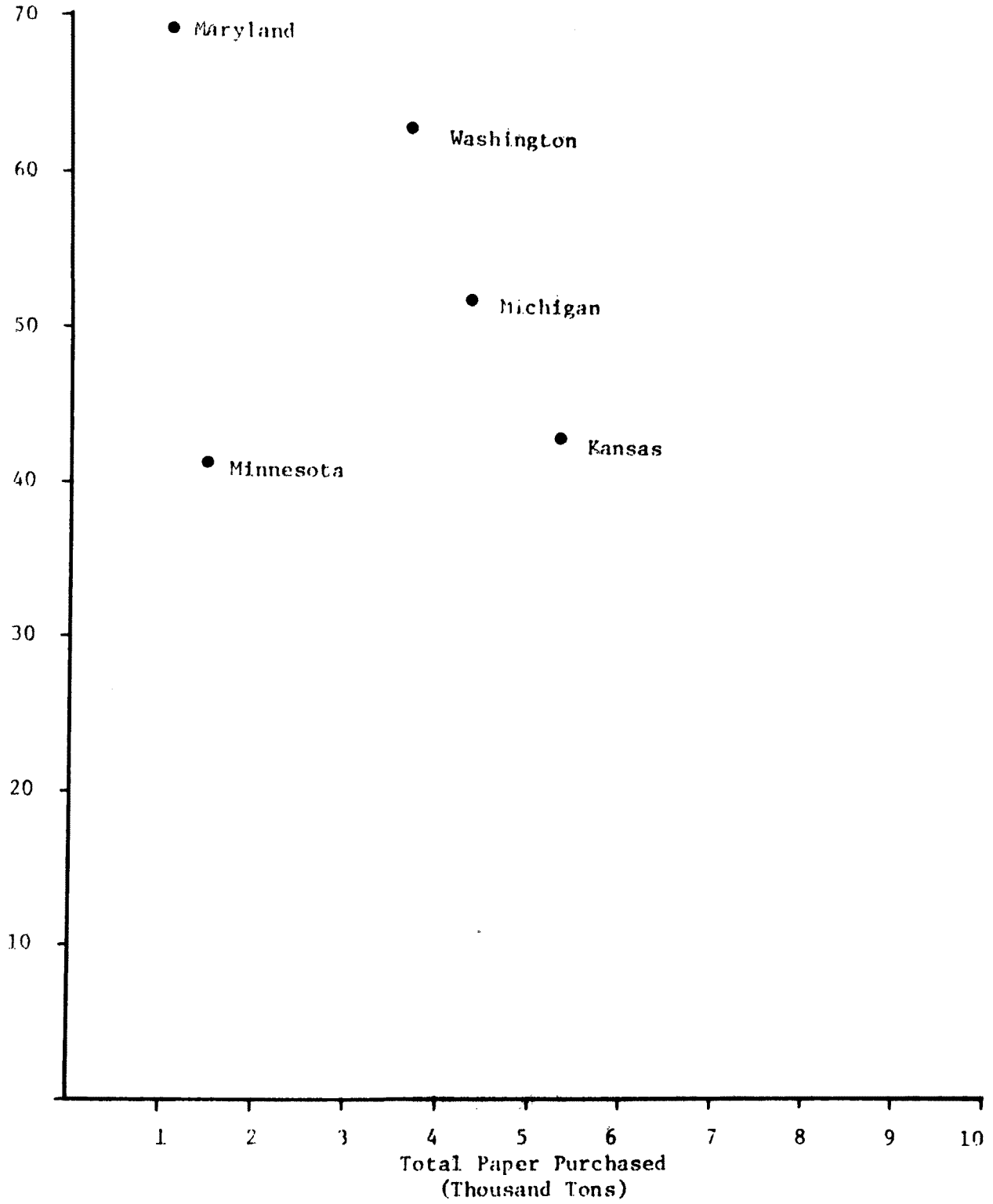

Figure B-1. Comparison of employment to paper purchases for five states.

Local Governmental Paper Purchases

Estimation of the amounts of paper and paper products purchased by local governmental units is complicated by the fact that some 78,000 local governmental units were identified by the 1972 Census of Governments. These local governmental units range in size from towns which are barely more than crossroads in the country to mammoth bureaucracies such as New York City. Further, the size of local governmental units is not distributed evenly throughout this range. For sociological and economic reasons, local governmental units are more likely to be of certain sizes than of others. Thus the sampling technique used to estimate state purchases would be difficult to implement for the local government level.

In consideration of these difficulties, a macro-economic approach was used. While this methodology may seem simplistic, even a moderate error in these calculations is insignificant, as discussed in Appendix C of this study. For the purposes of this analysis, it is first assumed that the estimates of paper consumed at the state level (as discussed above) are reasonably accurate. Second, it is assumed that for local governments to spend a dollar of revenue, only 25 percent of the paper required at the state level is needed. While this second assumption is somewhat arbitrary, it is based upon an interview with a local government official in Kansas City concerning the relationship between paper purchases and total budget. Third, it is assumed that local governments purchase principally writing papers, notably for office photocopying equipment.

As determined in the first section of this appendix, it is estimated that approximately 126,000 tons of writing paper were consumed at the state governmental level during 1976. Although total state government expenditures for 1976 are not yet available, such expenditures amounted to $156,171 million in 1975. Correspondingly, total local governmental expenditures totaled $162,320 million during 1975, including an indeterminant number of transfer payments between state and local governmental levels. Disregarding whatever degree of double-counting may be involved, local governments were apparently responsible for about 1.04 times the expenditures made for the state level.

It may be concluded that the level of activity in the local governmental level is roughly the same as in the state governmental level. By applying the 25 percent "efficiency factor" to the total state consumption of writing paper determined above (126,000 tons), it is estimated that approximately 32,000 tons of writing paper are consumed annually by all local governmental units in the United States. Using the simple calculation described in the previous section of this appendix, this local governmental consumption of paper and paper products represents approximately 2/10 of one percent of the total domestic production of printing and writing paper during 1976.

Purchases of sanitary paper by local governments is probably most closely related to employment. A total of about 7.3 million people were employed at the local government level in 1976, compared to about 2.8 million at the state level. This is a ratio of about 2.6:1. Since state consumption of sanitary paper is about one percent of total production, total local government use is probably about 2.6 percent of the total domestic production.

School District Purchases

Local school districts represent the third level of governmental organization which might be considered to "multiply" the effect of Federal paper procurement policies and procedures. In the absence of suitable macro-economic data concerning the expenditures of local school districts, this analysis undertook a survey of local school district administrators to determine the amounts of paper products which were purchased. First, in the Greater Metropolitan Kansas City Area, a complete census of the 17 different school districts was conducted. Second, telephone interviews were held with purchasing agents of the St. Louis public school districts, and finally, data were solicited from selected school districts in other states, notably Washington and Florida.

In each interview, inquiries were made as to the physical quantities of mimeo and duplicating grades of writing paper, and toilet paper and paper toweling grades of sanitary paper which were purchased by the district in anticipation of the current school year. Additionally, the anticipated enrollment was obtained for each school district. While this data collection procedure ignores inventory carryovers and potential overages/shortages, it still represents a reasonable approximation. The grades of paper selected for analysis represent the four largest grades of paper consumed in the greatest quantities by school districts. (Tablet and notebook papers are purchased by individual students at local retail outlets.)

Table B-3 presents a summary of the data obtained. In several cases, separate accountings for mimeographing and duplicating papers were not available and a combined total is presented instead. Perhaps the most interesting aspect of these figures is the wide range of variation between the districts. Enrollment ranged from a low of about 4,000 to a high of about 45,000. Annual consumption ratios of mimeographic papers ranged from 0.05 reams per student to 0.40 reams per student, and were found to have insignificant statistical correlation with enrollment. The consumption of duplicating papers was more closely correlated with enrollment, but ranged from 0.84 reams per student to 2.20 reams per student.

As with the data obtained from the state level survey discussed in the first section of this appendix, it was found that the best overall indicator of school district consumption was obtained by aggregating the totals. It was found that these aggregate totals were satisfactorily correlated with enrollment in a linear relationship, as would be expected. The regression analysis technique described in the first section of this appendix was used for this investigation as well, and indicates that for each additional student enrolled, the school districts consumed a little over 2.1 additional reams of printing and writing paper. Further, each school district consumed an average of about 32,000 reams per year per district.

Table B-3

KANSAS CITY METROPOLITAN
SCHOOL DISTRICT PAPER PURCHASES

District	Enrollment	Mimeo (reams)	Duplicator (reams)	Toilet Tissue (8-oz rolls)	Towels (cases)
North K.C.	19,514	28,000		24,000	1,500
ratio:		1.43		1.22	0.077
Raytown	13,756	17,770		15,360	975
ratio:		1.29		1.12	0.071
Shawnee Mission	39,000	15,740	64,191	19,296	1,272
ratio:		0.40	1.64	0.49	0.033
Kansas City, Mo.	45,250	2,400	100,000	57,600	3,096
ratio:		0.05	2.20	1.27	0.068
Kansas City, Ks.	27,700	3,290	23,200	28,800	3,000
ratio:		0.11	0.84	1.03	0.108
Park Hill	6,693	14,340		8,640	525
ratio:		2.14		1.29	0.078
Independence	13,060	1,680	18,100	14,400	1,225
ratio:		0.12	1.38	1.10	0.094
Grandview	5,910	10,000		9,600	500
ratio:		1.69		1.62	0.085
Center	3,926	N/A	N/A	5,280	375
ratio:				1.34	0.096
Hickman Mills	11,493	16,900		30,720	786
ratio:		0.68		2.67	0.068
Turner	5,000	4,050		6,528	335
ratio:		0.81		1.30	0.067

To estimate the market share represented by school district purchases of printing and writing paper, the number of students enrolled in grades K through 12 was multiplied by the average per capita consumption for each of the three grades of paper considered in this analysis. It is unlikely that Federal policy mandates would influence the purchasing policies of parochial schools, so the public school enrollment for 1975 of 45,053,000 was used for the purposes of this analysis. Use of this figure ignores consumption by school faculty and staff, but this omission does not appear to substantially distort the result.

Since the survey conducted in Kansas City indicates that 2.1 reams of mimeo and duplicating papers were consumed per student per year, it is estimated that 94.6 million reams of paper were consumed in 1975. Assuming that each ream of paper is of "20 substance" and thus weighs approximately five pounds, it is estimated that approximately 236.5 thousand tons of mimeo and duplicating papers were consumed in public school districts nationally during 1975. This is equivalent to roughly 92 percent of the total domestic output of mimeo and duplicator papers.

It would seem that a unique situation exists with respect to the consumption of mimeo and duplicating papers by school districts. As discussed above, this investigation indicates that school districts consume approximately 92 percent of the total domestic output of mimeo and duplicating papers. This result is most unusual, considering the relatively small market shares represented by school district purchases in other grades.

This estimate may be reasonably accurate, however. The mimeo and duplicator grades of paper are specially formulated and calendared for good results in relatively specialized duplicating equipment. They are not generally satisfactory for most other purposes. A casual survey of secretaries and ex-teachers in our office building indicated that most spirit duplicating and mimeographic equipment is found in and used by schools. While churches and a few groups such as Boy Scouts occasionally use such equipment, the vast majority of businesses employ photocopying and Xerographic copiers exclusively. This seems to be especially the case for spirit duplicating ("Ditto") equipment, which is found almost exclusively in schools. Thus it may be that the unusually high estimate of school district consumption of mimeo and duplicating grades of paper may be understandable after all.

The estimate of sanitary paper consumption by school districts was determined in an analogous manner. The Kansas City census indicated that each study consumes approximately 1.25 rolls of toilet paper each year, each roll weighing about 8 ounces. Using this ratio, it is estimated that 14.1 thousand tons of toilet tissue were consumed by school districts during 1975. This is equivalent to approximately 0.3 percent of the total domestic production of toilet paper that year. While this estimate may appear somewhat low, it is quite probable that students arrange their bowel habits so as to minimize their use of school restrooms. Especially in the secondary schools, the appeal of using school sanitary facilities for sanitary purposes is low.

The analysis of paper towel consumption was confounded by the fact that some districts purchased towels in roll form while other purchased towels in folded form and others purchased towels in both forms. To derive a common denominator, case counts were used for all districts regardless of the type of towel actually purchased. The consumption of paper towels was more highly correlated with enrollment than was the consumption of toilet paper, but less so than the consumption of printing and writing papers. The consumption ranged from a low of 0.03 cases per student to a high of 0.11 cases per student per year. On the average, the districts surveyed consumed approximately 0.08 cases per student per year. It was not possible to state this estimate as a percentage of total production of paper towels because of the wide variation of towel types encountered, which prevented assessment of a reasonable weight estimate.

CONCLUSION

As determined by the procedures described above, it is estimated that the state share of printing and writing paper consumption is approximately 0.95 percent of total annual domestic production. Similarly, it would appear that the market share represented by local governmental units is approximately 0.2 percent of total production, while the market share represented by school districts is approximately 1.8 percent. Totaling these provides the conclusion that the total market share of printing paper production represented by consumption for state, local, and school district activities represents approximately 3 percent of total production. Since the consumption of printing and writing papers for Federal level activities represents approximately 1.25 to 1.50 percent of the total production (as determined in Appendix A of this report), it may be concluded that the state-local government purchases are approximately double the size of Federal purchases.

In an analogous manner, the multiplier effect for sanitary papers may be estimated. The consumption of sanitary papers at the state government level was estimated at 1.0 percent of total domestic production. Use at the local government and school district levels is estimated at 2.6 percent and 0.3 percent, respectively. These total about 3.9 percent of the total annual domestic production of sanitary papers. Since the Federal consumption of these grades is approximately 1.5 percent, it may be concluded that the "multiplier effect" for sanitary grades may be as high as 2.6.

Appendix C

PURCHASING POLICIES OF STATE GOVERNMENTS, LOCAL GOVERNMENTS, AND SCHOOL DISTRICTS

INTRODUCTION

It is frequently assumed that the influence of Federal policies and programs will be magnified as state and even local governments follow the Federal example. This assumption is basic to the presumption of the economic "multiplier effect" discussed in Appendix B of this report. However, unless the "modeling effect" of policy emulation occurs, whatever additional economic impact that might exist may not be directed towards enhancing the effects of Federal action. This appendix investigates the potential "modeling effects" which may be associated with Federal paper purchasing policies. Also, the relationship between policy "modeling effects" and economic "multiplier effects" will be explored.

Policy emulation, or "modeling effects," may result from either or both of two substantially different causes. First, lower governmental units may voluntarily emulate the policy decisions of the Federal Government. Second, the Federal Government may employ economic or political coercion to force lower levels of government to adopt specific Federal policies. Since compliance with any policy frequently depends upon whether or not the policy was adopted willingly, it seems likely that the impact of potential "modeling effects" at lower governmental levels may depend upon whether or not the policies were adopted voluntarily.

Voluntary policy emulation may occur if it seems that the Federal Government has the resources to more thoroughly investigate certain policy issues than the state of local governments do. The policy decisions implemented at the Federal level may appear to reflect the best judgment available on a given issue. State and local governments, unable to support such policy decisions on their own, might voluntarily model their own policies after the Federal policy in these instances. Such voluntary modeling presumes that what is good for the Federal Government level for a specific issue is also appropriate and good for the lower governmental level. Voluntary "modeling effects" also presume that lower governmental units are politically and organizationally amenable to change.

The existence of involuntary "modeling effects" presumes that the Federal Government has the ability to coerce policy decisions at lower governmental levels. Clearly, the Federal ability to coerce exists. For example, the national speed limit of 55 miles per hour was adopted by every state, frequently with significant opposition. The Federal Government coerced reluctant states into adopting this legislation by threatening to withhold Federal highway funds support if the speed limit legislation was not enacted.

With respect to paper procurement policies, it is expected that both voluntary and involuntary factors may be employed to encourage the "modeling effects" at the state, local, and school district levels. The voluntary factor which would enhance the degree of Federal policy emulation would primarily be those of economic benefits. If Federal paper procurement policies were to allow lower levels of government to obtain equivalent-quality products at a lower price, almost certainly there would be significant voluntary "modeling effect." Another factor which would enhance voluntary "modeling effects" would be the public support which might accrue to socially worthy policies. For example, if the Federal Government were to adopt a paper procurement policy which had great emotional appeal to the general public, the degree to which such policies would be adopted by lower governmental levels would be significantly enhanced.

Involuntary "modeling effects" will probably also occur with respect to Federal paper procurement policies. For example, the Resource Conservation and Recovery Act (RCRA, PL94-580) provides that Federal procurement policies must be employed at lower governmental levels if Federally-supported expenditures for certain materials exceeds a minimum limit. Unfortunately, since such policy emulation is involuntary, it may be expected that some degree of non-compliance will occur. To the degree that such non-compliance exists, the effectiveness of the apparent "modeling effect" is reduced. Thus it may be that while "modeling effects" are necessary for the "multiplier effect" to exist, they are not by themselves sufficient.

METHODOLOGY AND DISCUSSION

The research for the investigation reported in this appendix was conducted through personal and telephone interviews with various state government, local government, and school district administrators. These interviews were initiated principally to obtain data concerning the amounts of paper and paper products purchased by the various agencies, but also included questions about the size, structure, and operation of the purchasing departments responsible for acquiring paper and related items. Frequently, conclusions about the effectiveness and efficiency of such purchasing operations were suggested by the amount, form, and apparent accuracy of the numerical data provided in cooperation with this analysis.

State Government Purchasing Policies and Procedures

As mentioned briefly in Appendix B of this report, thirteen states were contacted to solicit their cooperation in providing data for this study. The states contacted include the following: Florida, New York, Ohio, Minnesota, Wisconsin, Kansas, Missouri, California, Texas, Washington, Arkansas, Oklahoma, and Maryland.

These interviews made apparent that state purchasing policies and procedures varied widely. For example, the state of Ohio has no central purchasing office or record keeping for paper purchases whatsoever. Supplies for the various agencies in the state of Ohio were purchased locally and without the aid of a central office. In contrast, the state of Kansas has a full-time paper procurement officer who specializes in purchasing paper and related products for almost every state agency, including universities. This agent has access to a great deal of historical data of great detail. The remaining states contacted for this analysis seemed to fall between these two extremes with respect to sophistication in purchasing procedures and systems.

Even when formal purchasing departments were established, it was not uncommon for the record keeping to be unable to supply even one year of historical paper and paper product purchase data. For example, the data provided by the state of Missouri would seem to indicate that the entire state government consumes about as much paper as is needed to conduct the business of a single large urban school district.

Frequently historical data were available, but not in an easily-accessed form. For example, the states of Oklahoma, Arkansas, Texas, and Florida reported maintaining archives of records which supposedly contained the data requested, but to locate and copy these data was virtually impossible. It seems that the filing systems and staffs changed with each election, and little continuity was maintained.

In two instances, California and New York, the records presented an overwhelming copying task to the staff of the purchasing divisions. The data were not available in aggregate form, and the detail data were voluminous. Hence, no numerical data were provided by these states, either.

It seems that state purchasing activities tend to be more different than similar. The state purchasing administrators have widely differing levels of expertise with respect to paper products. As mentioned earlier, while one state employs a full-time paper specialist, most other states purchase paper products more as an auxiliary function to some other responsibility. For example, in one state sanitary papers are purchased by the Director of Building Services, who is principally concerned with custodial personnel, not paper. It would seem that the potential for both voluntary and involuntary "modeling effects" is at least partially dependent upon the organization of the state purchasing agencies. It seems likely that as the complexity of the Federal procurement policies becomes greater, the degree of "modeling effect" at the state level would decrease as less-sophisticated state purchasing systems become frustrated or overloaded. The wide range of differences found between various state purchasing systems suggests that the degree to which both voluntary and involuntary "modeling effects" occur will probably vary widely.

Voluntary "Modeling Effects." As was mentioned earlier, voluntary modeling may occur when the Federal Government is perceived to have researched a policy issue thoroughly when state governments cannot. To the degree that the policy is economically beneficial to the state, it would seem that "modeling effects" would be evident. While this is probably true, it may not always seem so. For example, in 1971 the GSA began to change their purchase specifications in such a way as to encourage the use of recycled fiber in paper and paper products. The development of these revised purchasing standards was generally publicized, and about 30 states and some large cities approached the GSA for copies of these revised procurement specifications. This was initially interpreted as indicating a pronounced voluntary "modeling effect." However, of the 13 states contacted and interviewed for this study, including nine which had requested copies of the new GSA specifications, not one of these states had implemented the new specifications.

In exploring why the apparent enthusiasm for emulating the Federal specifications was not actualized, it was found that, generally speaking, the state purchasing systems not only lack the expertise and resources to develop sophisticated policies, they also lack the necessary resources to implement and monitor such sophisticated specifications. Thus, the potential modeling of the Federal procurement specifications required a realignment of manpower and budget which was not structurally feasible, even if economic benefit would result in the long run.

Voluntary "modeling effects" may also result from public support for a given Federally-implemented policy. Environmental and ecologically-sensitive policy decisions are examples of this type of motivation for voluntary "modeling effects." However, states vary widely in sophistication and sensitivity to environmental issues involving paper. For example, several states purchase only virgin grades of paper as a matter of tradition or policy. In contrast, at least three states (Maryland, Missouri and California) maintain special agencies for the purpose of encouraging resource conservation practices in state government. Just as the sensitivity to ecological issues and desire for public support vary from state to state, it seems likely that the degree of voluntary "modeling effect" for paper procurement policies will also vary. In those states which are generally sensitive to resource and ecology issues, it seems likely that voluntary modeling would occur to a large degree if Federal policies were to generate public support for those issues. Correspondingly, the degree of modeling would be less in those states which are not especially sensitive to those issues.

Involuntary "Modeling Effects." Federal paper procurement policies may be modeled involuntarily as well. The Resource Conservation and Recovery Act (RCRA) (PL-94-580) includes provisions requiring the adoption of Federal procurement policies if Federal money is used to purchase paper products in amounts in excess of $10,000. It is difficult to estimate how much "modeling effect" will result from this provision, since relatively few state paper or paper products purchases involve amounts larger than a few thousand dollars at a time. Frequently, as discussed above, state purchasing procedures are so decentralized that paper purchases which may aggregate to above this limit may not be recognized because they are so widely distributed as small purchases.

Certainly in some states, extensive auditing and monitoring efforts would have to be implemented to verify compliance with regulations as included in RCRA. In addition, involuntary emulation of Federal policy is likely to be seen as something to be thwarted, not supported, by state administrators.

Local Government Purchasing Policies and Procedures

The potential "modeling effect" at the local governmental level for Federal paper procurement policies was evaluated through a series of personal and telephone interviews with officials of the various municipalities comprising the Greater Kansas City Metropolitan Area, which consists not only of the twin cities of Kansas City, Missouri and Kansas City, Kansas, but also 112 local jurisdictions, including counties. These smaller governmental units represent from 100 to approximately 100,000 residents each. Kansas City, Kansas has an estimated 1975 population of 168,000, while Kansas City, Missouri has an estimated 473,000 inhabitants.

It was found that only the Kansas City, Kansas and Kansas City, Missouri municipalities purchase their paper and paper products through a contract bid process. These contracts are awarded every two years for most paper products, and only those vendors located within the respective municipalities are considered for award. Apparently the allegiance of local government to local vendors is strong, not only in the Kansas City area but also in other cities generally. It seems likely that the smaller the municipality, the stronger this allegiance may be.

Indeed, in municipalities having fewer than 100,000 inhabitants, purchases of paper and paper products are frequently handled without formal contract/bid procedures. Of the 18,517 cities incorporated in the United States (1975 census), 99.1 percent of these served fewer than 100,000 inhabitants, and 97.9 percent of these served fewer than 50,000 inhabitants. Thus it seems that the vast majority of municipalities purchase paper and paper products exclusively from local vendors without formal purchase agreements. In the Kansas City Metropolitan Area, for example, not one of the several jurisdictions surveyed had formal paper procurement policies. All of the municipalities surveyed except Kansas City, Missouri and Kansas purchased paper as needed from local stationery stores within their respective city limits. Such "hand-to-mouth" paper procurement procedures suggests that essentially no "modeling effect" of Federal policy is likely to occur at local governmental levels.

The cities of more than 100,000 inhabitants, comprising less than one percent of the cities in the United States, may have purchasing procedures capable of emulating Federal paper procurement policies. It seems unlikely that even cities would adopt Federal procurement policies voluntarily, however. Even if Federal policies were imposed upon these largest cities, the magnitude of their paper purchases would remain an insignificant share of the total paper market. Hence, the potential economic "multiplier effect" which might be obtained from local governments seems insignificant.

School District Purchasing Policies and Procedures

To assess the potential "modeling effect" which might occur at the school district level, a census of school districts in and around the Greater Metropolitan Kansas City Area was conducted. In addition, telephone interviews were conducted with purchasing agents of the St. Louis Public School District and the King County Directors Association in the state of Washington. As in the interviews with state purchasing officials, discussed earlier in this appendix, information about the size, structure, and operation of the purchasing operations at the school districts was solicited as well as the numerical data reported in Appendix B of this study. This census included all of the 17 different school districts in the Greater Metropolitan Kansas City Area, serving from 4,000 to 45,000 students each.

The first finding of these interviews is that school district purchases are made by full-time purchasing personnel only in the very largest school districts. Only three of the 17 districts interviewed employed formally-titled purchasing agents. The remaining 14 districts assigned purchasing responsibilities to various teachers and staff throughout the district, frequently on a volunteer basis.

Second, in all but one case, the people contacted for assistance with this study were extremely cooperative and equally busy. However, providing even the minimal amount of information requested for this study clearly imposed a significant administrative burden upon these people in many cases. It seems that any Federal policy which would increase the work load upon these individuals will not be "modeled."

Third, it was found that (with the exception of the three largest districts) paper products were purchased by the principal users of the products as opposed to a paper purchasing specialist. That is, sanitary papers were most commonly purchased by the director of custodial services, while ditto, mimeo, and Xerographic papers were purchased by staff in the superintendent's office, and specialty papers were purchased by individual teachers through their local school office procedures. In short, there were no centralized purchasing procedures in any but the largest three districts. It would seem that the likelihood of "modeling effects" is correspondingly diminished in such decentralized purchasing systems.

Of the 88,695 public schools in the United States (1975 census), the vast majority serve fewer than 150 students each. Correspondingly, the smaller the staffs of these numerous smaller schools, the less likely it is that "modeling effects" will occur.

Multi-district purchasing cooperatives have spontaneously been organized as budgets have decreased, prices have increased, and purchasing management resources have been fixed. In the census conducted for this study, three cooperative purchasing arrangements were discovered. One, in the Greater Kansas City Area, includes 13 rural and semi-rural school districts of suburban Jackson County, Missouri. A second cooperative outside of St. Louis, Missouri, serves some 40 independent school districts, and a third, much larger and more elaborate cooperative, has been established in the state of Washington and serves about 80 percent of the non-metropolitan

districts in the state. Communication between these three districts was non-existent, and no national federation or central organization of such cooperatives was discovered. Although the Kansas City cooperative knew of the St. Louis cooperative, the reverse was not true. Neither of the two Missouri cooperatives knew of the Washington cooperative. Each cooperative took great pride in having originated the cooperative purchase concept.

Without some central coalition and communication between such grassroots cooperatives, it is difficult to guess how many other such spontaneous cooperative arrangements have been organized. If there were to be a central administration, or even communication organ, it might be expected that some degree of voluntary "modeling effect" of Federal policies might occur, providing that they were economically beneficial to the local districts. Without such a central focal point for policy formulation, it seems unlikely that purchasing cooperatives will experience significant amounts of "modeling effect."

This conclusion is supported by the wide range of sophistication observed between the three purchasing cooperatives discovered in this study. On one hand, the Kansas City area cooperative met approximately twice a year to loosely organize the work of the cooperative. All work for the cooperative was done on a spare-time basis by volunteers working through their local chapter of the NEA. With respect to paper procurement, the principal achievement of this cooperative was the negotiation of an open-ended purchase agreement with a local paper vendor for mimeo, duplicating, and sanitary papers. The contract negotiated most recently was at a price only marginally improved over retail.

In contrast, the cooperative in the state of Washington is incorporated as a not-for-profit organization and maintains warehouse and transportation facilities. A small percentage markup is added to the price of the goods handled to cover the administrative costs incurred, and the price to the local school districts is close to that of volume wholesale purchases. This agency supplies varying amounts of paper products to about 80 percent of the school districts in the state. Significantly, the largest school districts do not participate in this organization. The larger school districts in the state of Washington, as elsewhere, maintain their own independent purchasing systems.

Cooperative purchasing agreements of a different kind were also explored with respect to paper procurement for school districts. Some states allow lower governmental units to purchase through state purchasing agreements and procedures. To estimate the extent of such state-district cooperation, purchasing administrators for 10 states in addition to the state of Washington, discussed above, were interviewed either in person or by telephone. It was found that the states of Florida, Ohio, Kansas, Missouri, Texas, Washington, and Maryland have no provisions for local school district purchases through state facilities or contracts. The states of Minnesota,

Wisconsin, and California allow the local school districts the option of purchasing through state facilities, but keep no records of purchases made by local school districts. California, for example, requires that such purchases be only in lots of a carload or more, although certain sanitary products could be purchased in smaller lots. New York and Maryland seem unique in that local governments and school districts (excluding New York City) use between 35 to 50 percent of the paper purchased by the state. Records of shipments to such local agencies are not maintained, however.

CONCLUSIONS

The degree to which potential economic "multiplier effects" will be aligned with Federal policy decisions depends upon the extent of "modeling effects" resulting from emulation of Federal policy at lower levels of government. It would appear that voluntary modeling of Federal policy would be more effective than involuntary or economically coerced adoption of Federal policy. The likelihood of voluntary policy emulation is a function of the perceived economic benefit to the lower governmental unit of adopting the Federal policy, as well as the political and organizational feasibility of such apparent cooperation with the Federal Government.

At the state level, the wide differences in organizations, expertise, and policy would suggest that the extent of "modeling effects" would vary widely. Generally, the more centralized and sophisticated the central purchasing system, the greater the likelihood that Federal paper procurement policies will be emulated. In addition, the more the state is sympathetic to resource conservation and ecological issues, the greater the likelihood that resource-conservative Federal paper procurement policies will be adopted. It seems unlikely that significant state level "modeling effects" will result from the fiscal incentives and constraints included in the RCRA act with respect to paper procurements.

At the local level, most such governmental units are so small that voluntary emulation of Federal policy seems highly unlikely. Paper purchases by most such small bureaucracies are apparently exclusively on a "hand-to-mouth" basis from local paper merchants in political favor.

At the school district level, as at the state level, a wide range of sophistication was encountered. The larger and more sophisticated the central purchasing operation, the more likely that "modeling effects" will occur. However, most school districts are very small and purchase paper products almost incidentally.

Even the cooperative purchasing agreements which involve many such small districts were found to be relatively unable to influence paper procurement policies of the constituent districts. It would seem that even with these cooperatives, the likelihood of school district "modeling effects" is nil.

Some states allow school district purchases of paper products to be made through the state purchasing facilities. In these instances, it seems more likely that Federal policies might be emulated at the school district level, providing that the states themselves model the Federal policies.

In summary, it appears that significant "modeling effects" at state, local, and school district levels of government are unlikely. Correspondingly, it is unlikely that the potential economic "multiplier effects" of Federal paper procurement policies will be realized.

The likelihood that lower governmental units will emulate any Federal paper procurement policy is apparently determined by the degree that such policies were economically beneficial to the states. That is, if a Federal policy were to lower the cost of paper products to the lower governmental units, the policy would be more likely to be adopted. Second, if a Federal policy generated widespread public support for a specific policy, then lower governmental units are more likely to adopt that policy. The ability to adopt any new policy is limited by the ability to restructure and change existing policies.

Finally, it seems likely that measures to force lower governmental units to adopt Federal paper procurement policies involuntarily will be unsuccessful for several reasons. First, the great majority of state, local and school district administrations are small, unsophisticated, and broadly diverse with respect to policies, procedures, and internal information systems. Monitoring Federal policy implementation across these organizationally and geographically widespread units would be overwhelming. Second, even in the larger, more sophisticated state, local, and school district administrations, the likelihood that additional Federal intervention into the present system and procedures is likely to be resisted for political and philosophical reasons.

In conclusion, not only is the economic "multiplier effect" small, as discussed in Appendix B of this study, but the likelihood that this economic "multiplier effect" would be aligned with Federal paper procurement policies is even smaller.

Appendix D

ENERGY REQUIRED TO MANUFACTURE VIRGIN AND RECYCLED PAPER AND PAPERBOARD

The mandate for EPA to prepare guidelines which are the subject of this report is contained in RCRA. The act also clearly states that overall resource conservation is a major goal. Thus, the possible energy impacts of the guidelines must be carefully considered.

The energy analysis here focuses on fossil energy, which excludes the energy derived from wood wastes which are generated and consumed on site during the manufacture of some kinds of paper and paperboard (self-generated energy). This source of energy is relatively fixed as to location, amount and potential utilization, and should not be viewed as part of the nation's general energy "reservoir." It is also renewable to the extent that trees used in paper and paperboard manufacture are renewable. If not used as an energy source by the paper and paperboard plants, this material would most likely be wasted. Thus, it seems to us that use of wood wastes in this fashion is a characteristic of a single industry, unlike fossil fuels such as gas, oil, and coal which are generally usable (and of finite extent).

The exclusion of energy from wood wastes is logical for policy analysis such as this. For example, the nation's best interests are served if a paper mill would substitute increased efficiency in use of wood wastes for use of natural gas. The so-called "black liquor" is not available for others to use. However, inclusion of the wood waste energy in this type of analysis would not show any advantage of the tradeoff of energy from that source for some fossil fuels. Thus, we have elected to focus only on fossil energy in this report.

In a recent report, the fossil fuel requirements of virgin and recycled paper products were studied.* The results of that study are used as the base for energy values derived here. Three basic methods of manufacture of products were considered. One method is to manufacture pulp from virgin materials and then transfer the pulp in a slush form to the paper manufacturing machinery nearby. Another option is to first dry the pulp and make it in to a product called market pulp. Market pulp can be stored indefinitely and shipped to remote locations before being mixed with water to form the slush pulp to be used in paper making. The third method is to use waste paper as the raw material to make a slush pulp for making paper. Drying of recycled slush pulp to make market pulp is almost never done.

* Hunt, Robert G., "Comparisons of REPA Impacts for Selected Waste Management and Manufacturing Options for Paper and Paperboard," unpublished memo prepared for Marion Thompson, Environmental Protection Agency, Office of Solid Waste, Washington, D.C., 1976.

The three sequences described are shown in Figure D-1. Virgin paper products are made primarily by the slush pulp method, and some grades of recycled paper are made entirely from recycled slush pulp. However, some important grades of paper--notably printing and writing paper--are routinely made of a blend of recycled slush pulp and market pulp in recycling mills. However, some virgin mills must also supplement their self-manufactured slush pulp with market pulp in order to achieve the needed pulp characteristics for certain products.

In order to calculate the energy required for recycled and virgin paper manufacture, Table D-1 was prepared. The table lists fossil fuel energy for 100 percent virgin and 100 percent recycled products. Also shown is the energy for market pulp manufacture.

At the present time, paper products--especially printing and writing papers--may or may not be manufactured with some market pulp, although light weight grades of printing and writing papers frequently require market pulp. This has important energy consequences, because use of market pulp introduces an extra energy-intensive drying stage in the paper manufacture sequence. This can be seen in Table D-1.

In order to assess this situation, Figures D-2 and D-3 were prepared. They show the energy intensity of paper products at various blends of market pulp.

It is apparent, ther, that in the status quo situation, the selection of recycled paper products can result in either more or less energy consumption, depending on the particular situation. However, if recycled paper use increases over the status quo, there is always an energy savings. This is shown in Figure D-4, where the data derived from Table D-1 are plotted. The figure shows that energy savings as high as 30 million Btu per ton of product are possible by replacing virgin fiber in the status quo with recycled fiber. This would amount to a 50 percent savings for the tissue products presently made from market pulp. However, increases in recycling that great are highly unlikely, with near term potential for energy savings more likely in the range of zero to 5 percent.

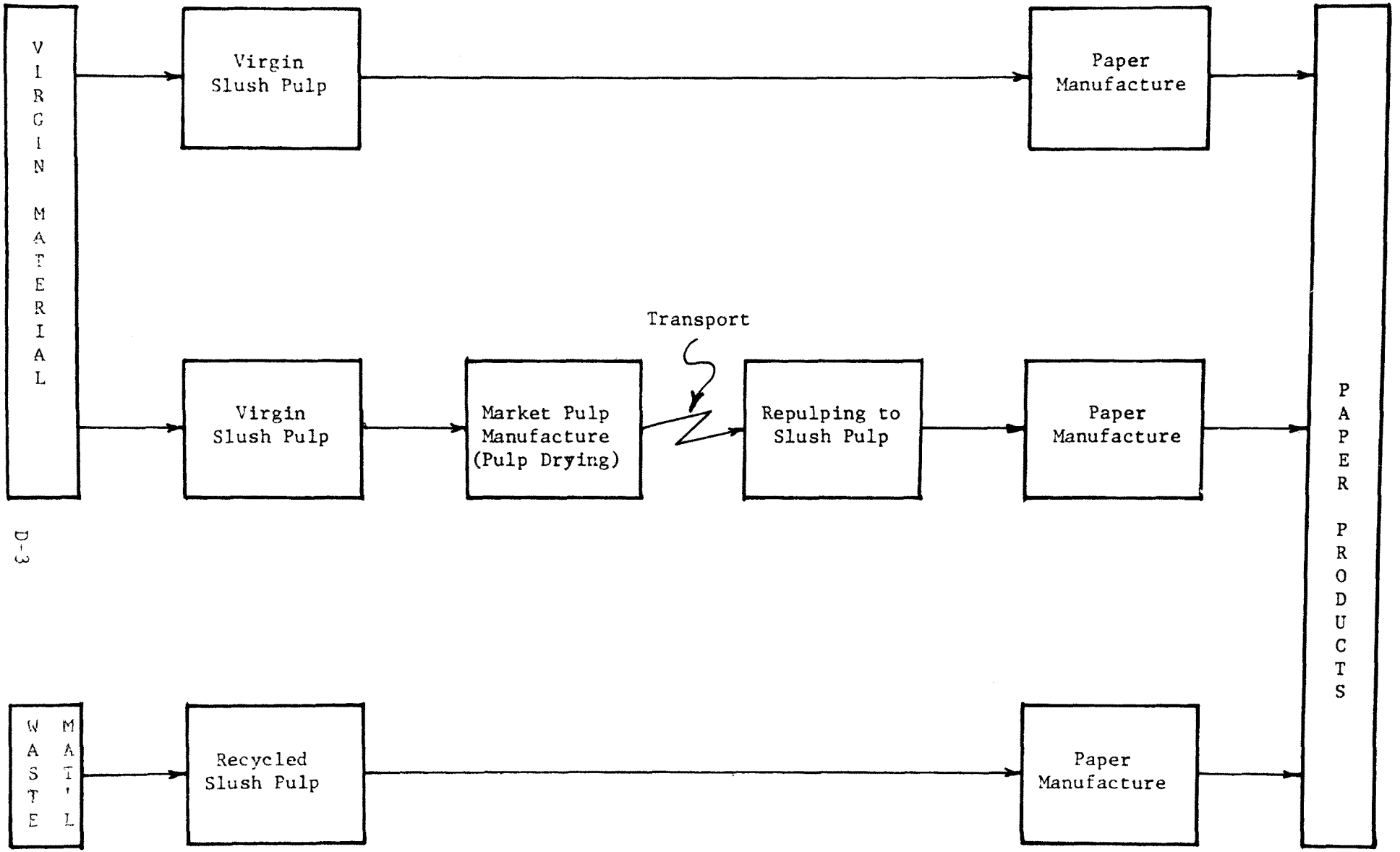

Figure D-1. Simplified flow diagrams of paper product manufacture by three methods.

Table D-1

ESTIMATES OF FOSSIL FUEL REQUIREMENTS
FOR VIRGIN AND RECYCLED PAPER
AND PAPERBOARD PRODUCT MANUFACTURING SYSTEMS
(10^6 Btu/ton)

	Virgin	Recycled	Difference	Source
Corrugated Containers	20	20	0	(1)
Packaging Paperboard	47	43	4	(4)
Paper Packaging	24	24	0	(1)
Printing Paper	49	44	5	(5)
Tissue	40	29	11	(7)
Newspapers	30	20	10	(5)
Printing Paper from Market Pulp	70	-	-	(8)
Tissue from Market Pulp	61	-	-	(9)

Note: In addition to the fossil energy listed here, self-generated power derived primarily from process wastes was used at an estimated rate of 18 x 10^6 Btu/ton for the manufacture of the following virgin grades: packaging paperboard, paper packaging, printing paper, tissue, and the two market pulps listed. For virgin corrugated containers, the value is 12 x 10^6 Btu/ton. No self-generated energy is used in the manufacture of newspapers. See text for a discussion of the self-generated energy.

TABLE D-1 NOTES AND REFERENCES

1. Page 174, reference 2, was used for virgin values, with difference in virgin and recycled from p. 25, reference 3.

2. Welch, Richard, Ron Fellman, May Simister, Dennis Viscek, William Franklin and Robert Hunt, "Resource and Environmental Profile Analysis of Five Milk Container Systems, With Selected Health and Economic Considerations, Volume I, Final Draft Report," prepared by Midwest Research Institute and Franklin Associates, for the Environmental Protection Agency, Office of Solid Waste, Washington, D.C., June 18, 1976.

3. Hunt, Robert G. and William E. Franklin, "Environmental Effects of Recycling Paper," presented to the 73rd National Meeting of the American Institute of Chemical Engineers, August 27-30, 1972, Minneapolis, Minnesota (Revised July 9, 1973).

4. Virgin packaging paperboard values were approximated by using values for gallon milk containers, from pages 4 and 176, reference 2. The difference between virgin and recycled is from p. 25, reference 3.

5. The virgin values are estimated from p. 15, reference 6, with the recycled value from reference 7.

6. Love, Peter, "Net Energy Savings from Solid Waste Management Options--Summary," prepared by Middleton Associates for Solid Waste Management Branch, Environment Canada, Toronto, Canada, September 1976.

7. Franklin Associates estimates.

8. Market pulp must be dried, shipped and subsequently recycled before being fabricated into paper products. It was assumed that the manufacture of printing paper from slush pulp is 49×10^6 Btu/ton (as shown in the table) with the added steps of using market pulp being pulp drying (16×10^6 Btu/ton, reference 7) and repulping (5×10^6 Btu/ton, reference 3). Transportation energy for the market pulp transport contributes only a small amount and was omitted from this analysis.

9. The same 21×10^6 Btu/ton increment above virgin products used in reference 8 was assumed to be valid for tissue.

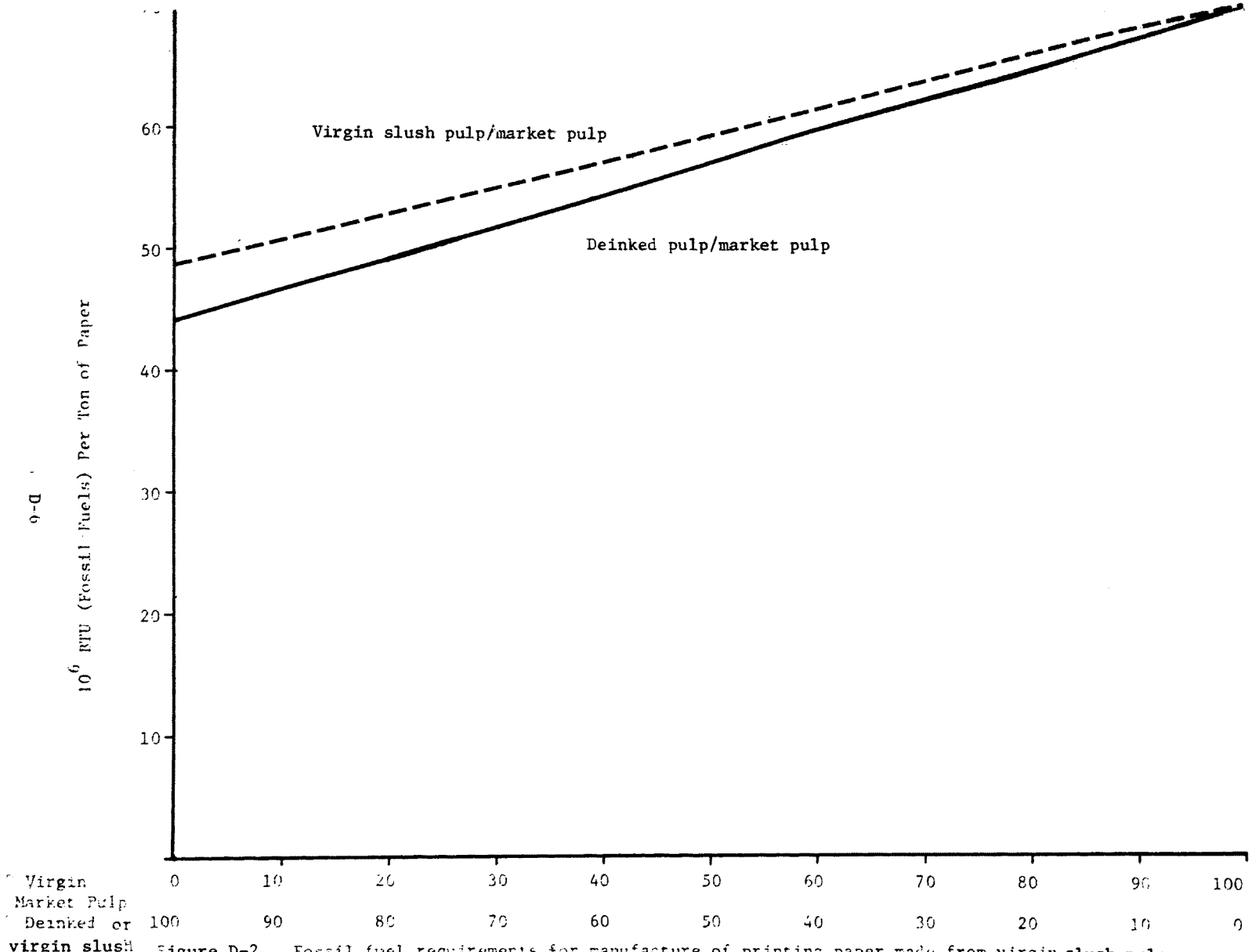

Figure D-2. Fossil fuel requirements for manufacture of printing paper made from virgin slush pulp, virgin market pulp and deinked waste paper pulp.

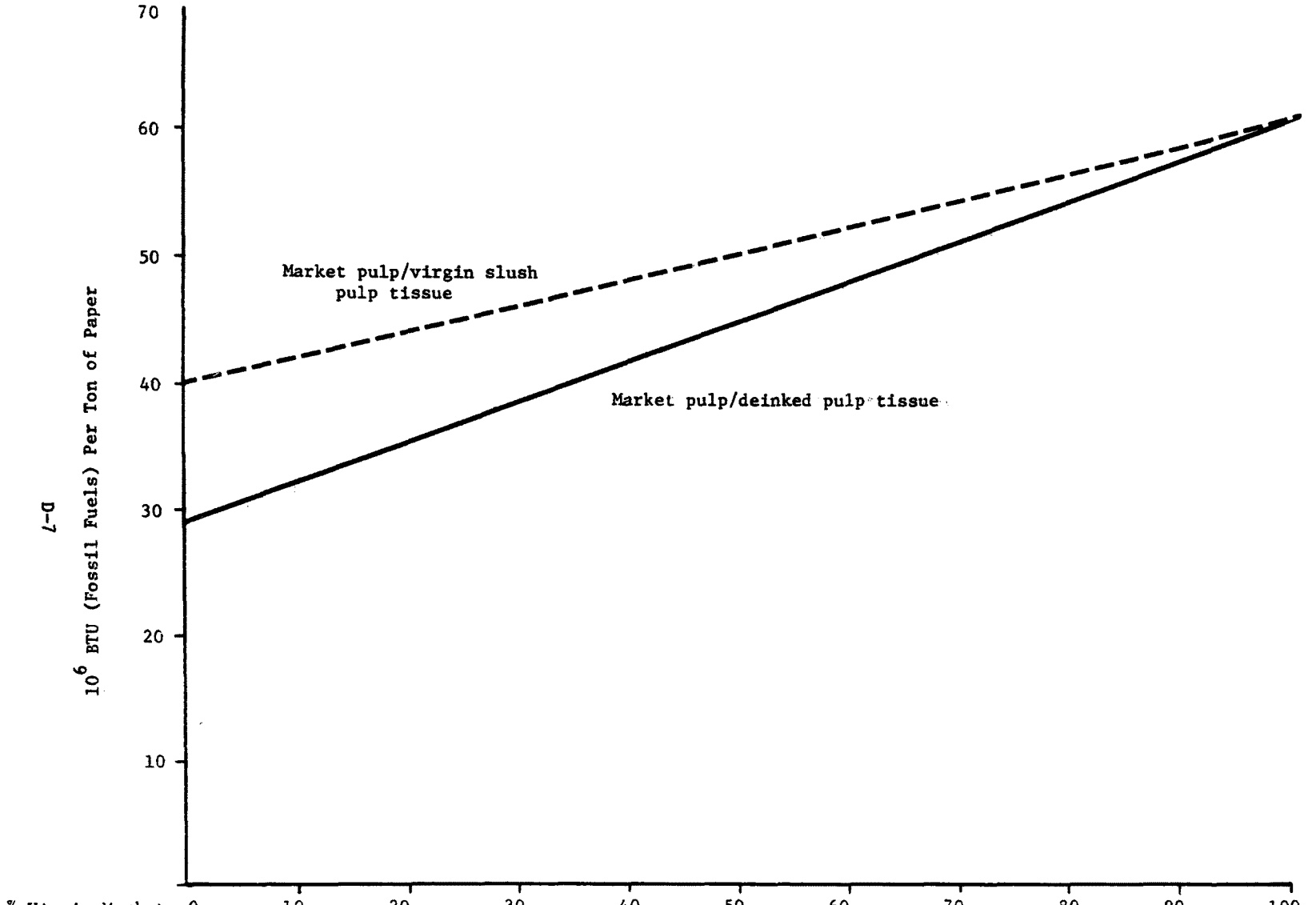

Figure D-3. Fossil fuel requirements for manufacture of tissue made from virgin slush pulp, virgin market pulp and deinked waste paper pulp

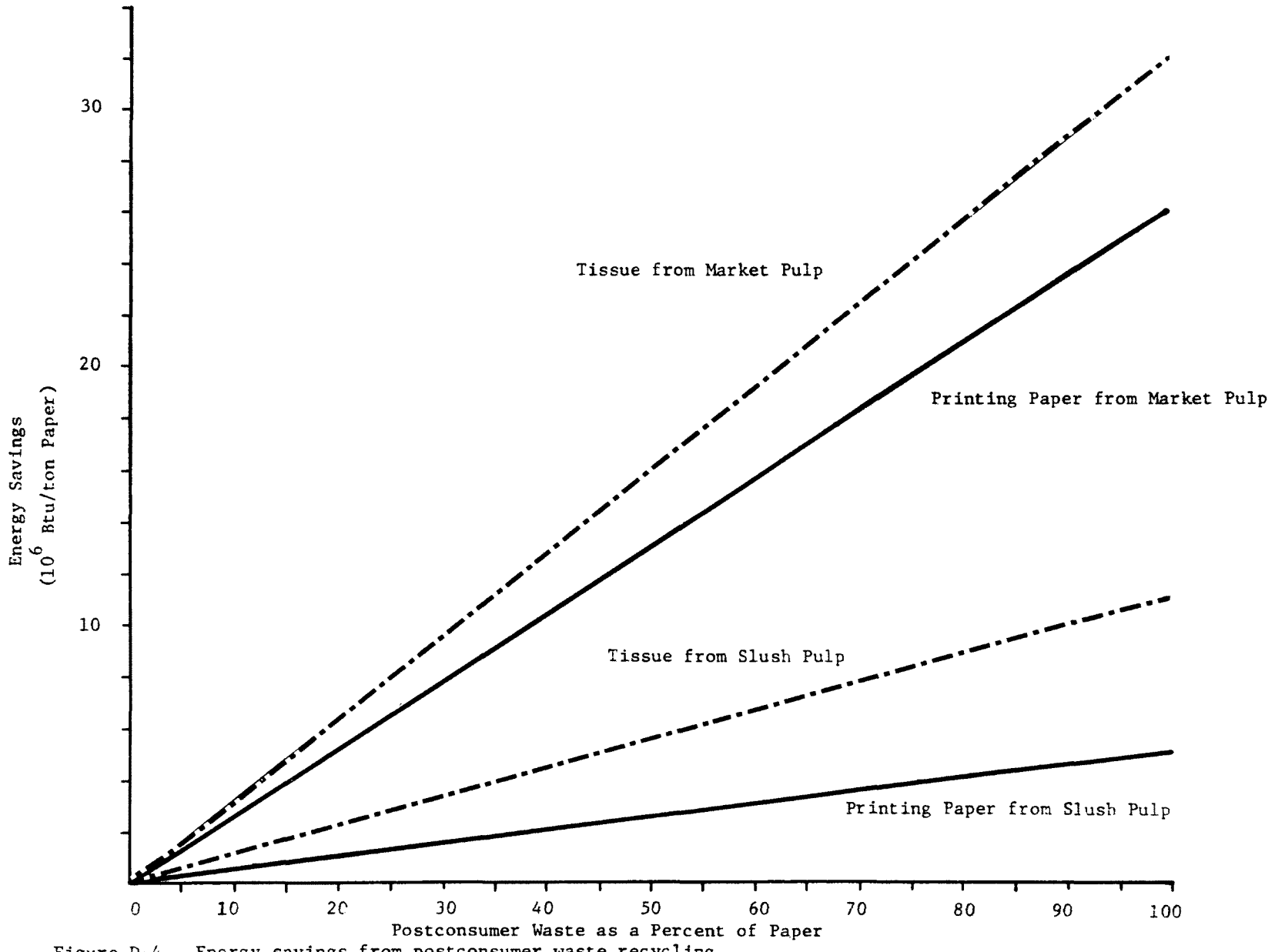

Figure D-4. Energy savings from postconsumer waste recycling.

In addition to the values in Table D-1, a set of energy numbers just released by the American Paper Institute (API) to the Department of Energy (DoE) are included in this appendix as Table D-2. These numbers are drawn from the API energy monitoring system and the annual capacity survey. They are actual mill operating data and include the energy consumed on site by the papermill. A comparison of the values in Table D-2 to Table D-1 reveals that the API numbers are much lower than the FAL values in Table D-1. The basic reason is that the FAL numbers are much more inclusive than the API. Included in the FAL numbers and not included in the API values are as follows: (1) energy to harvest, procure, and transport raw materials, including chemical additives, (2) energy required to mine, procure, refine, and transport fuels, (3) energy losses incurred in generation and delivery of electricity, and (4) energy to convert paper and paperboard into products. Thus, it is clear that these numbers cannot be directly compared, but an analysis of the API numbers is very revealing.

The FAL values reflect typical, or model, mill values. In some cases they show energy savings from recycling, while in some cases they do not. As new mills are constructed, virgin and recycling mills built under similar circumstances might be expected to show the energy relationship in Table D-1. However, the differences in existing mills are nothing short of astounding, as revealed in the API data. It is not uncommon for mills manufacturing identical products to differ in energy requirements per ton of output by more than 100 percent. This wide range of values is caused by many differences between mills, such as climate, operational skill, and availability of capital to implement energy conservation. Other reasons are also given in the notes preceding Table D-2.

This wide range of energy values in all mills leads to the situation as shown in Table D-2--that recycling mills for the grades for which data are available may require comparatively little energy, or comparatively large amounts of energy. Correlations run on the data show very low correlation between recycling rates and energy.

The policy implications of this are quite important. It means that if the Government buys paper from a recycling mill, there is no way of knowing if that paper purchase resulted in less or more energy consumption than if virgin paper had been purchased. Thus, if the values in Table D-2 are accepted, there is no basis for assuming that purchases of recycled paper from the existing industry will result in energy conservation, although the possibility remains that new recycling capacity may be energy saving.

The indications are that government actions could bring about either an increase or decrease in energy consumption. If government actions merely substitute products from existing recycling mills for virgin products, then the energy consumption may either go up or down, depending on the particular situation. On the other hand, if government action brings about an increase in overall recycling, then energy conservation will result.

Our long term projections are that government action will stimulate the growth in use of waste paper at a very slow rate. The probable result is a small decrease in energy consumption. However, any changes in energy consumption from the guidelines over the next ten years will most likely be insignificant.

Table D-2

EXPLANATORY NOTES

The following are excerpts from explanatory notes submitted by API to DoE on April 13, 1979.

> "Attached are tables showing the energy, both gross and net, and the percent of waste paper used at mills producing paper and paperboard. The data were calculated using API's energy monitoring system and annual capacity survey.
>
> It is important to note that the energy data is only the energy used in the paper mill. In order to calculate total energy, the energy used by supplier companies in producing the raw materials used by paper mills, and the energy consumed in transporting the material to the mill, and shipping the finished product to a consumer, must also be included.
>
> Although data for gross energy and net energy are provided, the only valid measurement is net energy which is equivalent to the mills' purchased energy.
>
> The paper industry is unique in its utilization of energy in that a substantial percentage currently comes from recovered materials.
>
> In 1978, 47% of the paper industry's energy requirements were internally generated by burning process wastes such as spent pulping liquors, bark and waste wood. In 1972, 42% of the industry's energy requirements were internally generated. As the data indicates a number of mills generate a very high percentage of their energy requirements making them almost independent of purchased energy.
>
> In 1978, 60% of the fiber used to make paper and paperboard was from recovered materials (24% waste paper, 35% waste wood and 1% other waste fibers). In 1972, 51% was recovered materials (22% waste paper, 27% waste wood and 2% other fibers)."

The mills included in this survey were single product mills reporting energy consumption to API. Excluded were mills producing a variety of products, in which case there was no allotment to allocate energy consumption to individual products.

Table D-2

FACTORS THAT INFLUENCE ENERGY CONSUMPTION

1. Ambient air and water temperature

   Mill location is important; northern mills have cooler incoming air and water than southern mills, therefore more energy is required.

2. Steam pressure

   Mills use different steam pressures in drier drums. The higher the pressure of the generated steam, the more energy required.

3. Yield

   When comparing some products made from virgin fiber paper or paperboard, the yield in square feet per ton produced can be 10% to 30% higher than a product made from waste paper.

Table D-2

ENERGY USAGE FOR 100% TISSUE MILLS
PAPERMAKING ONLY, 1977 DATA

Gross Energy Btu/Ton	Net Energy		Percent Waste Paper
	Btu/Ton	Percent Internally Generated	
25.8	8.9	65	5
12.6	12.6		100
13.1	13.1		16
13.6	13.6		
29.6	14.3	52	
14.7	14.7		21
42.8	15.3	64	
15.9	15.9		50
16.0	16.0		50
16.8	16.8		46
16.9	16.9		55
17.0	17.0		100
17.0	17.0		97
17.6	17.2	2	44
17.4	17.4		91
17.6	17.6		32
17.7	17.7		
17.8	17.8		100
18.0	18.0		45
20.6	18.2	9	19
19.5	19.5		60
20.3	19.8	3	40
19.9	19.9		
20.1	20.1		11
20.4	20.1	6	
20.2	20.2		
20.3	20.3	2	7
28.4	20.3	28	11
21.6	21.6		14
23.4	23.4		8
26.8	23.7	12	100
24.0	24.0		100
24.5	24.5		90
32.0	25.0	20	39
29.6	25.3	15	16
29.6	29.6		100
32.6	32.6		61
34.7	34.7		40
39.2	39.2		100

Table D-2 (con't)

ENERGY USAGE BY GROUNDWOOD PRINTING PAPER AND NEWSPRINT MILLS
(Papers with groundwood fiber content over 40%)

Gross Energy Btu/Ton	Net Energy		Percent Waste
	Btu/Ton	Percent Internally Generated	
26.44	9.41	64.4	-
21.13	13.16	37.7	1.9
16.04	13.40	16.5	-
14.10	14.01	0.6	-
15.07	15.07	0	-
15.98	15.98	0	-
25.94	16.24	37.4	0.3
42.88	17.40	59.4	-
29.14	19.31	33.7	-
21.45	20.10	6.3	-
31.64	21.03	33.5	38.2
21.14	22.47	6.3	5.0
42.30	22.53	46.7	-

Table D-2 (con't)

ENERGY USAGE BY BLEACHED CHEMICAL WOOD PULP
PRINTING-WRITING PAPER MILLS
(Integrated)

Gross Energy Btu/Ton	Net Energy Btu/Ton	Net Energy Percent Internally Generated	Percent Waste	C or U
35.18	12.90	63.3	-	U
36.73	15.17	58.7	4.5	C&U
22.52	16.33	27.5	-	C&U
29.13	17.45	40.1	24.1	U
28.55	18.15	36.4	6.0	U
37.08	18.18	51.0	-	C&U
37.40	19.87	46.9	7.4	U
39.19	20.03	48.9	-	U
39.85	20.51	48.5	13.2	U
39.77	21.10	46.9	10.4	U
28.68	22.39	21.9	28.4	U
42.86	23.12	46.1	4.7	C&U
48.11	24.80	48.5	-	U
45.45	30.30	33.3	-	C&U
41.85	30.38	27.4	-	C&U
45.84	30.94	32.5	-	C&U

C = coated
U = uncoated

Table D-2 (con't)

ENERGY USAGE BY BLEACHED CHEMICAL WOOD PULP
PRINTING-WRITING PAPER MILLS
(Non integrated)

Gross Energy Btu/Ton	Net Energy Btu/Ton	Net Energy Percent Internally Generated	Percent Waste	C or U
10.93	10.93	0	2.6	U
12.18	12.18	0	15.5	U
12.85	12.47	3.0	-	U
14.83	14.83	0	17.9	U
17.06	17.06	0	16.4	U
17.84	17.84	0	20.1	U
17.92	17.92	0	35.7	U
18.06	18.06	0	14.8	U
20.72	20.72	0	-	U
20.96	20.96	0	2.1	U
22.18	22.18	0	4.3	U
22.99	22.99	0	-	U
24.06	23.89	0.7	12.9	U
27.31	27.31	0	24.7	C&U
29.20	29.20	0	10.9	U
29.80	29.80	0	29.6	U
39.19	39.19	0	-	C&U

C = coated
U = uncoated

Table D-2 (con't)

ENERGY USAGE FOR SEMICHEMICAL PAPERBOARD
1977

SOUTHERN

Gross Energy Btu/ton	Net Energy		Percent Waste Paper
	Btu/Ton	Percent Internally Generated	
15.66	5.00	68.1	27.7
14.77	12.79	13.4	25.3
19.60	14.09	28.1	16.5
19.39	15.49	20.1	23.8
17.74	15.85	10.7	1.9
	NORTH CENTRAL		
20.27	13.36	34.1	15.2
14.68	13.89	5.4	45.7
14.87	14.87		29.2
17.56	17.56		34.5
22.28	19.28	13.5	9.9
31.12	27.96	10.2	24.2

Table D-2 (con't)

ENERGY USAGE FOR UNBLEACHED KRAFT PAPERBOARD - SOUTHERN

1977

Gross Energy Btu/Ton	Net Energy		Percent Waste Paper
	Btu/Ton	Percent Internally Generated	
26.10	7.25	72.2	
30.43	7.74	74.6	
29.98	9.02	69.9	1.5
29.22	9.41	67.8	
27.23	9.45	65.3	15.0
25.57	9.46	63.0	0.2
25.34	9.70	61.7	8.3
33.68	11.49	65.9	
35.41	12.06	65.9	
27.40	12.24	55.3	
34.84	12.51	64.1	
33.20	13.06	60.7	
28.92	13.12	54.6	10.2
30.73	15.11	50.8	10.5
37.45	15.86	57.7	14.3
31.20	16.61	46.8	6.3

Table D-2 (con't)

ENERGY USAGE FOR SOLID BLEACHED PAPERBOARD
1977

Gross Energy Btu/Ton	Net Energy		Percent Waste Paper
	Btu/Ton	Percent Internally Generated	
40.31	19.70	51.1	0.8
42.14	23.11	45.2	
50.90	23.49	53.9	
44.49	23.72	53.3	8.4
47.25	24.62	52.1	

Table D-2 (con't)

ENERGY USAGE FOR
RECYCLED PAPERBOARD
1977
NORTH REGION

Gross Energy Btu/Ton	Net Energy Btu/Ton	Net Energy Percent Internally Generated	Percent Waste Paper
8.63	8.41	2.5	100
10.93	10.93		100
11.56	11.56		100
11.69	11.69		100
12.40	12.40		100
12.64	12.64		100
13.01	13.01		100
13.40	13.40		100
13.89	13.67	1.6	100
14.25	14.25		100
15.12	15.12		100
15.81	15.81		100
17.03	17.03		100
17.92	17.92		100
18.56	18.56		100
19.51	19.51		100
20.46	20.46		100
	NORTH CENTRAL		
7.68	7.68		100
9.31	9.31		100
11.48	11.48		100
11.72	11.72		100
12.21	12.21		100
12.65	12.65		100
13.32	13.32		100
13.68	13.68		100
14.16	14.16		100
14.63	14.63		100
14.67	14.67		100
14.68	14.68		100
14.77	14.77		100
15.19	15.19		100
16.34	16.34		100
19.76	19.76		100
20.57	20.57		100
21.66	21.66		100
22.70	22.70		100
23.81	23.81		100

Table D-2 (con't)

ENERGY USAGE FOR
RECYCLED PAPERBOARD
1977
PACIFIC COAST

Gross Energy Btu/Ton	Net Energy Btu/Ton	Net Energy Percent Internally Generated	Percent Waste Paper
10.56	10.56		100
10.78	10.78		100
10.90	10.90		100
11.33	11.33		100
12.32	12.32		100
12.89	12.89		100
14.72	14.72		100
14.98	14.98		100
	SOUTH		
9.44	9.44		100
9.78	9.78		100
10.14	10.14		100
11.06	11.06		100
12.58	12.58		100
12.70	12.70		100
12.89	12.89		100
13.19	13.19		100
13.46	13.33	1.0	100
14.08	14.08		100
14.13	14.13		100
14.90	14.90		100

ENERGY USAGE FOR RECYCLED CONTAINERBOARD - TOTAL 1977

Gross Energy Btu/Ton	Net Energy		Percent Waste Paper
	Btu/Ton	Percent Internally Generated	
11.53	11.53		100
11.89	11.89		100
11.94	11.94		100
13.25	13.25		100
13.49	13.49		100
16.00	16.00		100
18.97	18.97		100
19.20	19.20		100

Appendix E

HEALTH RELATED ISSUES FOR VIRGIN AND RECYCLED PAPER AND PAPERBOARD PRODUCTS

INTRODUCTION

It might be assumed that if the use of either recycled or virgin fiber in paper products were proven more healthful to the user, demand for the product would increase. Unfortunately, the healthfulness of a given product is frequently difficult to determine, especially regarding products that are not obviously injurious or beneficial. Most paper and paper products fall into this category. Nonetheless, even a general determination of health hazards and/or benefits resulting from the use of one type of fiber in paper and paper products would be helpful in policy formulation.

Two different forms of health hazards associated with paper and paper products are investigated in this appendix. First, potential health hazards resulting from the use of recycled fiber in paper and paper products are investigated. These hazards are generally associated with the unknown and potentially hazardous contamination of the postconsumer waste (PCW) portion of the fiber furnish. Second, a potential health hazard associated with the use of virgin fiber in paper and paper products is considered. Specifically, the eyestrain resulting from exceptionally high-brightness printing and writing papers is investigated.

In the course of this investigation, 15 paper manufacturing companies were contacted for telephone or personal interviews. These companies were selected to represent a broad spectrum of product lines, using both recycled and virgin fiber in varying percentages as furnish, and representing a wide variety of product lines. The interviews included questions concerning health-related issues which had been or might be encountered as a result of using significant amounts of recycled fiber in paper and paper products. In addition, an extensive search of the literature was conducted to specifically investigate the health hazards associated with high brightness printing and writing papers. Significant cooperation was also obtained from the staff of the Library of Congress on this issue, as well.

This appendix is not a definitive exposition of these issues, but raises some of the important health-related questions.

DISCUSSION

Potential Hazards Associated with the Use of Postconsumer Waste in Paper Products

In the interviews with paper company representatives, it was noted that manufacturers using exclusively virgin fiber sources mentioned possible health effects of the use of recycled fiber for products of a sanitary or food

contact end-use. Several concerns about the use of recycled fiber, especially PCW were raised. Apparently it is not uncommon for young children and infants to ingest a variety of paper products such as napkins, plates, cups, toilet paper, etc. Several manufacturers reported receiving occasional inquiries from doctors or distressed parents inquiring about the composition of a specific product in order to prescribe a remedy. However, no documented instances of acute toxemia resulting from the ingestion of paper or paper products were discovered. But, if the product were to contain a high level of a hazardous substance, the health implications might become significant. While the virgin mill representatives frequently mentioned this potential health hazard, representatives of mills using PCW as a fiber source had had experience with these sources of fiber for a number of years and state that no significant health hazards exists. Again, no documented instances of hazard were presented by any person interviewed.

A significant portion of paper and paperboard is used to package food products, approximately 37.7 percent of the domestic production of paperboard in 1977. This figure includes folding boxboard and similar grades of paper, but excludes corrugated. Although much of this food-related paperboard does not actually come in physical contact with the food itself because an interior liner is used, some of this paperboard does contact the food product it contains.* Concern has been expressed, primarily by the virgin mills, that hazardous substances may migrate from contaminated fiber in the paperboard to the food product. The magnitude of this hazard has not been determined insofar as this study could discover. As with the ingestion hazard mentioned above, representatives of PCW-using mills minimized the potential of this hazard, while the virgin-mill representatives tended to stress it.

There is no doubt that the possibility of receiving contaminated PCW at a paper mill exists, but the long history of its use by some paper mills implies that a significant health hazard can be avoided.

Potential Hazards Associated with High Brightness Printing and Writing Papers

It has been suggested that the high brightness typical of most virgin printing and writing papers may be hazardous or at least tiring to the human eye. It has also been suggested by some that paper using significant percentages of recycled PCW fiber are generally lower in brightness than virgin grades, so that recycled grades do not pose whatever health hazard might be associated with higher brightness papers.

Research on the issue of eyestrain (asthenopia) resulting from overbright paper was conducted at Linda Hall Scientific Library, The University of Missouri at Kansas City Library, and The University of Kansas Medical Center Library. In addition, the "Medline" on-line medical literature search service of Index Medicus was used. Index Medicus itself was also employed in the search, and the National Library Service for the Blind Physically Handicapped was contacted at the Library of Congress.

* This includes raisins, spaghetti, and other dry foods. Wet or oily foods are generally not found in contact with boxboard.

Of the hundreds of articles, books, and textbooks on the subject of eyes, eye hygiene, industrial opthomology, industrial eye hygeine, eye pathology, and eye hazards, references to asthenopia were found in ten books and eight articles. A bibliography of these sources is provided at the end of this appendix. Key-word references to asthenopia, eyestrain, eye fatigue, eye discomfort, and the effects of brightness (reflective) upon the eye were sought. Although the index of the ten volumes listed asthenopia or related term, none of these books made definitive statements of causality. The references were essentially definitional, although one volume (Heaton, J. M.) cited some very old (circa 1900) research suggesting that eyestrain was in fact exclusively psychological in origin.

The literature search using Index Medicus and "Medline" indicates that since 1940, relatively little interest has been shown in asthenopia. While some research was conducted around the turn of the century, these investigations were of questionable quality and were conducted by experimental psychologists interested in learning, reading, and pattern recognition rather than in eyestrain.

During the next 30 to 40 years, virtually no research was done, but at the advent of World War II, eyestrain once again drew some experimental interest. Prior to about 1940, research on asthenopia was limited principally to intuitive observations that eyestrain occurred under poor lighting conditions when doing relatively close work for long periods of time. The prescribed treatment was also intuitive: add more and better light and work shorter hours. During World War II, research investigated the effects of wartime "blackout" conditions upon industrial workers who were forced to do relatively fine work under conditions of near total darkness. The research concluded that eyestrain did result after a period of time in most, but not all, workers. Further, a brief period of rest was found to alleviate the symptoms substantially. Notably, no research was conducted during this period upon the effects of having too much light.

The next phase of asthenopic research apparently occurred during the late 1950s and early 1960s, when the issue of television-induced eyestrain was addressed. While there were several short journal articles published which dealt with this question, the research was rather deficient. There was an apparently unanimous conclusion, however, that television did not induce serious eyestrain.

Recent research considers eyestrain as symptomatic of other pathologies of the eye, and apparently does not consider eyestrain to be a proper subject for treatment in and of itself. The recent studies consider the sensation of eyestrain as an aid in differential diagnosis of other eye pathologies. Eyestrain itself is not considered pathological; that is, a condition to be treated, per se.

None of the references to asthenopia and related topics mentioned paper-induced eyestrain, or eyestrain resulting from exaggerated contrast ratios or excessive ambient lighting. In an interview with the staff of the eye-optholmology department of the University of Kansas Medical Center in Kansas City, none of the doctors in that department could offer further information concerning the etiology of asthenopia. It would appear that medical research has not investigated the effects of over-bright paper upon the eye.

Although the medical literature is notably devoid of asthenopic research involving high brightness paper, a small amount of study has been done on the effects of over-bright paper upon the ability of visually handicapped people to read comfortably. Asterisks mark the seven studies dealing with this aspect of asthenopia in the Bibliography at the end of this appendix. These citations were located with the extensive cooperation of the National Library Service for the Blind Physically Handicapped, at the Library of Congress.

The information found in these seven sources may be summarized briefly. First, no data, information, or recommendations of any kind were located which addressed the issue of paper brightness or color with respect to eyestrain in normally-sighted individuals. The literature dealt only with the needs of visually handicapped. Second, most of the references to paper color were limited to instructions concerning the publication of books in large type face for the visually handicapped. The most relevent statement found among these large-type recommendations was from the National Braille Association, "Standards for Large Type Transcribing" which recommended, "Use white, off-white, or very light tint; avoid 'bright white' papers. The finish of the paper should be dull, vellum, or non-glare that can provide a maximum of contrast without glare. Opacity of at least 91 percent is required."

An additional reference was located in "Guidelines for the Production of Material in Large Type," published by the National Society for the Prevention of Blindness, Inc. This publication admonishes, "It is particularly important that there be no show-through, especially when both sides of the paper are used, specify paper as follows: color: white (avoid such designations as "high white" or "blue white"); quality: vellum (dull finish, non-glare); opacity: 0.91 to 0.92." This publication was the most recent citation located, and was dated 1965.

In the interviews done to gather the information for this study, an occasional mention was made about a study which recommended the use of buff colored or off-white paper in preference to bright white paper. Apparently this recommendation was understood to refer to all printing and writing papers. It would seem that this reference is to a study reported in Education of the Blind, "Legibility of Ink and Paper Color Combinations for Readers of Large Type." This article, written by Carson Y. Noland, reported some simply-designed studies conducted in 1932 and 1938. In these experiments, combinations of blue and black ink on white, off-white, buff, and canary-colored papers were tested for legibility by the visually impared. The study concluded that all

combinations of ink and paper were equally legible, but that some combinations required greater effort on behalf of the visually handicapped reader. The study did not indicate that any one combination of color and/or ink was significantly better than the others, but did recommend that the use of blue ink on buff-colored paper was most suitable for albino readers who were visually handicapped. These few readers found the highly reflective white paper uncomfortable after prolonged periods of reading. This study was done in the Cleveland public schools, apparently using fewer than ten subjects. The study was not statistically controlled, nor has any replication study been found in the literature. Significantly, the study specifically avoids suggesting that its findings apply to normally-sighted people.

CONCLUSIONS

While certain potential hazards may exist to some degree in the use of PCW-containing paper for sanitary and food packaging uses, there have been no documented instances of injury revealed by this investigation. In addition, there is essentially no medical basis for suggesting that high-brightness paper is a factor contributing to eyestrain in normally-sighted people. Rather, paper brightness is apparently irrelevent to eye pathology, although glare may be a minor factor in legibility for some visually handicapped people. In summary, it appears that there is insufficient basis for either encouraging or discouraging the use of recycled fiber in paper for health reasons.

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Appendix F

USE OF RECYCLED PAPER IN OFFICE COPIERS

INTRODUCTION

Office photocopiers represent one of the largest single end-uses for cut and wrapped writing papers. These machines are most often used for general office memorandums, short report copying, and duplicate record keeping. Before the introduction of these machines, these office needs were met largely through the use of mimeograph and "ditto" spirit duplicators. While these latter copying methods are still used (mostly in churches and schools), use of the modern electromechanical photocopier offers significant savings in time and effort. As photocopying technology has improved, machines have become more reliable and copy quality has improved. Purchase and leasing cost of the photocopying machines has fallen, and the net result of these factors is that most offices employ one or more such machines.

This appendix investigates the technical feasibility of using recycled-fiber paper in modern photocopying equipment.

METHODOLOGY

Information for this appendix was obtained through telephone and/or personal interviews conducted with representatives of Xerox Corporation, IBM Corporation, Savin Corporation, and Royal/SCM Corporation. The interviews discussed whether the company had conducted research concerning the use of recycled-fiber papers in their respective copiers, whether the company had developed a formal policy statement concerning the use of such papers, and if the company knew of successful or unsuccessful use of such papers by their customers/clients.

Royal/SCM reported that they had not conducted research upon this issue specifically, but had designed their machines to use a wide range of paper grades and quantities. They reported that while their machines were generally somewhat slower than the machines of their competitors, the Royal/SCM machines were very tolerant of paper irregularities and should experience no difficult in using paper containing recycled fiber. They reported that they did not have a formal policy statement concerning the use of recycled fiber paper, but their Kansas City office was aware of at least one client who was successfully using recycled paper in their machines. Royal/SCM does function as a paper merchant to its clients, but does not require an accounting of the fiber source used for the paper which it buys wholesale from several large mills.

Savin Corporation reported that they did not maintain a research and development department of their own for paper products, but rather depend upon Great Northern-Nakoosa Paper Company to develop their papers. Savin reported that their machinery requires an unusually smooth (highly calendared) paper because their machines employ a liquid toner process which does not work well with rougher papers. In a follow-up interview with a representative of Great Northern-Nakoosa, it was confirmed that about 40 percent of all of Nakoosa's paper was made of secondary fiber* but virtually none of it was made from postconsumer waste. Savin Corporation reported that they did not have a formal policy statement concerning the use of recycled fiber papers in their machines, and did not know if their customers and clients were using paper containing recycled fiber successfully or unsuccessfully. It was suggested by Northern-Nakoosa that it was highly unlikely that recycled fiber papers could be successfully used in the Savin equipment because of the relatively tight finish requirements. Savin Corporation agreed that although they do not require that their clients use only Savin paper in their machines, both the Savin and Northern-Nakoosa representatives pointed out that there was probably no technical reason why paper using recycled fiber might not be used successfully in Savin equipment if it were finished properly. It was emphasized that it is impossible to identify postconsumer fiber from secondary fiber from virgin fiber in a finished product when the fiber is cleaned and bleached in the same way as virgin fiber would be. (While groundwood fiber can be identified from chemical fiber in a finished paper product, the different sources for chemical fiber cannot be differentiated in the finished product if the paper process is properly controlled.)

IBM Corporation does not develop their own paper, but does maintain a quality control department for the paper which they purchase for resale to their customers. IBM has not formulated an official policy statement concerning the use of recycled fiber paper in their machines, but since most IBM machines employ roll-fed paper, most IBM machine users purchase their paper through IBM. All of the paper merchanted by IBM is of virgin stock, apparently for reasons of quality control. Apparently no research has been conducted nor is planned concerning the use of recycled fiber paper in IBM copiers. However, one company reports successfully marketing recycled paper for use in the IBM copier II.

In contrast to the interviews discussed above, the interview with Xerox Corporation was more encouraging concerning the use of recycled fiber paper. Between 1974 and 1975, Xerox Corporation investigated the technical and economic feasibility of using recycled-fiber paper in their machines. At that time Xerox found that there were no technical limitations to the amount of recycled fiber which could be used, but that variations in curl due to changes in batch mix were a continuing problem. Xerox decided that these problems could be adequately handled through careful manufacturing and quality assurance controls. Xerox then developed plans to market two separate grades of recycled fiber papers to its customers.

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* Secondary fiber here used as generally defined in the paper industry to include wood and forest residues as well as converting wastes.

These plans were abandoned when it was found that only one mill could meet Xerox's specifications with sufficient precision, and that this mill (Bergstrom) could not supply even a significant fraction of Xerox's needs at that particular time of high paper demand. Xerox reported that an official policy had been formulated which encouraged the use of paper containing recycled fiber in its copiers, and that policy statement was issued about the time the research was conducted four years ago.

Since the time of the 1974-1975 study, Xerox Corporation has introduced a new line of high speed office copiers. These new machines have fuser stages employing much higher temperatures than did previous copier models. These high temperatures cause all regular paper to curl excessively. To compensate for this situation, Xerox specifies that all of the paper used with these machines must be manufactured with a "reverse curl" which serves as a pre-compensation for the curl induced by the new copiers. Since this "reverse curl" paper also works satisfactorily in the older, slower models, it is the only grade of paper which Xerox sells to its customers.

There are no technical qualities of recycled fiber which prevent its use in blends with virgin fiber for the manufacture of reverse curl paper. The absence of reverse curl paper containing recycled fiber is the result of the policies of the two companies which manufacture such papers. Furthermore, there are no technical reasons why recycled fiber could not be used for most copiers now in use (excluding the new high speed models) as long as the paper is manufactured to accepted quality standards. These same caveats also apply to virgin fiber paper.

Appendix G

PAPER AND PAPERBOARD INDUSTRY CONSUMPTION OF WOOD RESIDUES AND WASTE PAPER BY END-USE AND REGION

INTRODUCTION

It might seem that the massive generation of urban solid waste could supply more than enough waste paper to make all the recycled paper and paper products which could be needed. Of the 135.5 million tons of residential and commercial postconsumer net solid waste disposed of in 1976, approximately 30.3 percent of that amount, or 41 million tons, consisted of various paper and paper products. This is indeed quite a lot of waste paper.

However, one of the principal constraints to the use of recovered fiber in paper manufacture is the availability of such fiber within an economical distance to the paper mill. For postconsumer waste, the points of generation are large metropolitan areas, principally those which can support waste paper dealers. In contrast, most paper is manufactured at mills located at a great distance from such metropolitan areas. Even when baled, transportation of postconsumer waste paper is problematic and expensive.

In contrast, wood and forest residues enjoy a much better situation. First, wood residues are usually generated at essentially the same locations as the roundwood fiber sources. For harvest residues, this is obviously the case. Sawmill residues are produced at sawmills, which in turn are generally located as close to the roundwood supply as are paper mills. Second, the use of wood residues alleviates disposal problems both at the harvest location and at the sawmill. Third, wood residues are essentially uncontaminated, unlike postconsumer waste paper.

However, just as the generation of postconsumer waste paper varies from city to city, the generation of forest residues varies from region to region. For example, pulp wood forests produce relatively less sawdust than do forests harvested principally for dimension lumber. Thus both the availability of postconsumer waste paper and forest residues vary as a function of the geographic location of the mill.

In addition, the amount of wood residue or postconsumer waste paper used in the manufacture of a given grade of paper also depends upon the technological constraints associated with the manufacture of that grade of paper. For example, certain types of wood residues may be used in high percentages of sanitary papers but in only relatively small percentages in printing and writing papers. Likewise, the utilization of postconsumer waste papers depends upon the grade of paper being made.

This appendix investigates the current utilization of both forest wood residues and waste paper as fiber sources for various grades of paper. These utilizations are analyzed on a regional basis as well as aggregated. The purpose of this appendix is to highlight the differences in recovered fiber consumption for the manufacture of different grades of paper in different regions of the country.

METHODOLOGY

Data presented in this appendix were obtained from the American Paper Institute, Capacity Department. These data are presented both in tabular and graphic form. The graphical presentations present percentage-of-total data in two forms: discrete range percentage and cumulative percentage. The data are presented as national aggregates in the first part of this appendix, and as regional totals in the second part.

Note that caution must be used in interpreting the graphic figures in this appendix. The purpose in using two graphic methods for each set of data is to reduce the confusion which might arise from using one graphic method alone. An attempt has been made to anticipate confusions which may result from the figures, and these are discussed in the text associated with each table and figure.

DISCUSSION

Aggregate National Data for Forest and Manufacturing Residues

Table G-1 presents the American Paper Institute (API) capacity survey data for the consumption of forest and manufacturing residues in the manufacture of wood pulp during 1976. For each five percent range of forest and manufacturing residues used, the total amount of wood pulp produced is stated in thousands of tons. The wood pulp production in each range is also stated as a percentage of the total wood pulp production, both for each individual range as well as cumulatively.

The relative "evenness" of the steps of this cumulative presentation suggests that wood residue utilization in wood pulp manufacture occurs approximately uniformly across the entire range from zero to 100 percent utilization. Note that the steps between 35 and 40 percent residue content and 95 to 100 percent residue content are slightly larger than the remaining steps. These two "steps" correspond to the maximums displayed in Figure G-1 for these same respective ranges. That is, relatively more wood pulp is manufactured using either between 35 and 40 percent wood residue or 95 to 100 percent wood residue than any other range of wood residue content.

National Aggregate Data, Consumption of Waste Paper by End-use

For each utilization range of waste paper, Tables G-2 through G-6 show the amounts of five grades of paper produced in 1976. One table each has been prepared for printing/writing, tissue, bleached and unbleached kraft paperboard, semichemical paperboard, and kraft and special industrial paper production. Each table is similar with respect to the information presented, except that the waste paper utilization ranges vary from table to table.

Table G-1

FOREST AND MANUFACTURING RESIDUES
CONSUMED IN THE MANUFACTURE
OF WOOD PULP IN 1976
U.S. TOTAL

Percent Residues 1/	Residues Consumed (000 cords)	Wood Pulp Produced (000 tons)	Percent	Cumulative Percent
0 - 5%	13.2	505.4	1.1	1.1
5 - 10	198.9	1,771.2	4.0	5.1
10 - 15	409.9	2,196.8	4.9	10.0
15 - 20	362.5	1,525.2	3.4	13.4
20 - 25	1,501.2	4,099.9	9.2	22.6
25 - 30	1,259.6	2,752.9	6.2	28.8
30 - 35	1,639.9	3,397.7	7.6	36.4
35 - 40	3,028.4	5,042.5	11.3	47.7
40 - 45	2,621.7	4,089.7	9.2	56.9
45 - 50	2,146.9	2,834.2	6.3	63.2
50 - 55	2,891.2	3,473.7	7.8	71.0
55 - 60	1,285.3	1,619.4	3.6	74.6
60 - 65	1,136.2	1,272.9	2.8	77.4
65 - 70	790.5	780.8	1.7	79.1
70 - 75	1,108.9	1,044.8	2.3	81.4
75 - 80	1,156.8	828.8	1.9	83.3
80 - 90	2,341.9	1,498.0	3.4	86.7
90 - 95	1,472.0	904.1	2.0	88.7
95 - 100	7,973.2	5,034.8	11.3	100.0
TOTALS	33,338.2	44,672.8		
AVERAGE UTILIZATION RATIO		0.746 cords per ton		

1/ Residues consumed as a percent of total pulpwood consumed.

Source: API Capacity Survey, September 1977, and Franklin Associates, Ltd.

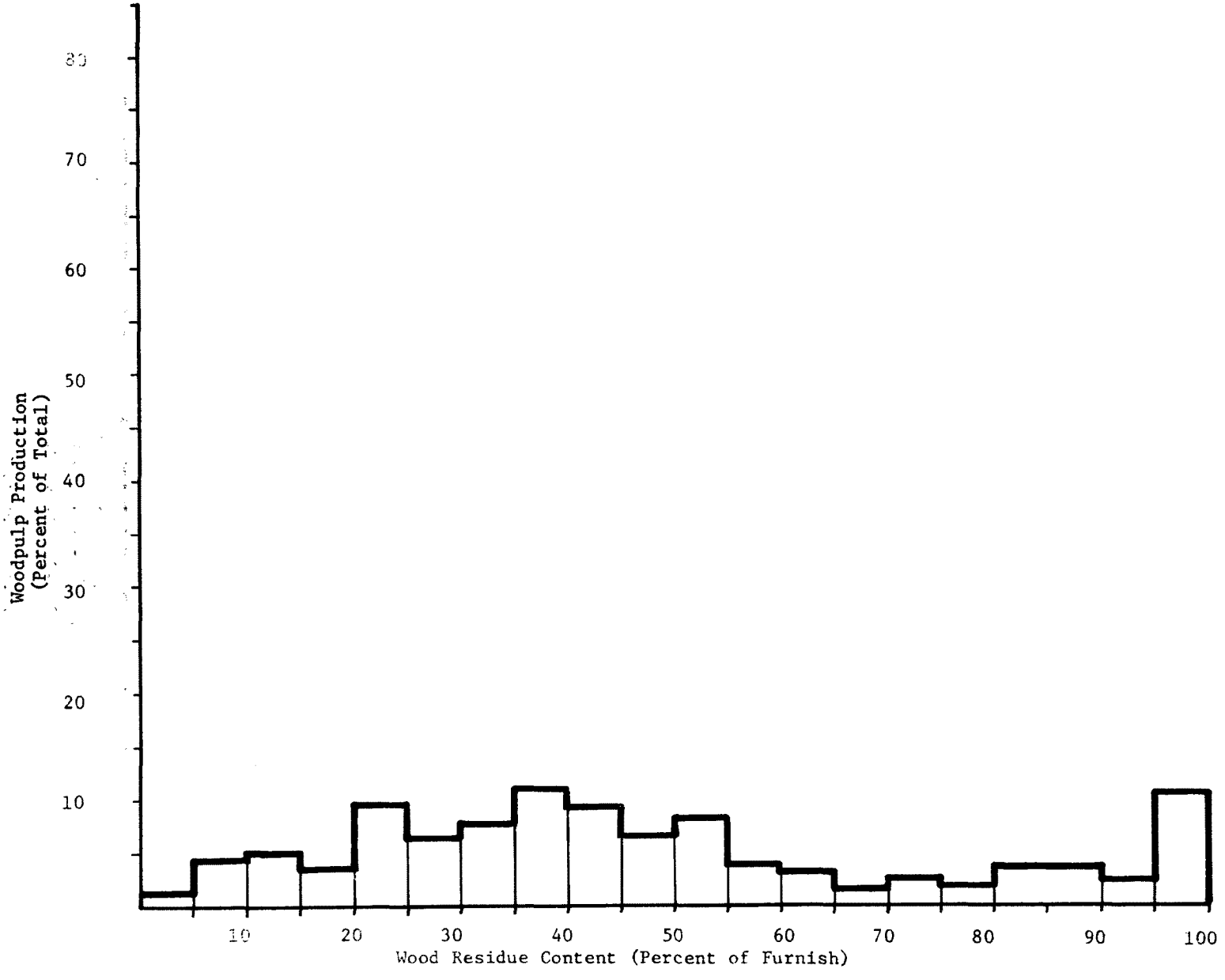

Figure C-1. Wood residue consumption in wood pulp production.

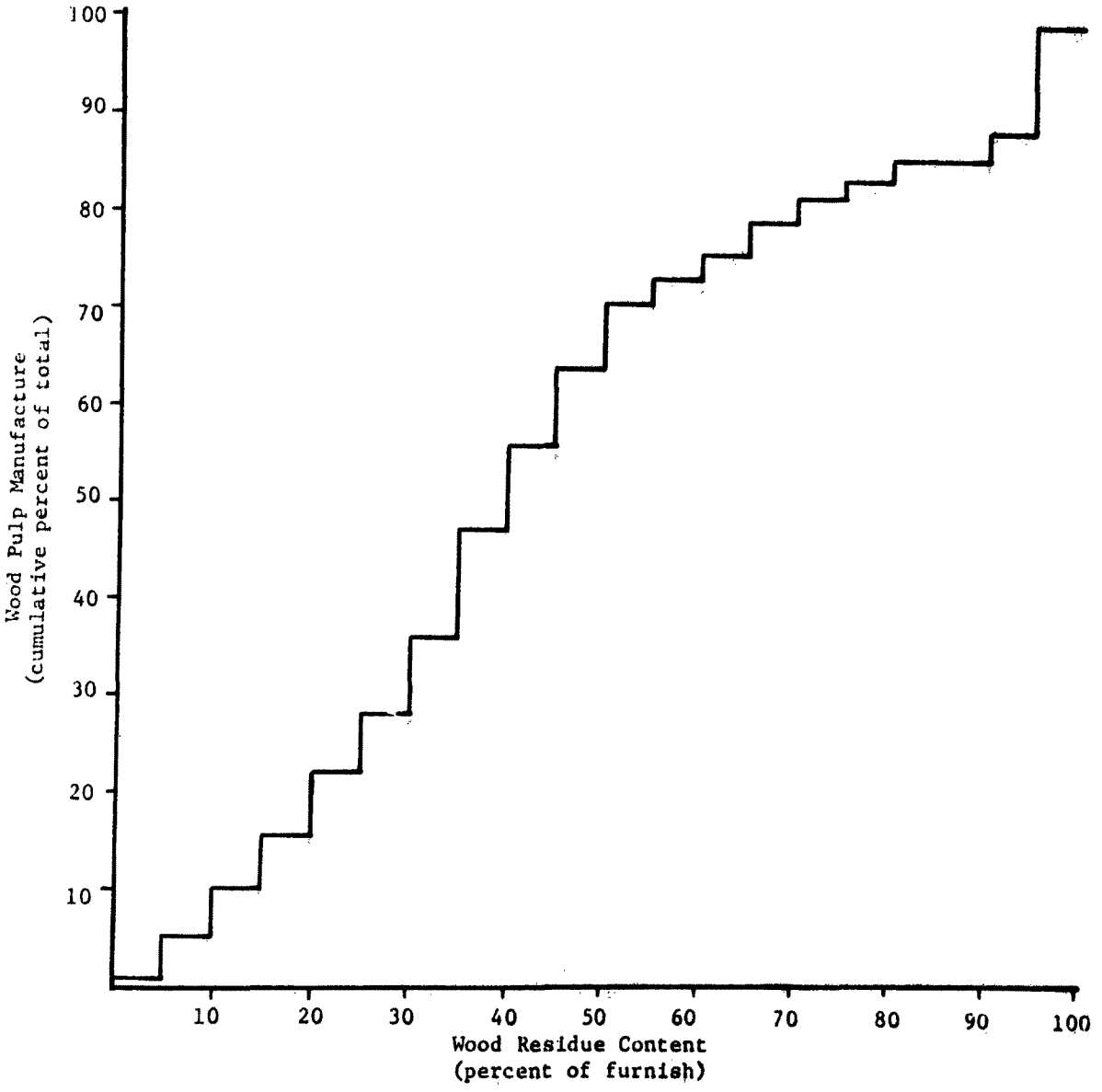

Figure G-2. Cumulative wood residue consumption in total wood pulp manufacture.

Table G-2

WASTE PAPER CONSUMPTION
IN PRINTING/WRITING PAPERS
RANKED BY PERCENT OF WASTE TO TOTAL PRODUCTION IN 1976

Percent[a/] Waste	Waste Paper Consumed (000 tons)	Paper &/or Paperboard Produced (000 tons)	Percent	Cumulative Percent
0 - 5%	33.8	10,059.7	76.5%	76.5%
5 - 10%	60.7	833.6	6.3%	82.8%
10 - 15%	55.0	459.6	3.5%	86.3%
15 - 20%	82.5	508.2	3.9%	90.2%
20 - 25%	24.7	106.8	0.8%	91.0%
25 - 35%	132.5	450.1	3.4%	94.4%
35 - 45%	127.2	319.1	2.4%	96.9%
45 - 70%	98.1	172.2	1.3%	98.1%
70 - 90%	59.4	69.1	0.6%	98.7%
90 - 100%	195.1	170.6	1.3	100.0
TOTALS	869.0	13,149.0		
AVERAGE			6.6%	

a/ Waste paper consumed by mills as a percent of production.

Source: American Paper Institute and Franklin Associates, Ltd.

Table G-3

WASTE PAPER CONSUMPTION
IN TISSUE MANUFACTURE
RANKED BY PERCENT OF WASTE TO TOTAL PRODUCTION IN 1976

Percent Waste[a/]	Consumed (000 tons)	Paper &/or Paperboard Produced (000 tons)	Percent	Cumulative Percent
0 - 5%	3.9	1,525.8	36.4%	36.4%
5 - 10%	31.9	391.0	9.3%	45.8%
10 - 15%	95.6	759.2	18.1%	63.9%
15 - 20%	25.7	144.7	3.5%	67.4%
20 - 30%	31.7	136.2	3.3%	70.6%
30 - 40%	61.1	182.1	4.4%	75.0%
40 - 50%	80.1	172.6	4.1%	79.1%
50 - 65%	18.4	30.0	0.7%	79.8%
65 - 90%	36.2	48.9	1.2%	81.0%
90 - 100%	884.7	795.5	19.0%	100.0%
TOTALS	1,269.3	4,186.0		
AVERAGE			30.3%	

a/ Waste paper consumed by mills as a percent of production.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

Table G-4

WASTE PAPER CONSUMPTION
IN BLEACHED AND UNBLEACHED KRAFT PAPERBOARD
RANKED BY PERCENT OF WASTE TO TOTAL PRODUCTION IN 1976

Percent[a/] Waste	Waste Paper Consumed (000 tons)	Paper &/or Paperboard Produced (000 tons)	Percent	Cumulative Percent
0 - 5%	94.7	13,508.5	78.6%	78.6%
5 - 10%	135.7	1,871.8	10.9%	89.5%
10 - 15%	139.0	1,173.7	6.8%	96.4%
15 - 100%	141.3	622.0	3.6%	100.0%
TOTALS	510.4	17,176.0		
AVERAGE			3.0%	

a/ Waste paper consumed by mills as a percent of production.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

Table G-5

WASTE PAPER CONSUMPTION
IN SEMICHEMICAL PAPERBOARD
RANKED BY PERCENT OF WASTE TO TOTAL PRODUCTION IN 1976

Percent[a/] Waste	Waste Paper Consumed (000 tons)	Paper &/or Paperboard Produced (000 tons)	Percent	Cumulative Percent
0 - 10%	27.1	686.0	16.7%	16.7%
10 - 20%	106.6	674.0	16.4%	33.1%
20 - 25%	148.3	666.4	16.2%	49.4%
25 - 30%	264.1	934.3	22.8%	72.1%
30 - 40%	183.7	477.3	11.6%	94.8%
40 - 100%	100.3	215.2	5.2%	100.0%
TOTAL	978.6	4,105.0		
AVERAGE			23.8%	

a/ Waste paper consumed by mills as a percent of production.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

Table G-6

WASTE PAPER CONSUMPTION
IN KRAFT AND SPECIAL INDUSTRIAL PAPERS
RANKED BY PERCENT OF WASTE TO TOTAL PRODUCTION IN 1976

Percent[a/] Waste	Waste Paper Consumed (000 tons)	Paper &/or Paperboard Produced (000 tons)	Percent	Cumulative Percent
0 - 5%	30.6	4,628.3	84.1%	84.1%
5 - 10%	21.2	377.5	6.9%	90.9%
10 - 15%	15.4	142.2	2.6%	93.6%
15 - 30%	9.3	35.5	0.6%	94.2%
30 - 35%	26.0	80.6	1.5%	95.6%
35 - 45%	14.1	34.8	0.6%	96.3%
45 - 65%	25.0	44.8	0.8%	97.1%
65 - 90%	90.7	123.5	2.2%	99.3%
90 - 100%	37.5	33.8	0.6%	100.0%
TOTALS	269.8	5,501.0		
AVERAGE			4.9%	

a/ Waste paper consumed by mills as a percent of production.

Source: American Paper Institute, Capacity Division and Franklin Associates, Ltd.

Printing and Writing Papers. Figure G-3 shows the consumption of waste paper in the manufacture of printing and writing papers, stated as a percentage of total printing and writing paper production for each range of waste paper utilization. Note that over 75 percent of all printing and writing paper is made from a furnish containing 5 percent or less waste paper. Even though some printing and writing paper production is reported at all levels of waste paper utilization, these levels are relatively small with respect to the zero to 5 percent category. Less than 10 percent of the total printing and writing paper produced during 1976 used more than 20 percent waste paper. This implies that specifying more than 5 percent waste paper in printing and writing papers may severely restrict the number of qualifying suppliers. Note that the waste paper used amounts to only 6.6 percent of the total production.

Figure G-4 portrays this same data as a cumulative percentage. The cumulative percentage starts at 76.5 percent, indicating that 76.5 percent of the total printing and writing papers produced during 1976 utilized from zero to 5 percent waste paper as a fiber furnish. The extremely small steps seen in Figure G-3 at ranges above approximately 50 percent imply that correspondingly little paper is produced using waste paper in percentages of 50 percent or higher.

Tissue. Figure G-5 presents the data found in Table G-3, showing waste paper utilization in tissue manufacture. As in Figure G-4, Figure G-5 presents this information cumulatively. Figure G-6 presents this information discretely. Figures G-4 and G-5 are presented on the same page with corresponding axes in order to highlight the differences in waste paper utilization between these two grades. Note that while Figure G-4 has a very large initial step as discussed above, the initial step of Figure G-5 is less than half as large. This indicates that more than twice as much printing and writing paper uses zero to 5 percent waste paper than does the production of tissue. Note also that the steps of Figure G-4 are very small, especially at the upper waste paper utilization percentages. In contrast, the largest step in Figure G-5 is at the 90 to 100 percent range. This implies that very significant amounts of tissue are manufactured with between 90 and 100 percent waste paper. The total amount of waste paper consumed in tissue manufacture represents 30.3 percent of total production, compared to 6.6 percent for printing and writing papers.

These comparative interpretations may be confirmed by inspecting Figure G-6, showing the discrete range distribution of waste paper content as a percent of total tissue production. Figure G-6 is directly analogous to Figure G-3, and comparison of these two figures will aid in understanding the differences between Figures G-4 and G-5.

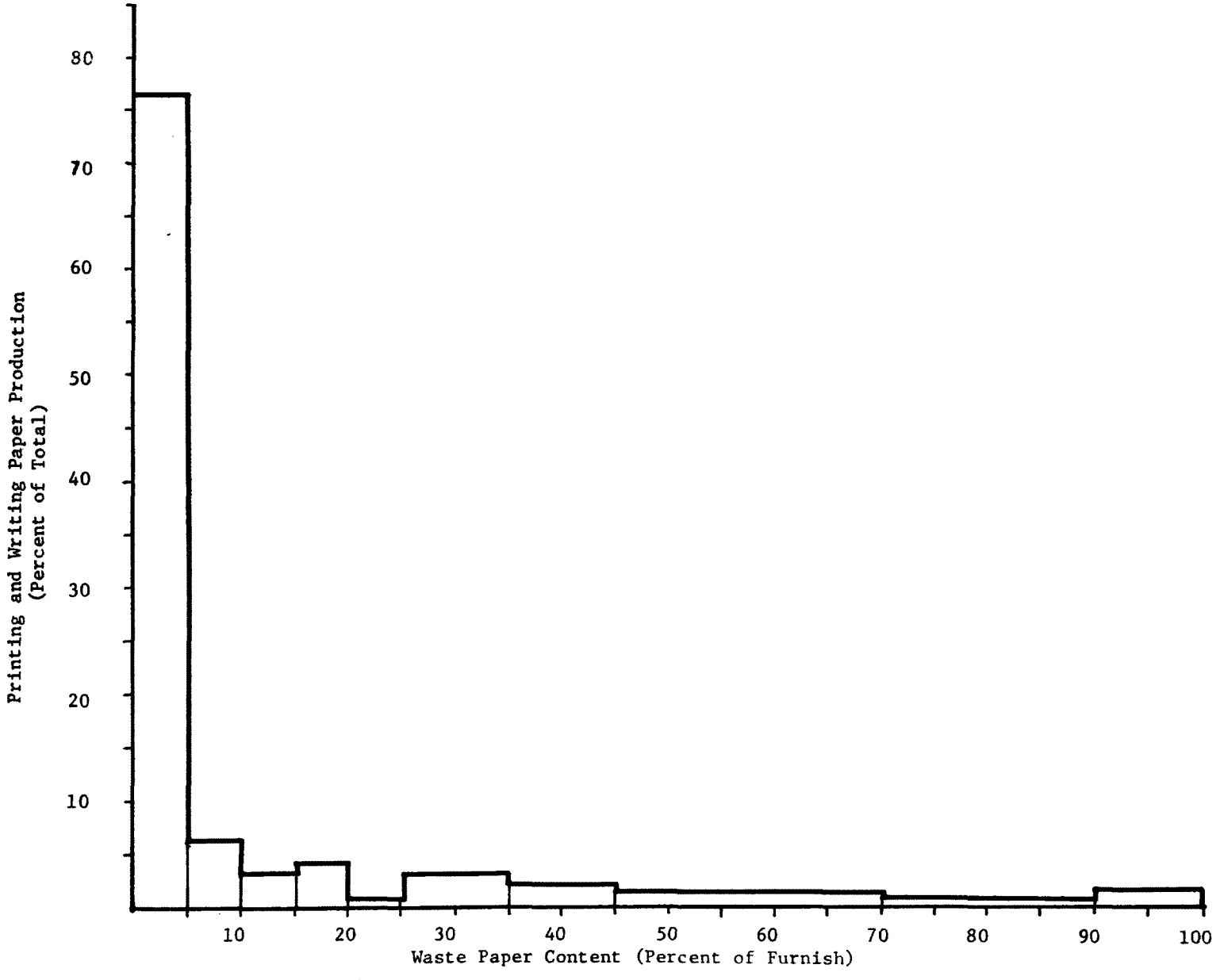

Figure G-3. Waste paper consumption in printing and writing paper manufacture.

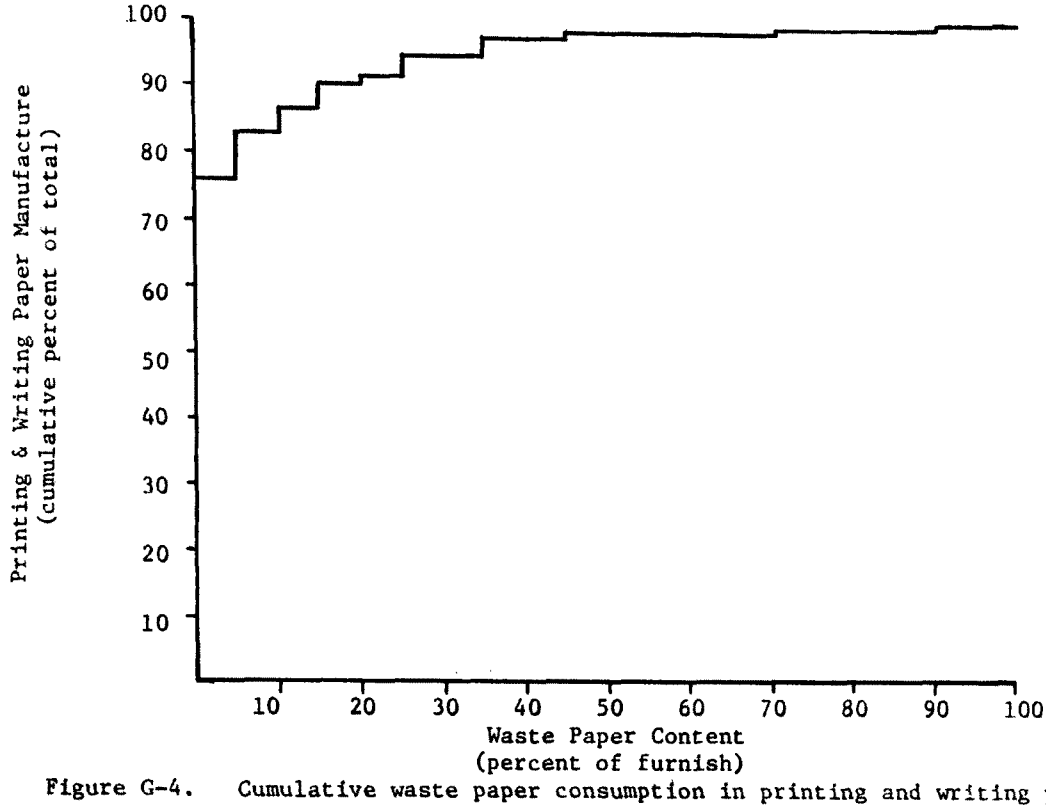

Figure G-4. Cumulative waste paper consumption in printing and writing paper manufacture.

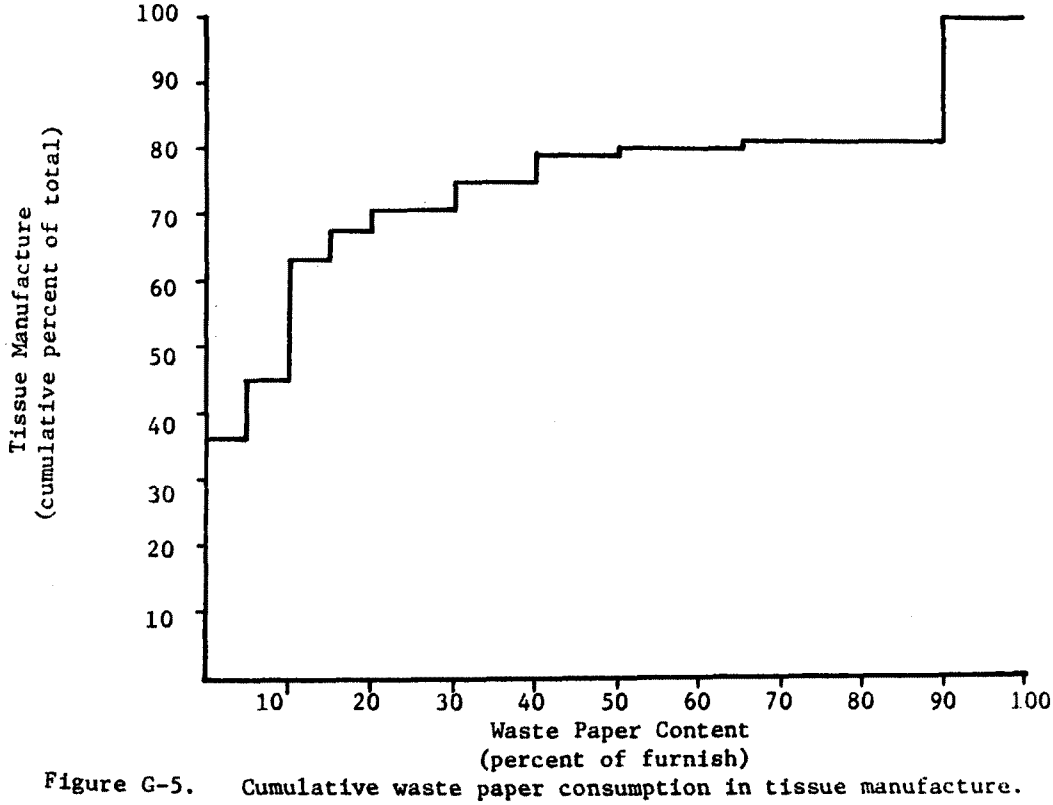

Figure G-5. Cumulative waste paper consumption in tissue manufacture.

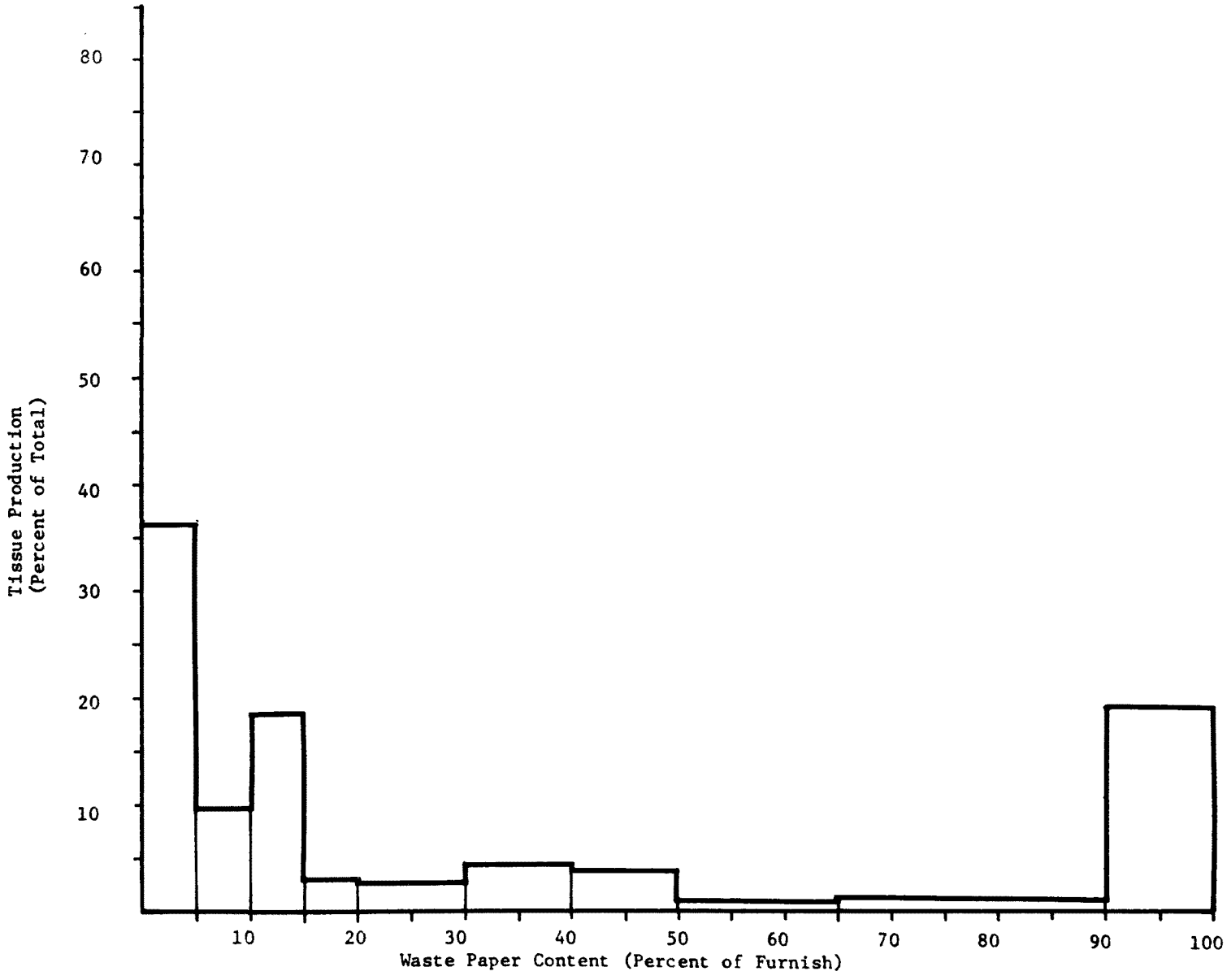

Figure G-6. Waste paper consumption in tissue manufacture.

The bi-modal distribution of waste paper utilization seen in Figure G-6 may be compared to the uni-modal distribution seen in Figure G-3. Figure G-6 shows that significant amounts of tissue are produced using either less than 15 percent waste paper as furnish, or 90 or more percent waste paper as furnish. In contrast, virtually all of the printing and writing paper uses less than 5 percent waste paper as furnish. Note that in tissue production there is relatively little production using intermediate ranges of waste paper. This situation is even more apparent on a regional basis, as will be discussed later in this appendix.

Bleached and Unbleached Kraft Paperboard. Table G-4 presents the consumption of waste paper in bleached and unbleached kraft paperboard. This information is presented as a discrete range distribution in Figure G-7, and as a cumulative distribution in Figure G-8. The potential for confusion in interpreting the graphic presentations of these data is more pronounced than in the earlier figures. Note that almost 80 percent of the kraft paperboard production uses 5 percent or less waste paper, and all but 3.6 percent uses less than 15 percent. Note also that only four ranges of waste fiber utilization are provided. Inspection of Figure G-7 clearly shows that most of the kraft paperboard production uses between zero and 5 percent waste paper as furnish.

Note that the total amount of waste paper consumed represents only 3.0 percent of the total production in this grade, although it may be mistakenly concluded that a sizeable percentage of kraft paperboard production uses more than 15 percent waste fiber as furnish. This incorrect impression may seem to be supported by the relatively large "arm" representing the 15 percent-100 percent range of waste paper content. Inspection of Figure G-8 more clearly presents the actual situation. Figure G-8 shows that all but about 4 percent of the kraft paperboard produced employs 15 percent or less waste paper as furnish. This example has been emphasized to clearly describe how to interpret the different graphical presentations of the data.

Semichemical Paperboard. Figures G-9 and G-10 present the data found in Table G-5, and show the consumption of waste paper in the manufacture of semichemical paperboard. The utilization of waste paper in the manufacture of this grade of paperboard presents a sharp contrast to that of kraft paperboard manufacture. As is evident from comparing Figure G-9 to Figure G-8, only about 17 percent of the semichemical paperboard produced in 1976 used less than 10 percent waste paper in its furnish. At the same time, only about 5 percent of the semichemical paperboard manufactured that year used more than 40 percent waste paper in its furnish.

This relatively narrow range of waste paper utilization may be seen by inspection of Figure G-10, showing the discrete range of distribution of the same data shown in Fugure G-9. The amount of waste paper consumed in the manufacture of this grade represents 23.8 percent of the total amount produced in 1976. It may be inferred that specification of semichemical paperboard containing 40 percent or less waste paper would probably not encounter significant supplier resistance.

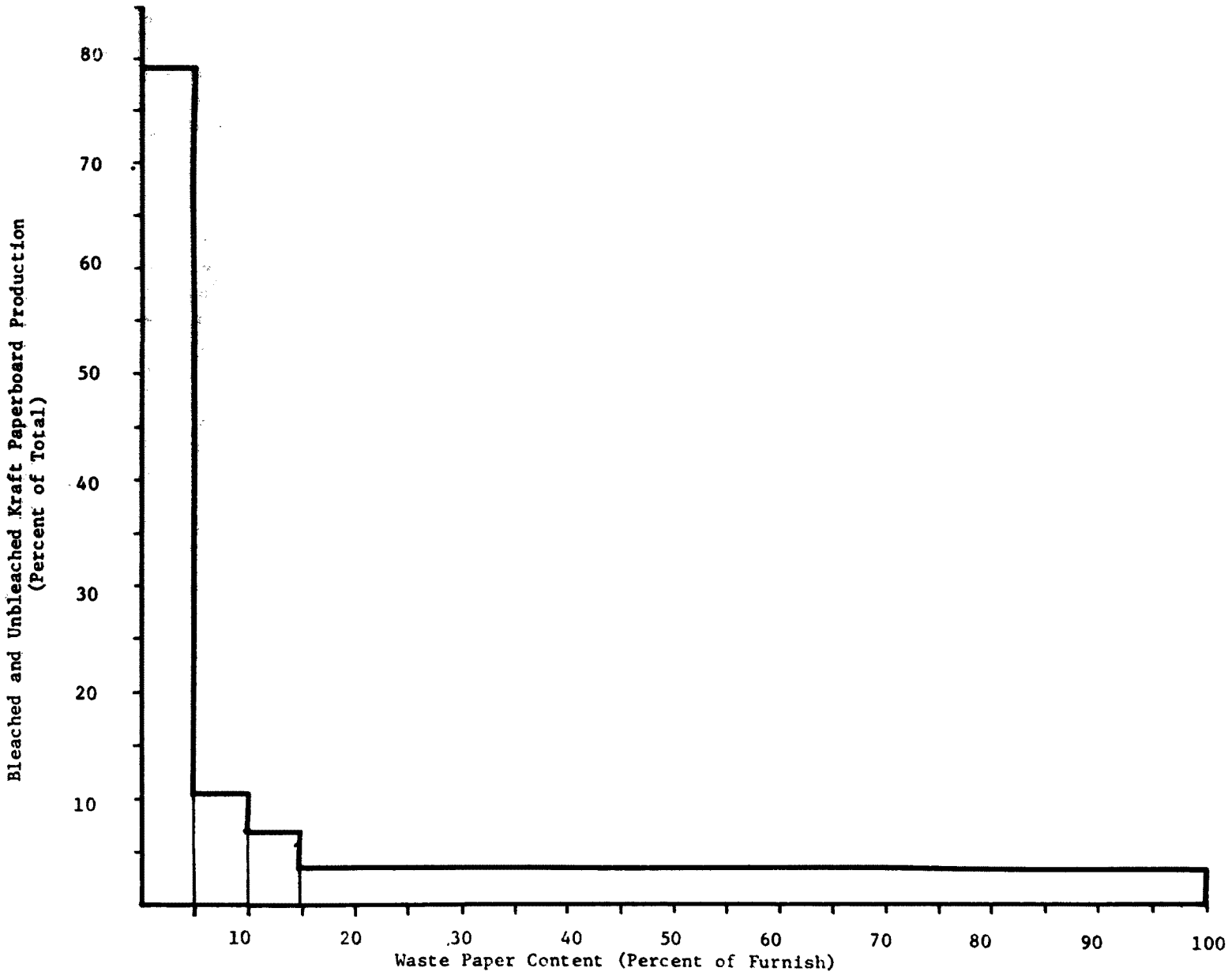

Figure G-7. Waste paper consumption in bleached and unbleached kraft paperboard manufacture.

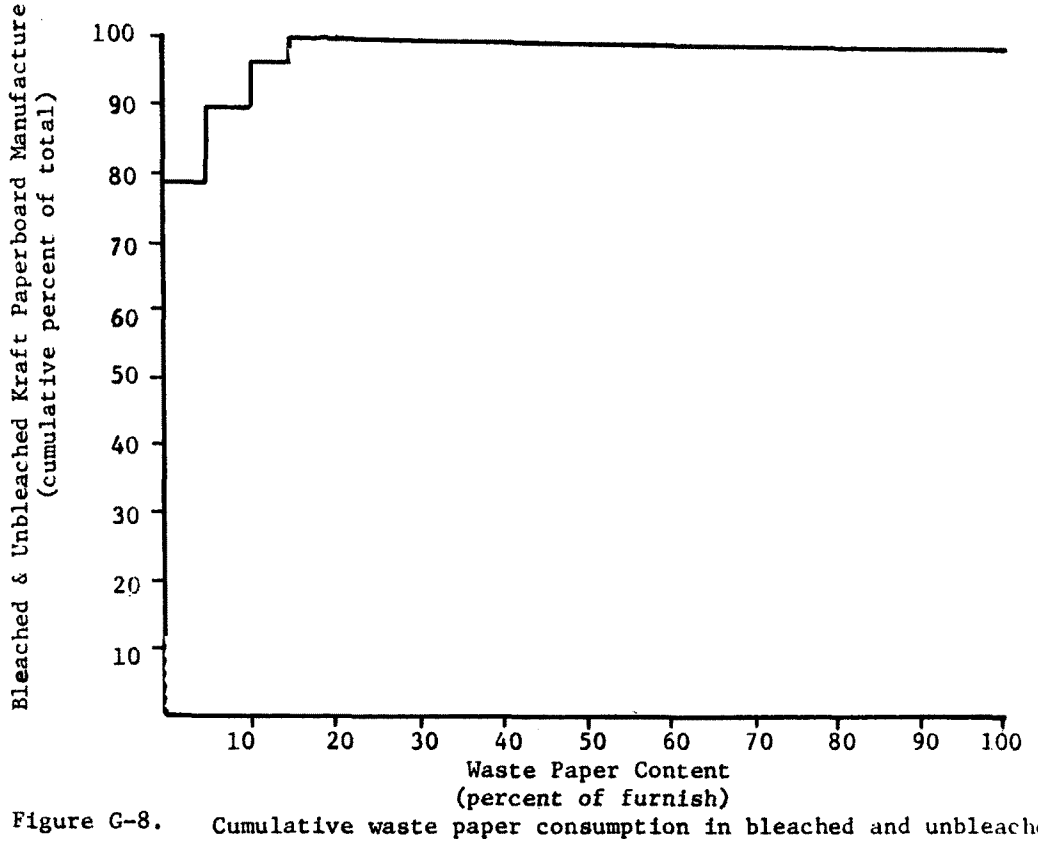

Figure G-8. Cumulative waste paper consumption in bleached and unbleached kraft paperboard manufacture.

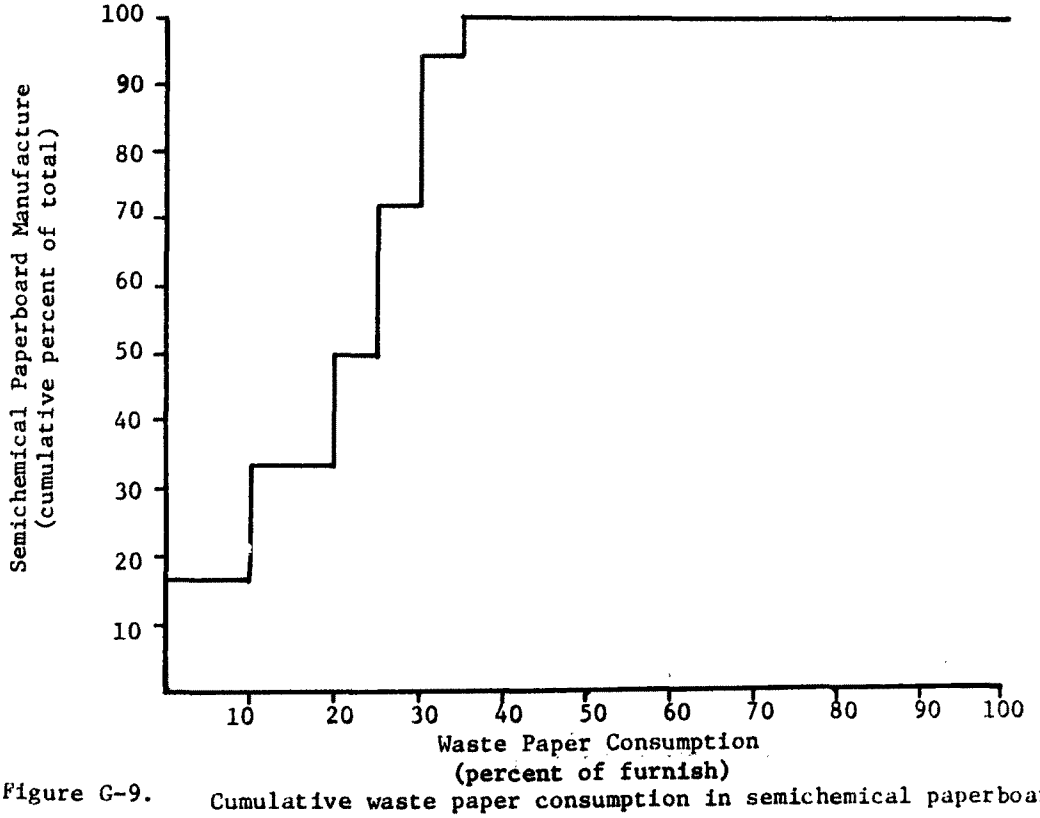

Figure G-9. Cumulative waste paper consumption in semichemical paperboard manufacture.

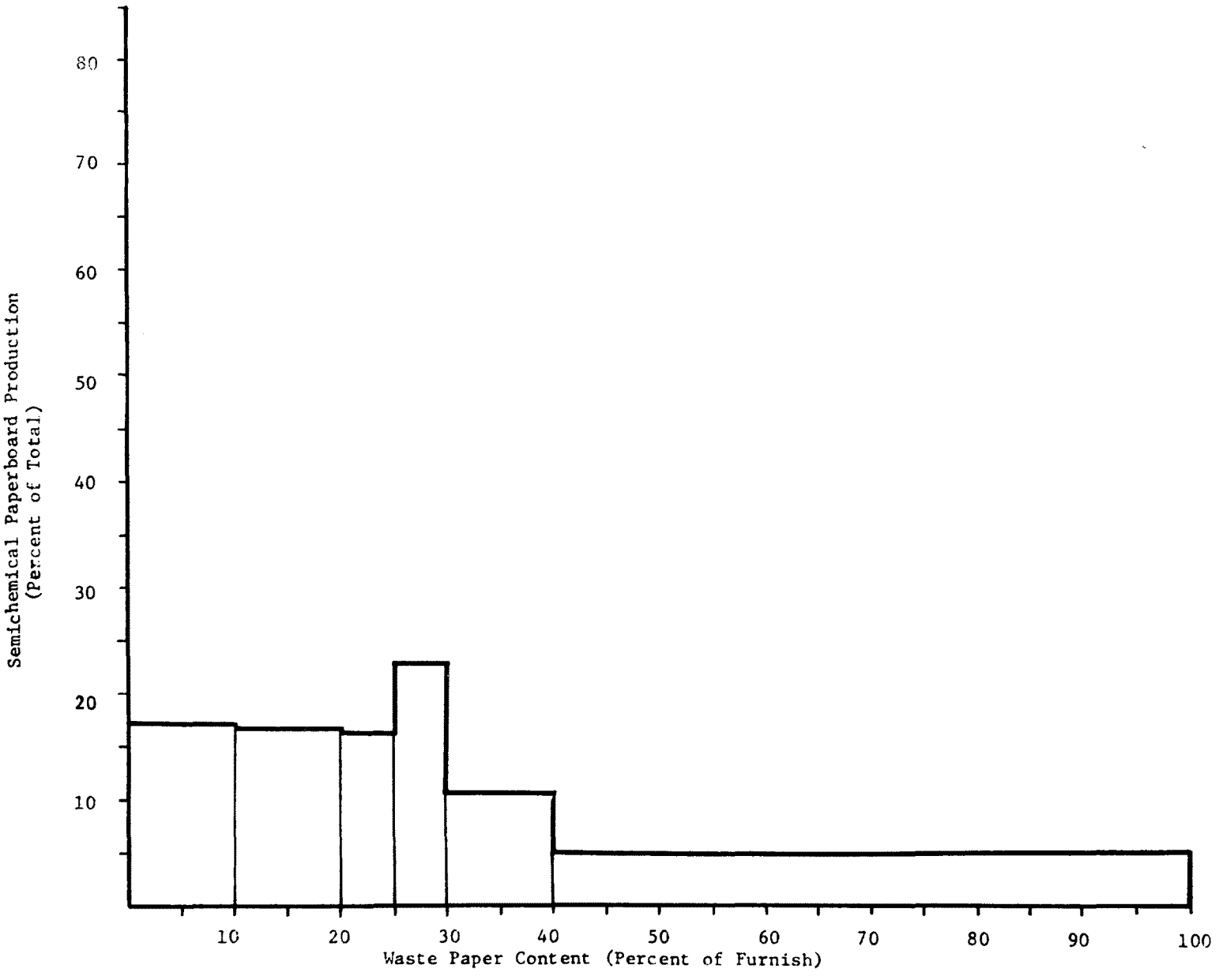

Figure G-10. Waste paper consumption in semichemical paperboard manufacture.

Kraft and Special Industrial Papers. Table G-6, showing the utilization of waste paper in the production of kraft and special industrial papers, is presented graphically in Figures G-11 and G-12. As with Figure G-7, which was easily misinterpreted, Figure G-11 is also subject to such misinterpretation, but to a lesser degree. As explained in the discussion of bleached and unbleached kraft paper manufacture, comparing the discrete interval distribution presentation (Figure G-11) to the corresponding cumulative presentation (Figure G-12) should aid in avoiding confusion. The utilization profile of these grades is even more pronounced than any discussed so far, and indicate that specification of more than 10 percent waste paper as furnish in these grades would exclude over 90 percent of the production. The total amount of waste paper consumed in this grade represents 4.9 percent of the total 1976 production.

DISCUSSION OF REGIONAL DATA

Forest and Manufacturing Residues

Table G-7 presents a more detailed break down of the information shown as an aggregate in Table G-1. For each of the four regions of the country (northeast, central, south, and west), the forest and manufacturing residues consumed in wood pulp manufacture are shown, ranked by percent of residues consumed. In a manner analogous to that of Figure G-1, Figures G-13 through G-16 show the percentage of total wood pulp production using each range of manufacturing and forest residue consumption. These data are presented in a cumulative presentation in Figure G-17, showing all four regions juxtaposed for ease of comparison.

The first section of Table G-7, showing data for the northeast region and depicted in Figure G-13, may be considered a standard for comparison for other regions. In the northeast, the consumption of forest manufacturing residues is spread approximately uniformly throughout the range of residue consumption from zero through 80 percent. The average utilization ratio in this region is 0.601 cords per ton, only slightly below the national average utilization ratio of 0.746 cords per ton. This implies that paper made with roughly average percentages of wood residue fibers are likely to be available in the northeast section of the country. This is represented in Figure G-17 as steps of approximately equal size in the cumulative graphic presentation for the northeast region.

Approximately the same situation as found in the northeast exists in the central region, as shown in the second section of Table G-7, Figure G-14, and the corresponding section of Figure G-17. Only 0.511 cords of wood residue are used per ton of pulp on the average in this region. As may be seen in Figure G-14, the utilization rate distribution is mostly lumped between 30 percent and 70 percent.

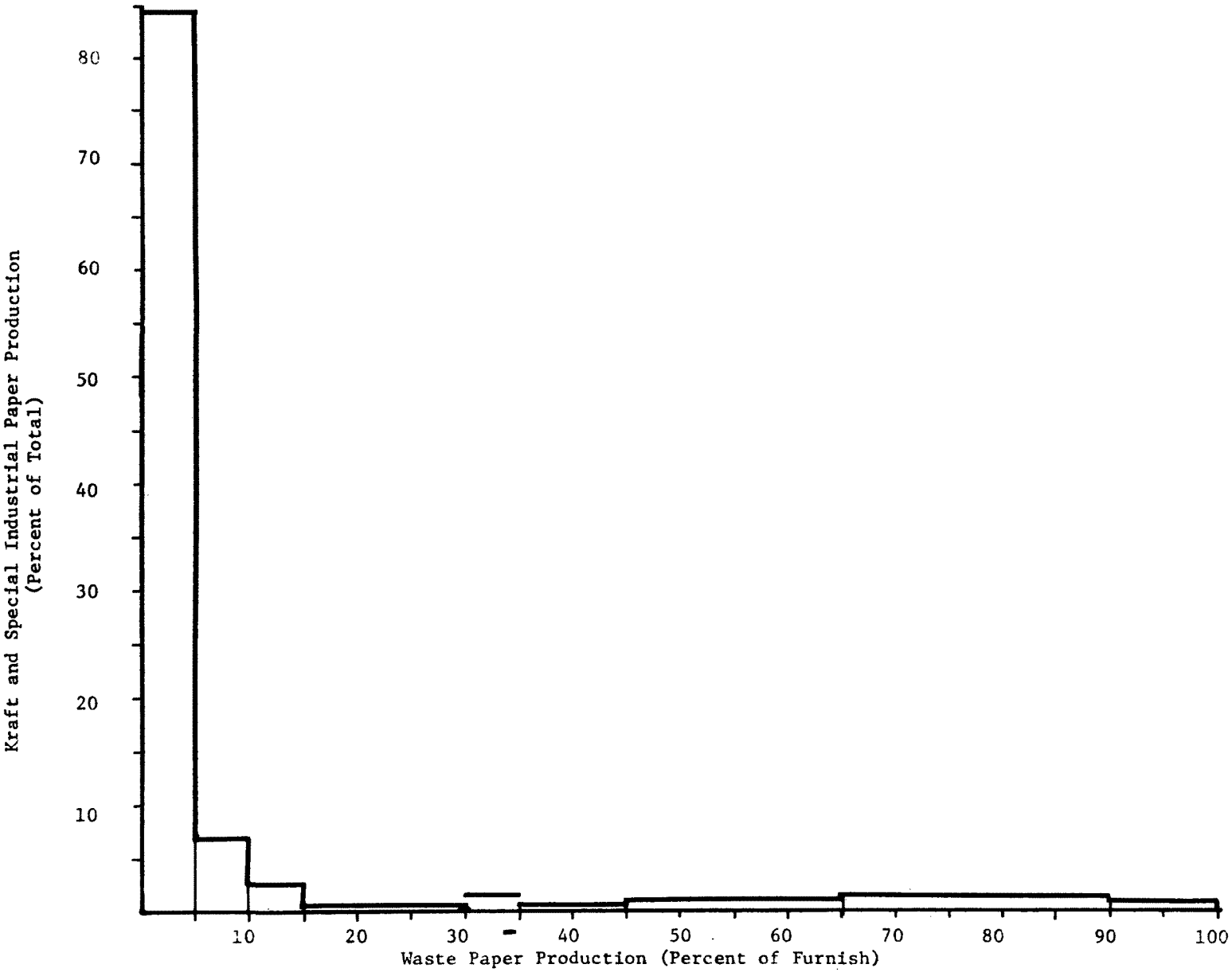

Figure G-11. Waste paper consumption in kraft and special industrial paper production.

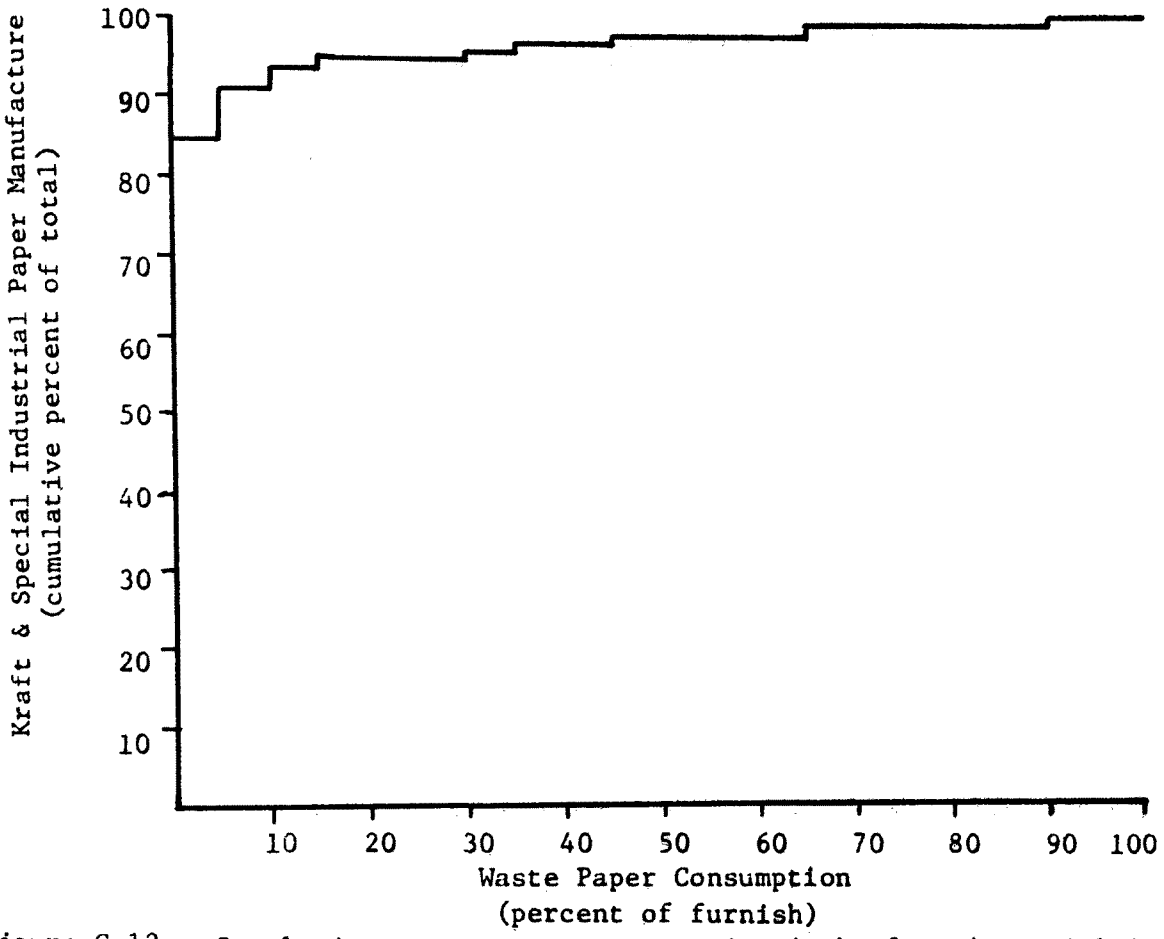

Figure G-12. Cumulative waste paper consumption in kraft and special industrial paper manufacture.

Table G-7

FOREST AND MANUFACTURING RESIDUES CONSUMED IN 1976
IN WOOD PULP MANUFACTURE
RANKED BY PERCENT OF RESIDUES IN PULPWOOD CONSUMED

	Northeast			
Percent Residues 1/	Residues (000 cords)	Wood Pulp (000 tons)	Percent	Cumulative Percent
0 - 30%	241.2	894.0	29.6%	29.6%
30 - 35%	354.9	664.2	22.0%	51.6%
35 - 50%	384.8	499.4	16.5%	68.1%
50 - 80%	585.3	787.4	26.1%	94.2%
80 - 100%	257.6	173.5	5.8%	100.0%
TOTAL	1,814.8	3,018.5	100.0%	
AVERAGE UTILIZATION RATIO	0.601 Cords Per Ton			

1/ Residues consumed as a percent of total pulpwood consumed.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

Table G-7 (con't)

FOREST AND MANUFACTURING RESIDUES CONSUMED IN 1976
IN WOOD PULP MANUFACTURE
RANKED BY PERCENT OF RESIDUES IN PULPWOOD CONSUMED

Percent Residues 1/	Central Residues (000 cords)	Central Wood Pulp (000 tons)	Percent	Cumulative Percent
0 - 10%	46.4	456.8	15.8%	15.8%
10 - 15%	9816	503.9	17.4%	33.2%
15 - 30%	155.7	263.3	9.1%	42.3%
30 - 40%	220.6	476.8	16.5%	58.8%
40 - 60%	286.5	566.8	19.6%	78.4%
60 - 70%	358.9	342.9	11.9%	90.3%
70 - 95%	84.4	89.2	3.1%	93.4%
95 - 100%	226.0	193.4	6.6%	100.0%
TOTAL	1,477.1	2,893.1	100.0%	
AVERAGE UTILIZATION RATIO	0.511 Cords per Ton			

1/ Residues consumed as a percent of total pulpwood consumed.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

Table G-7 (con't)

FOREST AND MANUFACTURING RESIDUES CONSUMED IN 1976
IN WOOD PULP MANUFACTURE
RANKED BY PERCENT OF RESIDUES IN PULPWOOD CONSUMED

South

Percent Residues[1/]	Residues (000 cords)	Wood Pulp (000 tons)	Percent	Cumulative Percent
0 - 10%	145.1	1,626.2	5.3%	5.3%
10 - 15%	199.1	1,195.1	3.9%	9.2%
15 - 20%	362.5	1,525.2	5.0%	14.2%
20 - 25%	1,334.0	3,659.6	11.9%	26.1%
25 - 30%	1,129.8	2,551.8	8.3%	34.4%
30 - 35%	1,204.0	2,456.9	8.0%	42.4%
35 - 40%	2,759.8	4,681.5	15.2%	57.6%
40 - 45%	2,451.8	3,799.0	12.3%	69.9%
45 - 50%	1,893.7	2,545.7	8.3%	78.2%
50 - 55%	1,821.5	2,118.2	6.9%	85.1%
55 - 60%	1,173.6	1,393.2	4.5%	89.6%
60 - 65%	646.1	925.4	3.0%	92.6%
65 - 75%	1,073.3	1,006.2	3.3%	95.9%
75 - 95%	655.3	526.6	1.6%	97.5%
95 - 100%	983.8	793.7	2.5%	100.0%
TOTAL	17,833.4	30,804.3	100.0%	
AVERAGE UTILI UTILIZATION RATIO	0.579 Cords per Ton			

1/ Residues consumed as a percent of total pulpwood consumed.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

Table G-7 (con't)

FOREST AND MANUFACTURING RESIDUES CONSUMED IN 1976
IN WOOD PULPMANUFACTURE
RANKED BY PERCENT OF RESIDUES IN PULPWOOD CONSUMED

	West			
Percent Residues 1/	Residues (000 cords)	Wood Pulp (000 tons)	Percent	Cumulative Percent
0 - 25%	32.9	175.5	2.2%	2.2%
25 - 55%	487.5	459.5	5.8%	8.0%
55 - 65%	518.0	394.5	5.0%	13.0%
65 - 75%	341.0	310.7	3.9%	16.9%
70 - 80%	766.6	549.2	6.9%	23.8%
80 - 95%	3,347.5	2,05..5	25.9%	49.7%
95 - 100%	6,719.4	4,010.0	50.3%	100.0%
TOTAL	12,212.9	7,956.9	100.0%	
AVERAGE UTILIZATION RATIO	1.535 Cords per Ton			

1/ Residues consumed as a percent of total pulpwood consumed.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

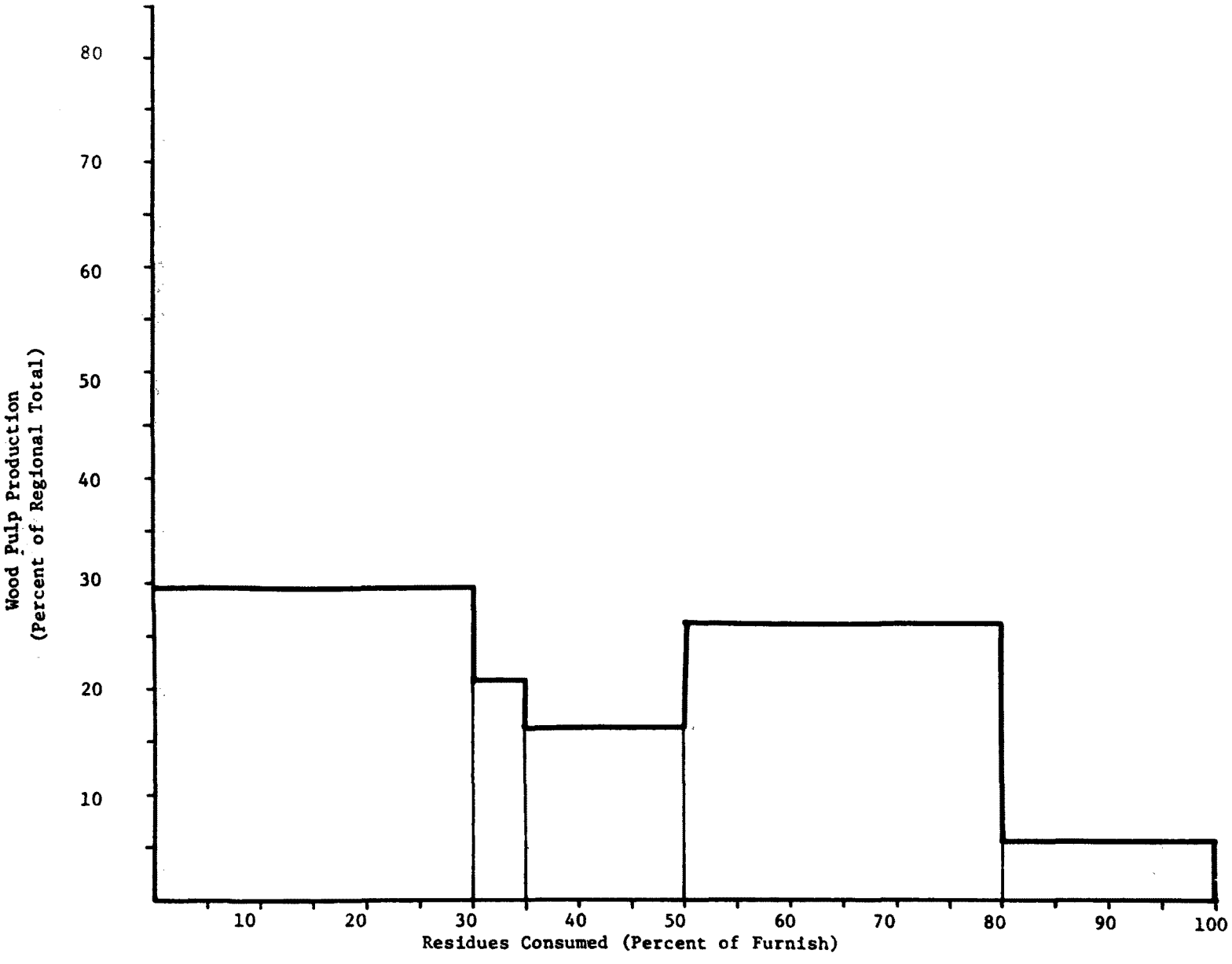

Figure G-13. Forest and manufacturing residues consumed, Northeast Region, 1976.

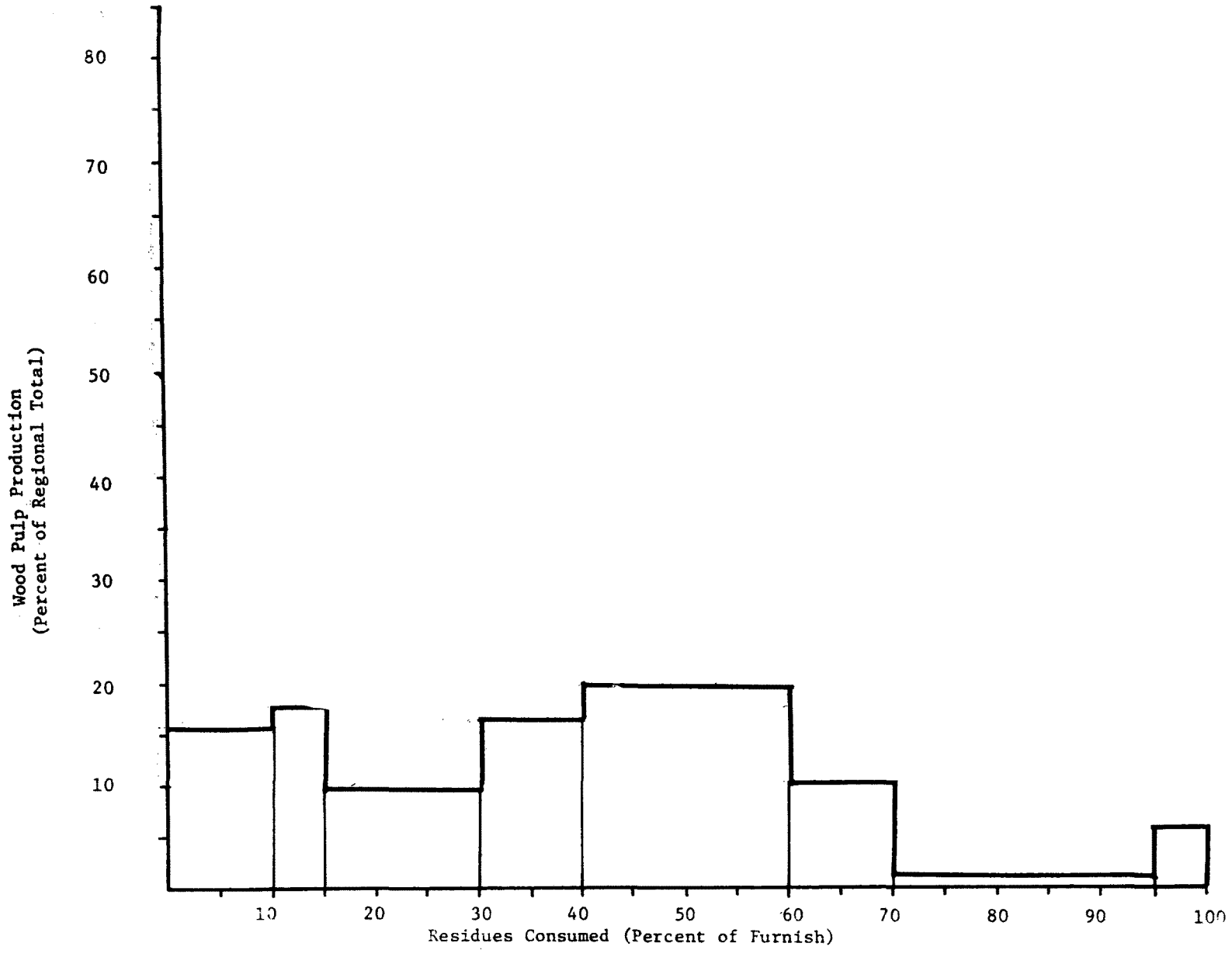

Figure G-14. Forest and manufacturing residues consumed, Central Region, 1976.

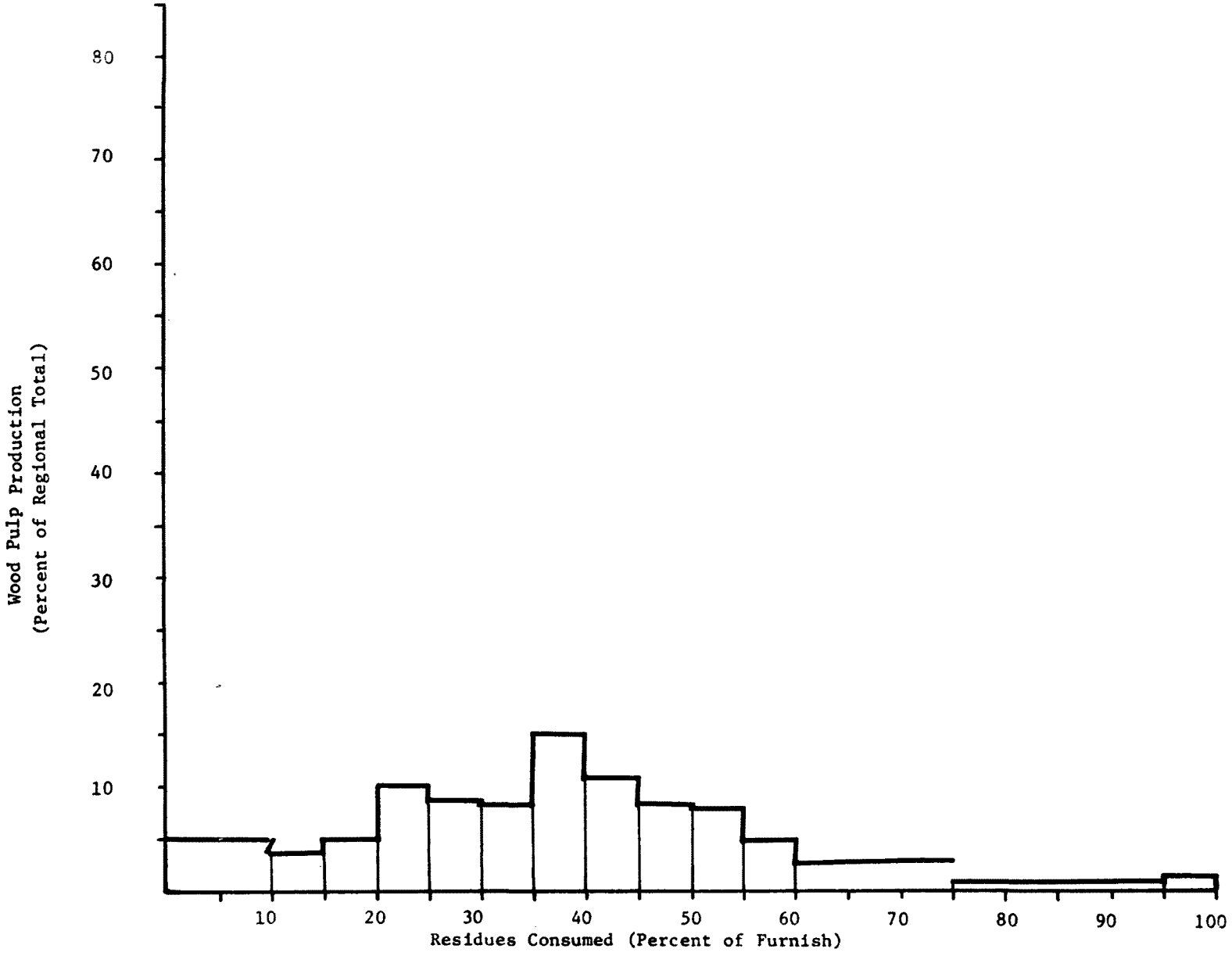

Figure G-15. Forest and manufacturing residues consumed, Southern Region, 1976.

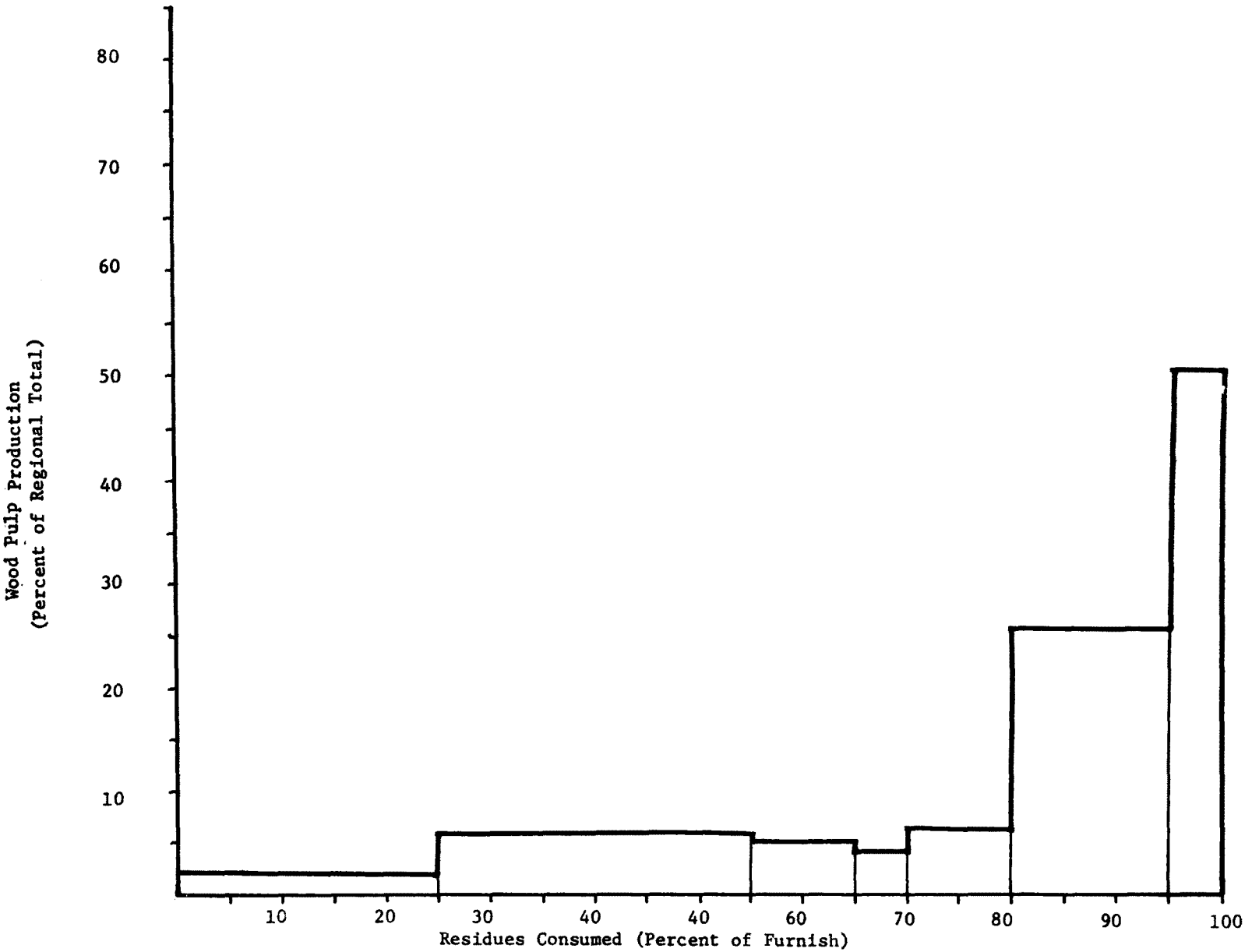

Figure G-16. Forest and manufacturing residues consumed, Western Region, 1976.

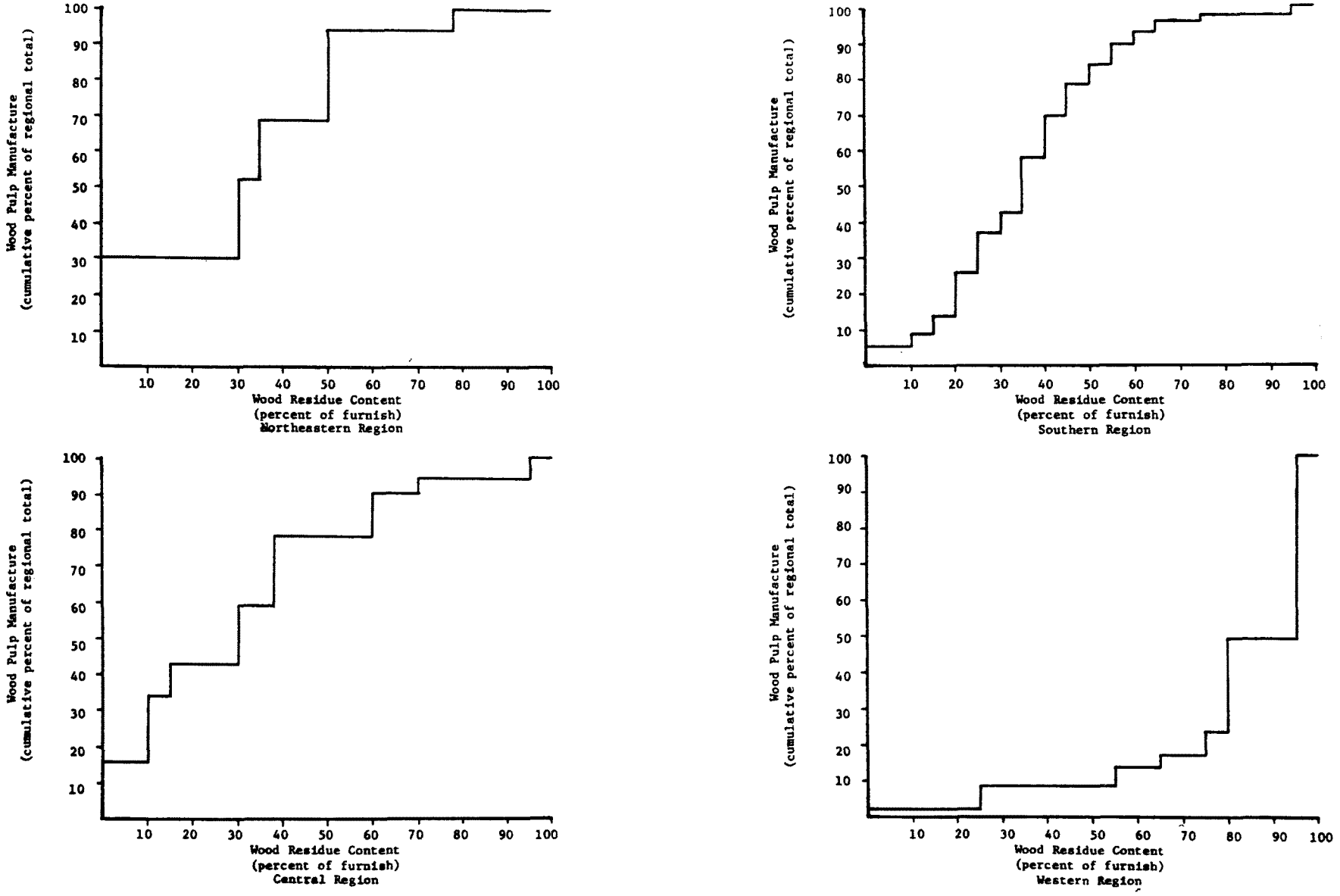

Figure G-17. Cumulative forest and manufacturing wood residue content in pulpwood manufacture, by region, 1976.

However, in the southern region the situation is somewhat different. As shown in the third section of Table G-7 and in Figure G-14, the bulk of the wood pulp production in this region uses less than 55 percent wood residue waste. This is shown in Figure G-17, the southern section, as relatively small steps in the cumulative graph above about 70 percent residue content. The regional average wood waste utilization ratio is 0.579 cords per ton, compared to 0.746 cords per ton nationally. Specification of high percentages of manufacturing and forest residue in paper made in this part of the country may meet with supplier resistance.

This situation is largely reversed in the western portion of the country, as shown in the last part of Table G-7 and Figure G-16. In this region, over 50 percent of the wood pulp manufactured uses 85 percent or more forest and manufacturing residues. Almost 98 percent of the wood pulp produced uses more than 25 percent forest and manufacturing residues. This may be seen in Figure G-17, showing cumulative distribution, as extraordinarily large steps at high levels of wood residue content in the western region. In contrast to other regions, the wood waste utilization ratio in this region is 1.535 cords per ton. This is almost three times as large as the central and southern regions, and more than twice as large as the national average. Thus, in the western portion of the country, there would be little difficulty in obtaining paper containing very high percentages of wood residue.

Inspection of Figure G-16 emphasizes the regional differences in wood residue utilization in wood pulp manufacture. Since transportation is a significant expense in the distribution of paper and paper products, it seems likely that specification of wood residue percentages in excess of those locally available may result in significant purchasing difficulty. Conversely, if paper and paper products having wood waste utilization rates which are fairly typical in the region in which the purchase is made, it is likely that suppliers may be more easily located than otherwise.

Regional Consumption of Waste Paper by End-Use

In a manner analogous to that of Tables G-2 through G-6, Tables G-8 through G-12 show the regional differences in the utilization of waste paper in the manufacture of the various grades of paper. For each grade of paper considered, discrete utilization distributions are shown for each region. A cumulative distribution, showing all four regions, is included to highlight regional differences, as well.

Printing and Writing Paper. Table G-8 is presented as a discrete utilization distribution in Figure G-18 and shows the utilization of waste paper in printing and writing paper manufacture in the northeast region. This same information is presented as a cumulative distribution in the corresponding section of Figure G-21. As is apparent, over three-fourths of the printing and writing paper made in this region uses 5 percent or less waste paper in its furnish. There is a slightly larger than average amount of printing and writing paper produced in this region using 25 to 45 percent waste paper in its furnish, representing about 9 percent of the total printing and writing paper production in this part of the country. It seems likely that this is the result of the large number of relatively

Table G-8

REGIONAL WASTE PAPER CONSUMPTION
IN PRINTING & WRITING PAPERS, 1976

Northeast				
Percent Waste[1/]	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 5%	9.3	3,322.4	75.9%	75.9%
5 - 10%	22.5	386.6	6.5%	82.4%
10 - 15%	17.0	133.7	3.1%	85.5%
15 - 20%	16.7	89.0	2.0%	87.5%
20 - 25%	24.2	104.6	2.4%	89.9%
25 - 45%	140.7	387.4	8.8%	98.7%
45 - 100%	50.8	56.3	1.3%	100.0%
TOTAL	281.2	4,380.0	100.0%	
AVERAGE			6.4%	

1/ Waste paper consumed as a percent of printing/writing papers produced.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

Table G-8 (con't)

REGIONAL WASTE PAPER CONSUMPTION
IN PRINTING & WRITING PAPERS, 1976

Central				
Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 5%	3.6	2,721.0	68.6%	68.6%
5 - 10%	16.3	247.9	6.3%	74.9%
10 - 20%	42.3	349.8	8.8%	83.7%
20 - 45%	90.7	291.7	7.4%	91.1%
45 - 90%	113.6	191.3	4.8%	95.9%
90 - 100%	188.2	164.3	4.1%	100.0%
TOTAL	454.7	3,966.0	100.0%	
AVERAGE			11.5%	

1/ Waste paper consumed as a percent of printing/writing papers produced.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

Table G-8 (con't)

REGIONAL WASTE PAPER CONSUMPTION
IN PRINTING & WRITING PAPERS, 1976

South

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 5%	19.0	3,235.9	84.7%	84.7%
5 - 100%	65.0	585.1	15.3%	100.0%
TOTAL	84.0	3,821.0	100.0%	
AVERAGE			2.2%	

West

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 100%	49.1	982.0	100.0%	100.0%
TOTAL	49.1	982.0	100.0%	100.0%
AVERAGE			5.0%	

1/ Waste paper consumed as a percent of printing/writing papers produced.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

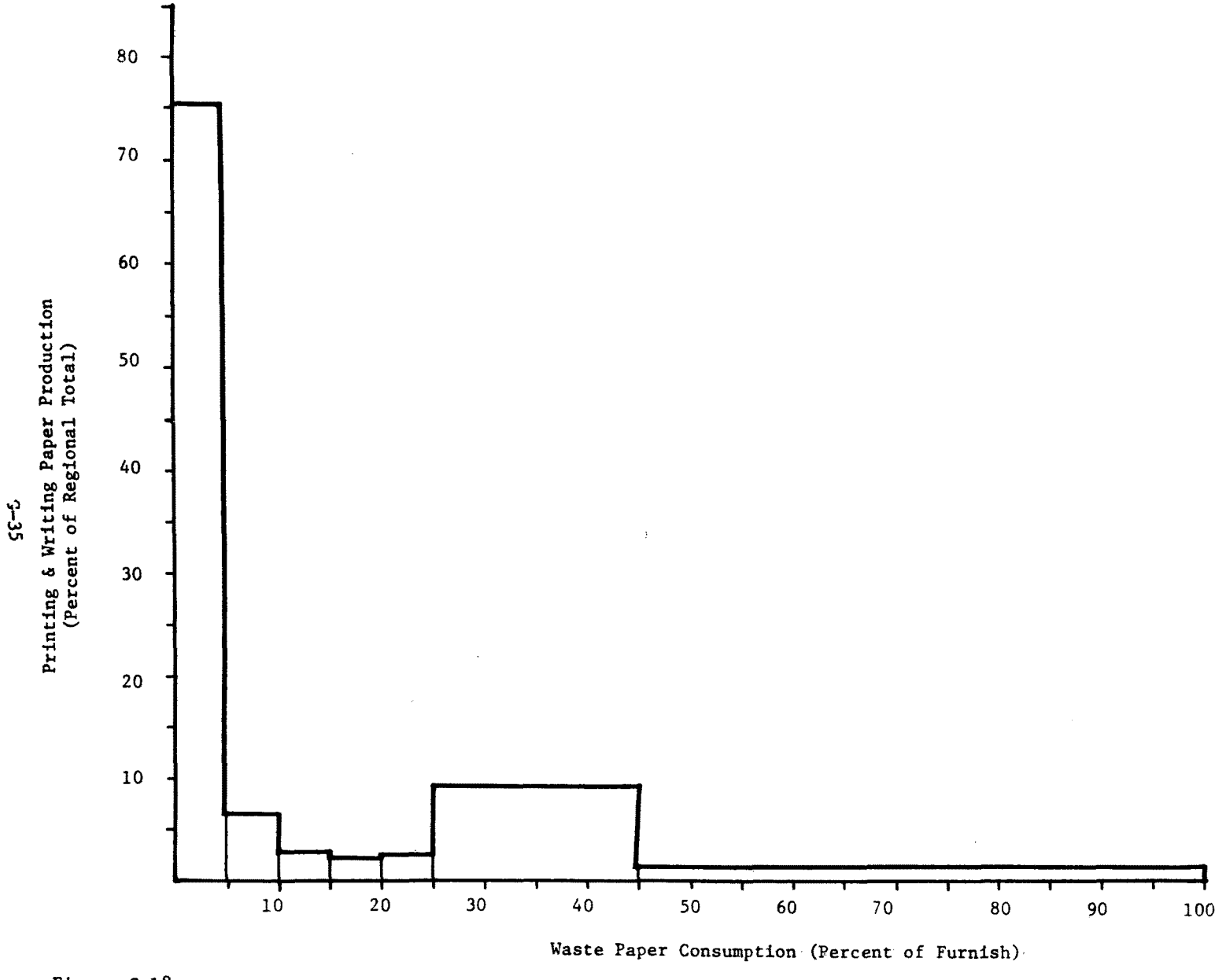

Figure G-18. Waste paper consumption in printing & writing paper, Northeast Region, 1976.

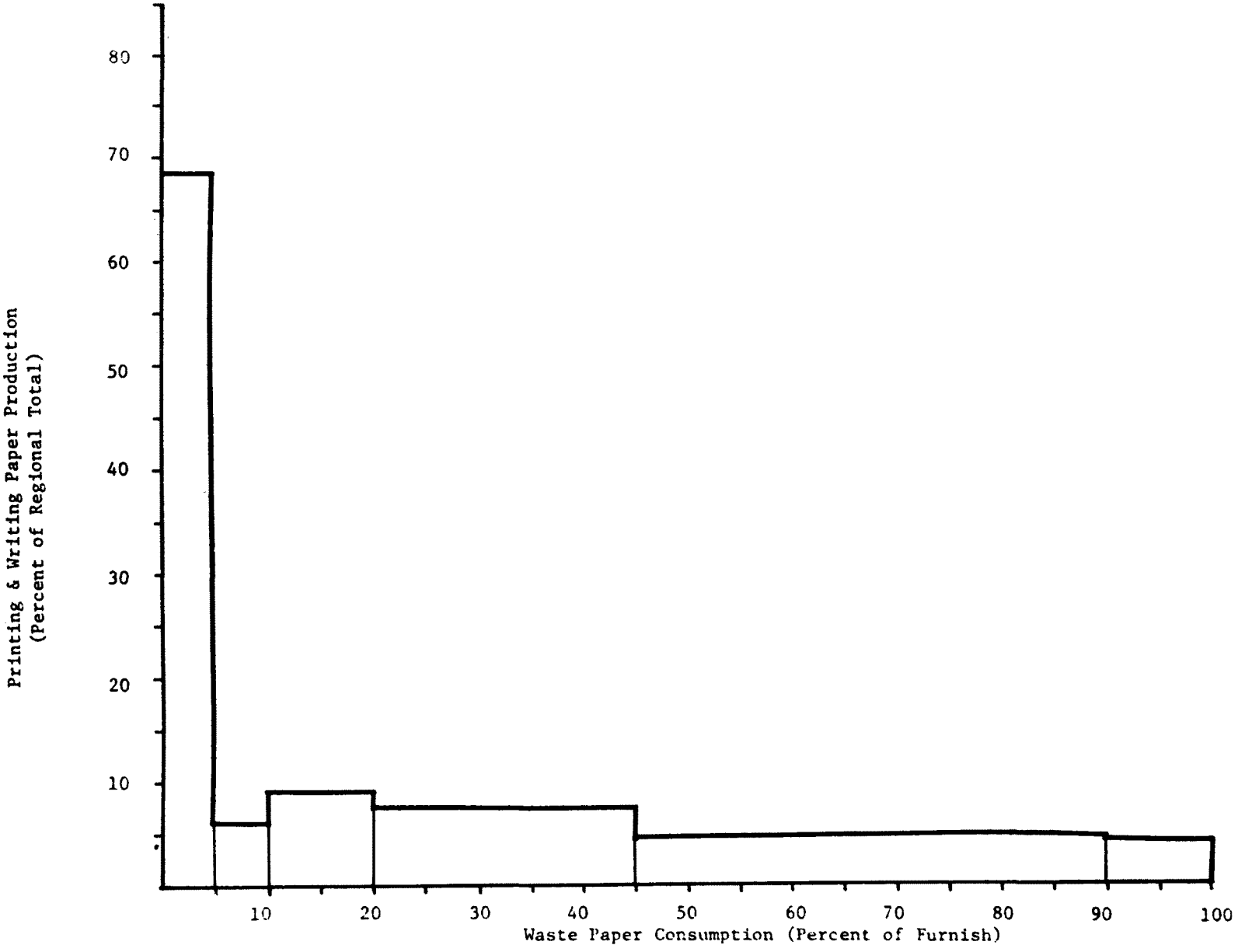

Figure G-19. Waste paper consumption in printing & writing paper, Central Region, 1976.

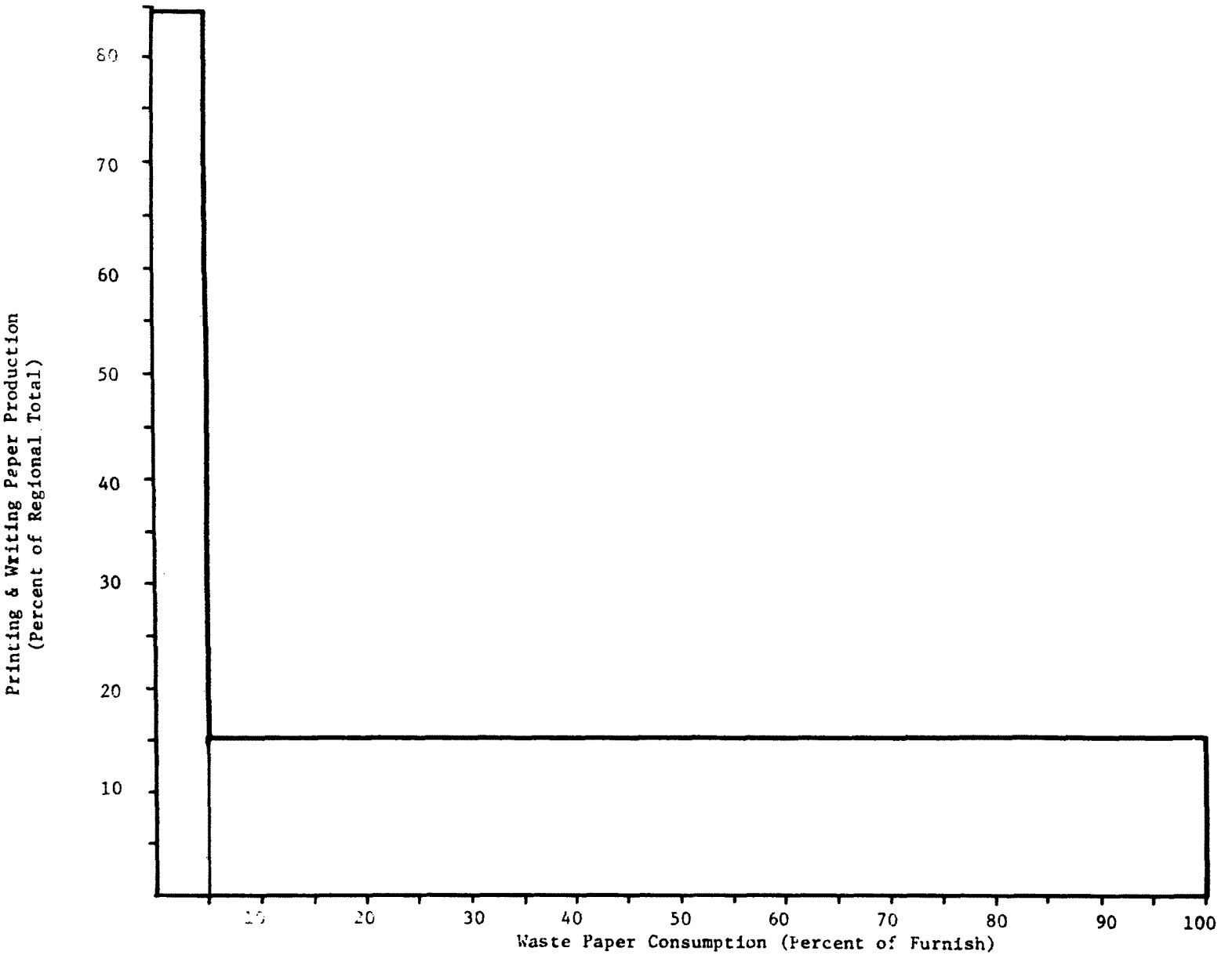

Figure G-20. Waste paper consumption in printing & writing paper, Southern Region, 1976.

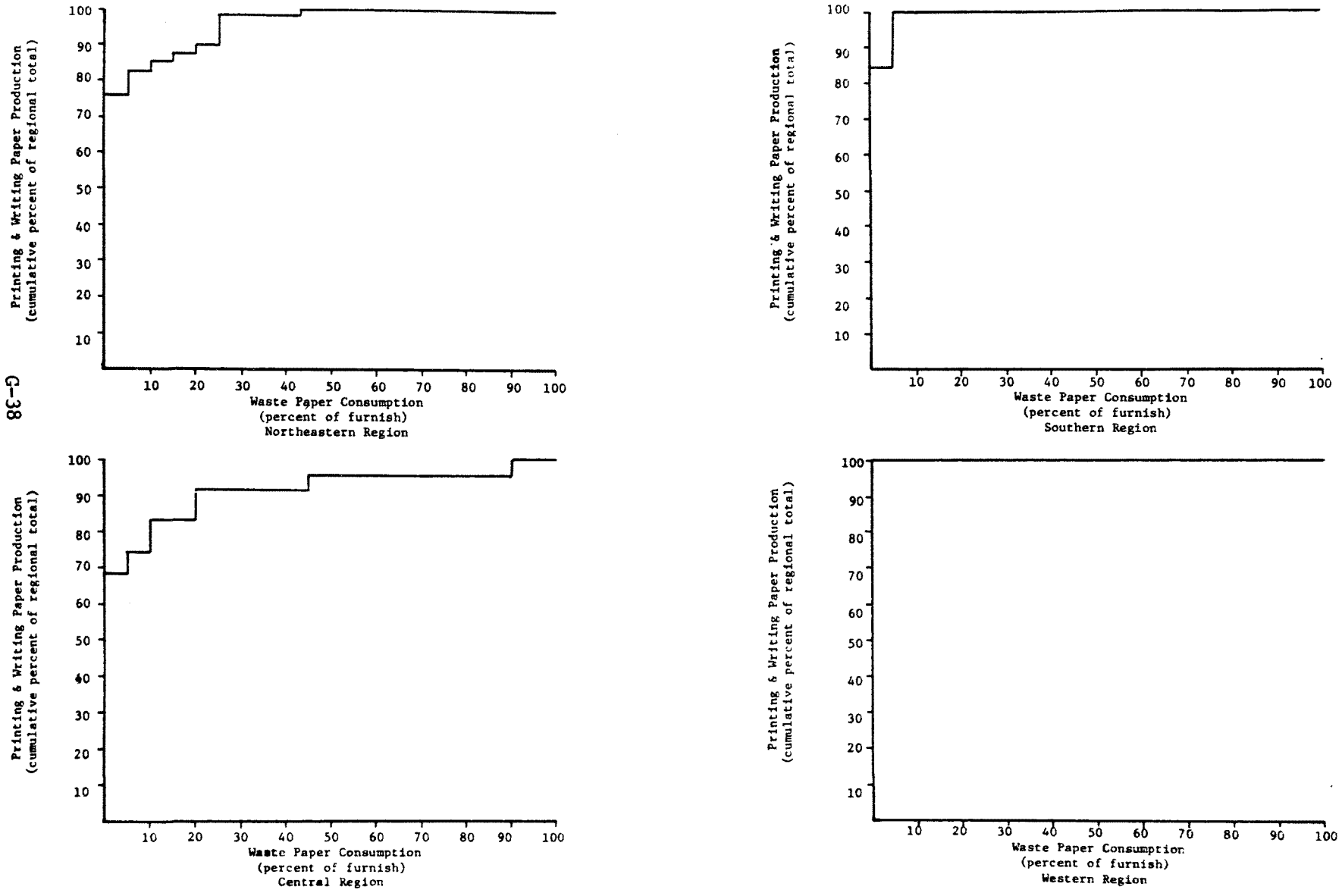

Figure G-21. Cumulative consumption of waste paper in printing and writing paper manufacture, by region,

small recycling mills which typically use roughly 30 percent waste fiber with about 70 percent market pulp as furnish for their specialty products. The total waste paper consumption in this region represents only 6.4 percent of the regional production, however.

The data in the second section of Table G-8 is presented in Figure G-19 and the corresponding section of Figure G-21. Notice that in these data for the central region the utilization of waste fiber at roughly the 30 percent level as discussed above is not present. The total amount of waste paper consumed is much greater, however, representing 11.5 percent of the total regional production. This average utilization rate is more than five times greater than that of the southern region.

The data for the southern region are shown in the third section of Table G-8, in Figure G-20, and in the corresponding section of Figure G-21. Note that Figure G-20 is easily misinterpreted since there are only two ranges of waste paper utilization shown. As plotted in Figure G-20, it might appear that the majority of printing and writing paper produced in the southern region uses about 15 percent waste paper in the furnish. This is an erroneous conclusion, however. Rather, Figure G-20 should be interpreted as indicating that only 15 percent of the total printing and writing paper production in the southern region uses more than 5 percent waste paper in its furnish. This may be more clearly visualized in the corresponding section of Figure G-21, showing the cumulative distribution of these data. Note that the total waste paper consumption in this region represents only 2.2 percent of total regional production. This is about one-third the rate in the northeast, one-half the rate in the west, and only one-fifth the rate in the central region.

The data for the western region are shown in the fourth section of Table G-8. No discrete utilization distribution is provided for this region since only one range of waste consumption is listed. The cumulative distribution of waste paper utilization for this region is shown in the corresponding section of Figure G-21. As may be seen, when only one range of utilization is provided, the graphic portrayal is relatively meaningless. It is likely that a very few mills are involved in the production of printing and writing papers using waste paper as furnish in this region, and the data are presented by the API in such a way as to provide non-disclosure of the individual mill data.

Note that the 49.1 thousand tons of waste used in this region represent only 5 percent of the total production of all mills in the region. This implies that very few mills use significant amounts of waste paper as supplemental furnish in this region. Specification of higher levels of waste paper in printing and writing papers produced in this region would probably result in purchasing difficulties.*

* Interviews with procurement officials for the state of California indicate that this is, in fact, the case. Even though California has a legislative mandate to use printing and writing papers containing at least 50 percent waste paper, the state has encountered great difficulty in locating vendors within their own geographic region.

Tissue. Table G-9 presents the regional waste paper utilization data for the production of tissue. The tabular data shown in the four sections of Table G-9 are presented in Figures G-22 through G-25 as discrete utilization distributions, and in Figure G-26 as cumulative utilization distributions. Interpretation of these figures is analogous to those discussed above for printing and writing papers.

As may be seen from these data, the utilization of waste paper in the manufacture of tissue is generally larger than in the production of most other grades of paper, and the regional differences are about the same. For example, all of the regions use an average of more than 10 percent waste paper as compared to regional production. In printing and writing paper manufacture, one region obtained only 2.2 percent of its furnish from waste paper. As with printing and writing papers, there is a five-fold difference between regions in waste paper utilization for tissue production. Waste paper use in the central region represents 52.0 percent of the regional total production, while the utilization in the southern region amounts to only 10.4 percent. Differences between other regions are less pronounced.

The regional differences may be seen in Figure G-26, showing the cumulative utilization function for all four regions juxtaposed for easy comparison. For example, the waste paper consumption profile for the northeast region demonstrates the bi-modal distribution discussed earlier. That is, roughly half of the tissue produced in the northeast region uses 10 percent or less waste paper as furnish, and approximately a fifth of the tissue produced in that region uses more than 75 percent waste paper as furnish. Figure G-22 demonstrates this situation clearly as well.

The central region evidences a somewhat different kind of bi-modal distribution, one with approximately half of the tissue production using 30 percent or less waste paper, while roughly 40 percent of the tissue production uses 90 percent or more waste paper in its furnish. This distribution is roughly the opposite of that found in the northeast region. This may be seen by comparing Figures G-22 and G-23, or by inspecting the northeast and central sections of Figure G-26, where the size of the "steps" indicates the differences in the distribution.

The last two sections of Table G-9, showing data for the southern and western regions, show markedly different waste paper utilization profiles. As shown in Figures G-24 and G-25, respectively, the majority of tissue produced in these regions uses relatively little waste paper. For example, almost three-fourths of the tissue produced in the southern region uses 10 percent or less waste paper as furnish, and only 2 percent of the tissue produced in this region uses more than 35 percent waste paper. This is evident in the corresponding section of Figure G-27.

Table G-9

REGIONAL WASTE PAPER CONSUMPTION
IN TISSUE, 1976

Northeast

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 10%	12.4	727.0	48.8%	48.8%
10 - 20%	32.7	263.3	17.7%	66.5%
20 - 40%	25.8	75.6	5.1%	71.6%
40 - 75%	56.0	106.5	7.2%	78.8%
75 - 100%	356.8	317.6	21.2%	100.0%
TOTAL	483.7	1,490.0	100.0%	
AVERAGE			32.5%	

Central

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 10%	4.3	244.0	21.5%	21.5%
10 - 30%	66.9	383.5	33.8%	55.3%
30 - 90%	38.6	64.5	5.7%	61.0%
90 - 100%	480.6	444.0	39.0%	100.0%
TOTAL	590.4	1,136.0	100.0%	
AVERAGE			52.0%	

1/ Waste paper consumed as a percent of tissue produced.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

Table G-9

REGIONAL WASTE PAPER CONSUMPTION
IN TISSUE, 1976

South

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 10%	18.7	628.3	73.9%	73.9%
10 - 35%	44.0	203.0	23.9%	97.8%
35 - 100%	25.4	18.7	2.2%	100.0%
TOTAL	88.1	850.0	100.0%	
AVERAGE			10.4%	

West

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 20%	37.7	595.5	83.9%	83.9%
20 - 50%	47.5	99.3	14.0%	97.9%
50 - 100%	21.9	15.2	2.1%	100.0%
TOTAL	107.1	710.0	100.0%	
AVERAGE			15.1%	

1/ Waste paper consumed as a percent of tissue produced.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

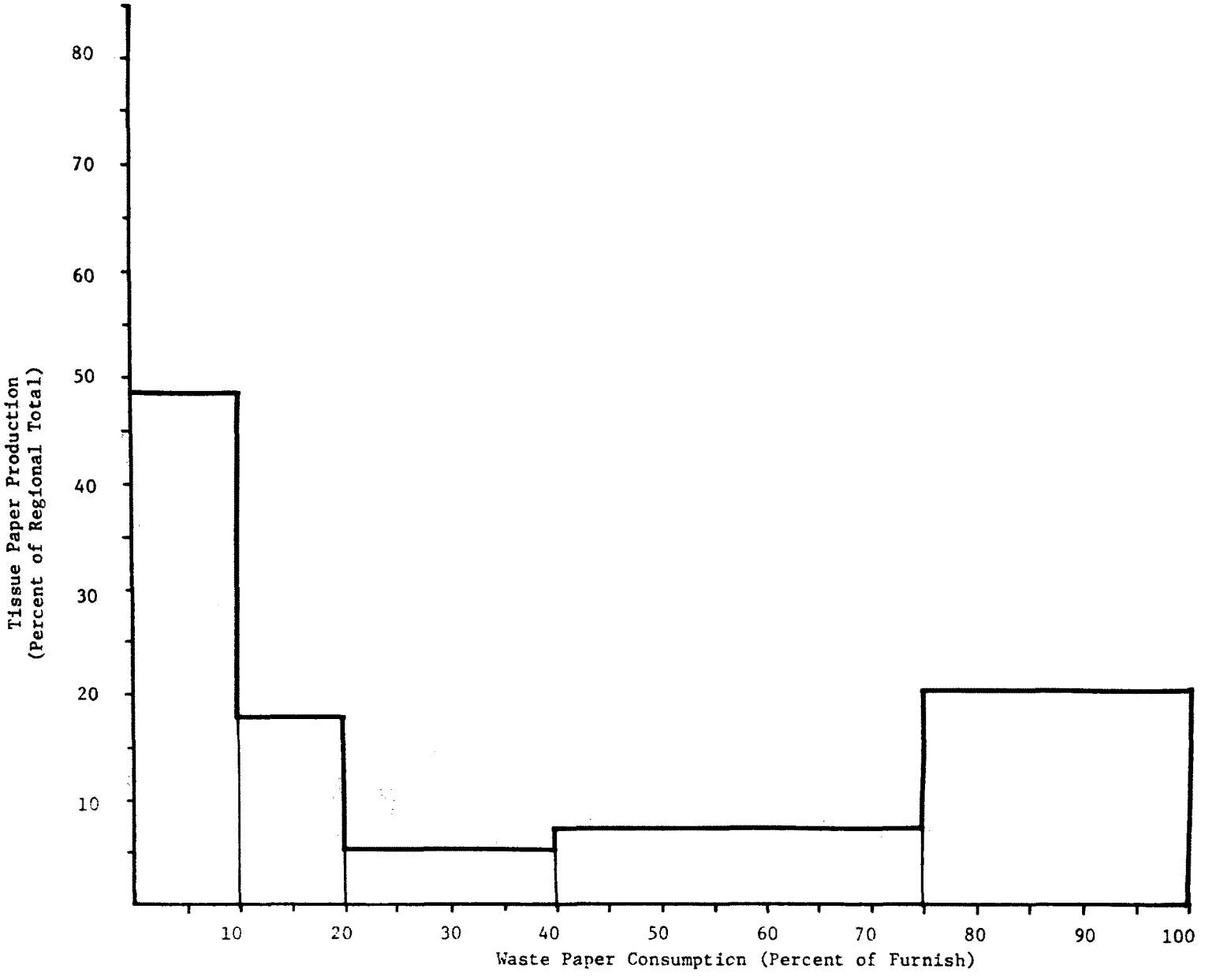

Figure G-22. Waste paper consumption in tissue, Northeast Region, 1976.

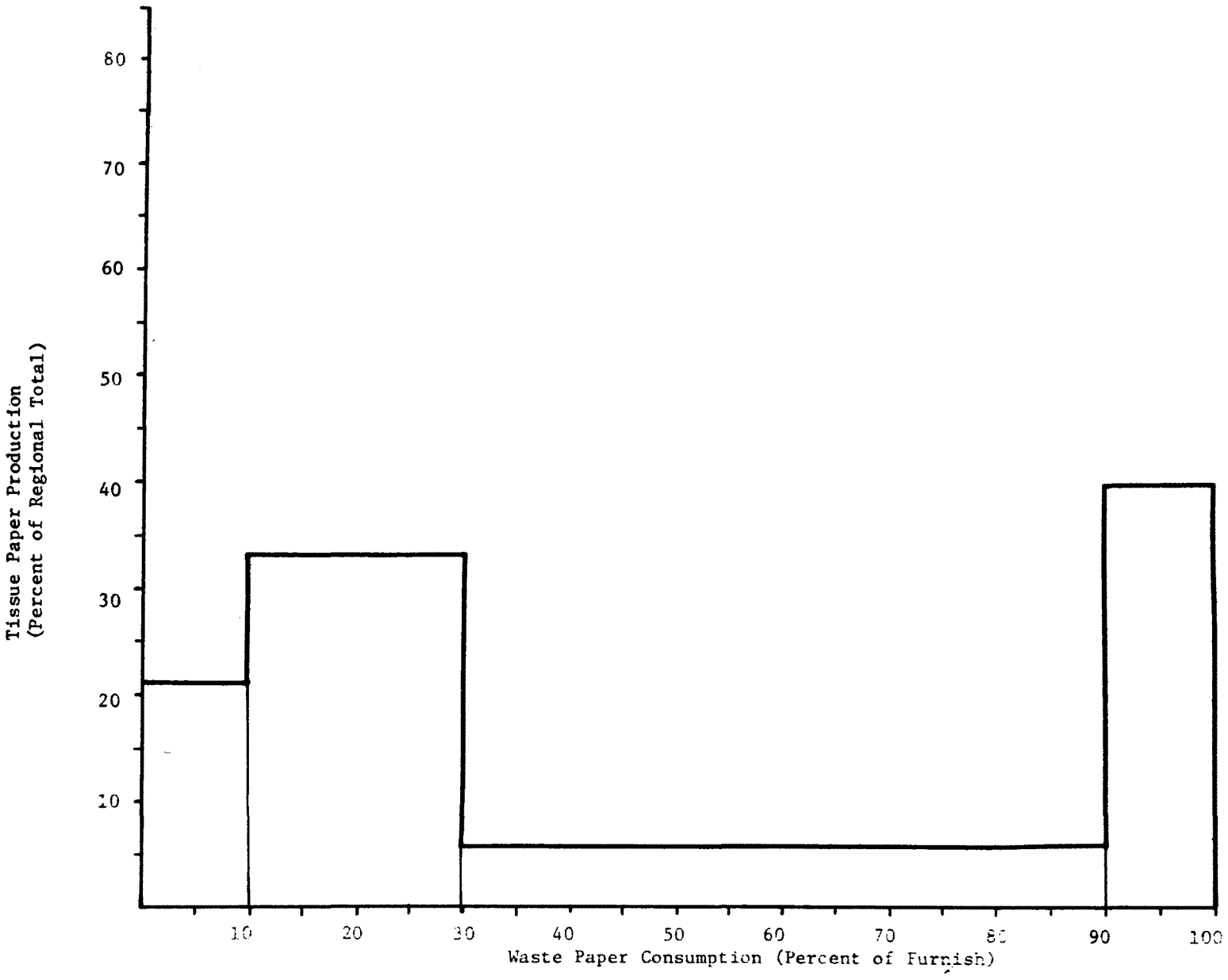

Figure G-23. Waste paper consumption in tissue, Central Region, 1976.

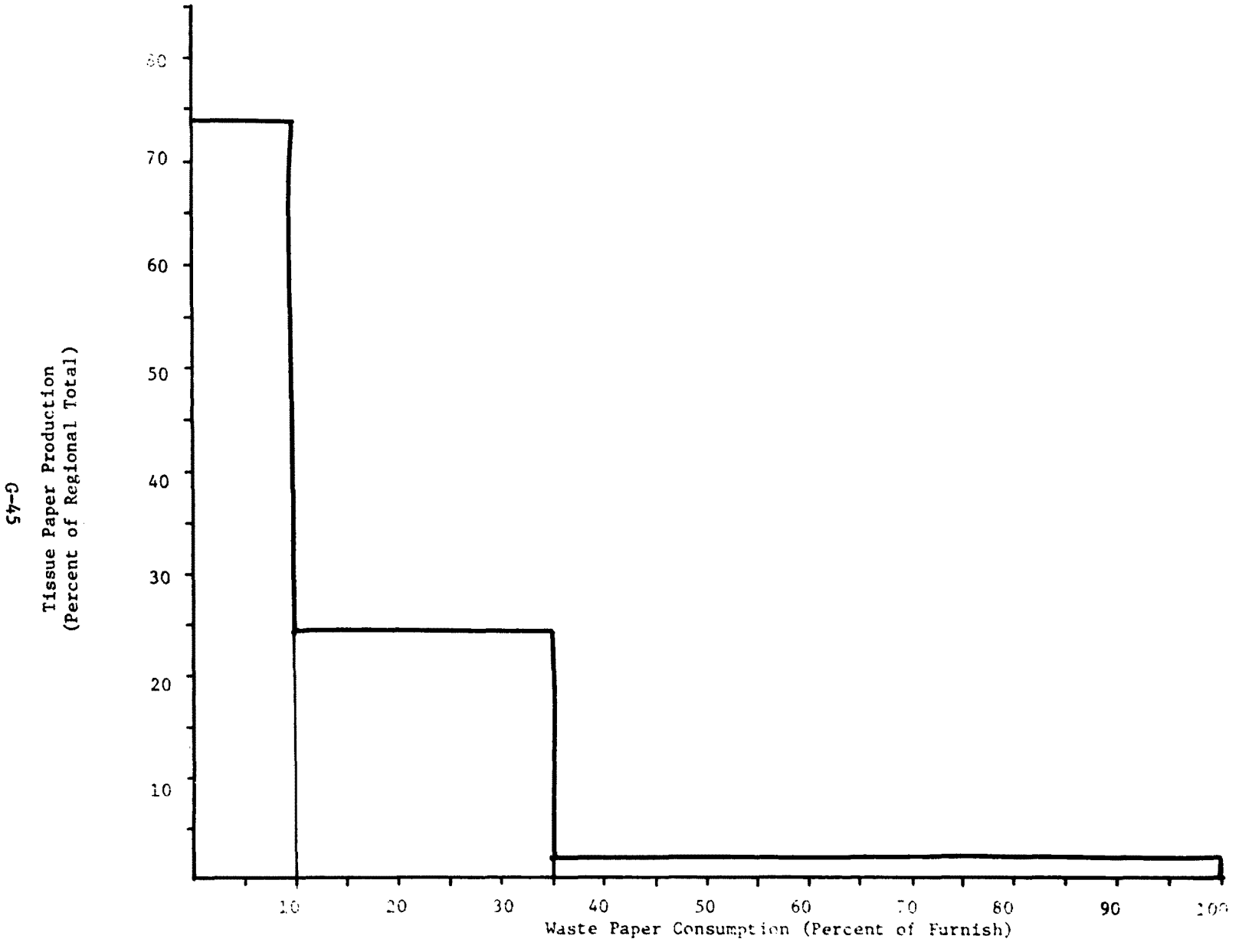

Figure G-24. Waste paper consumption in tissue, Southern Region, 1976.

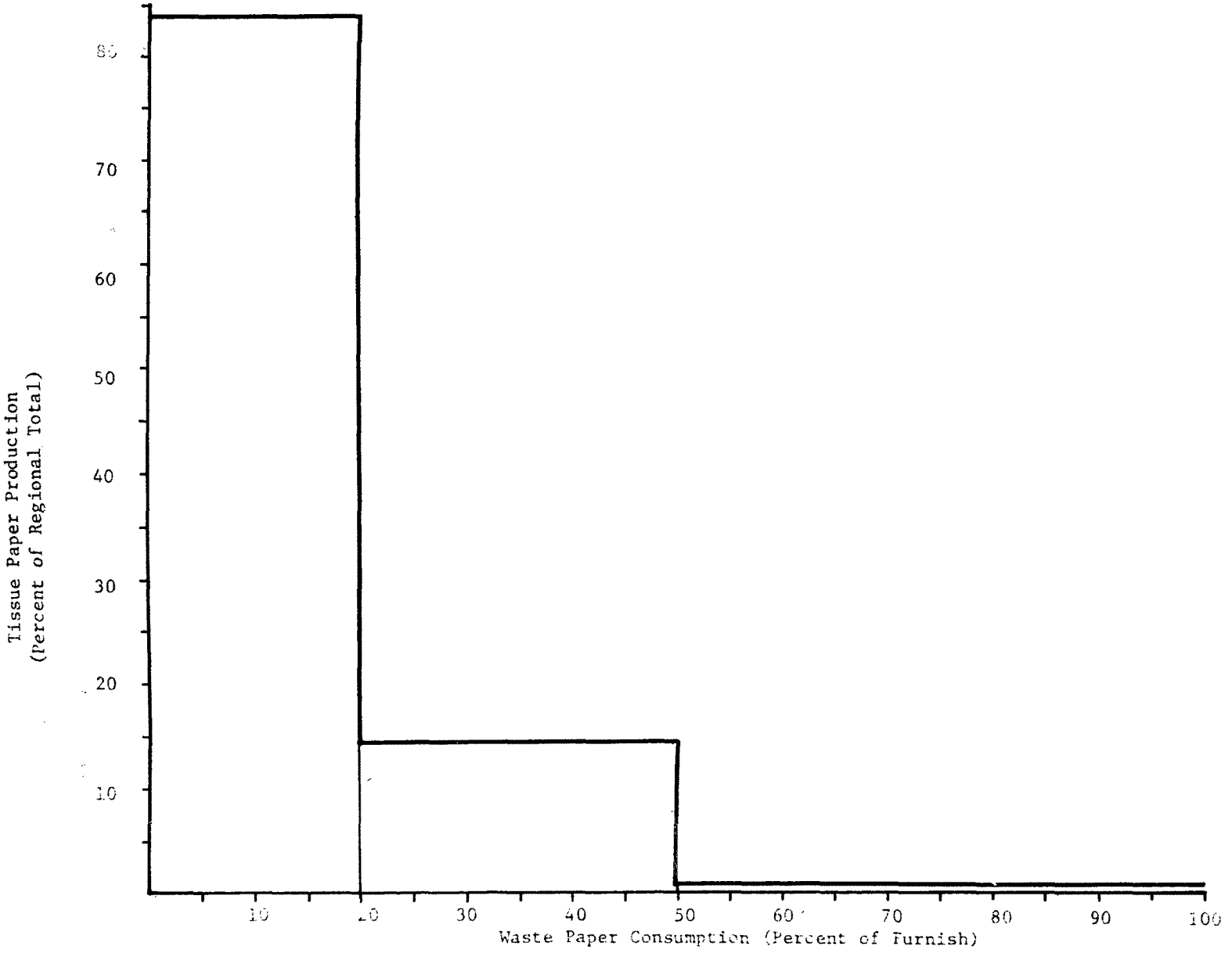

Figure G-25. Waste paper consumption in tissue, Western Region, 1976.

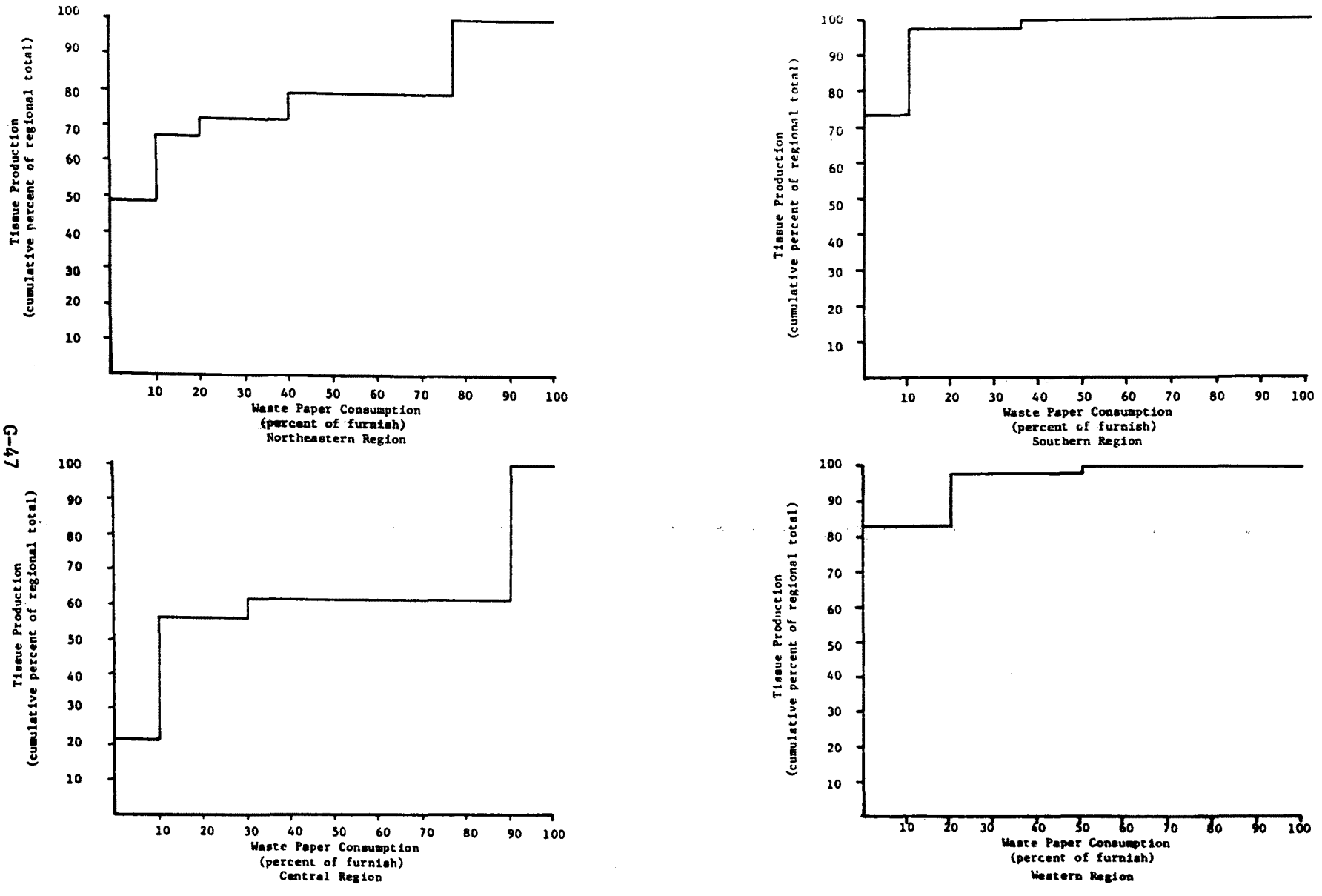

Figure G-26. Cumulative consumption of waste paper in tissue manufacture, by region, 1976.

Figure G-25, showing the data in the fourth section of Table G-9 for the western region, is similar to the profile for the southern region. More than four-fifths of the tissue produced in the western region uses 20 percent or less waste paper as furnish, and only about 2 percent of the tissue produced in this region uses 50 percent or more.

Inspection of Figure G-26 shows the similarities between the southern and western regions, the differences between the northeastern and central regions of the country, and the marked contrast between the northeast and central regions versus the southern and western regions. It may be concluded that in the southern and western regions of the country, which represent the majority of the virgin forest areas, specifications and acquisition of tissue using large percentages of waste paper may be exceedingly difficult. It is quite likely that even in the smallest range of waste paper utilization, 0 to 5 percent, the majority of the mills in these regions use no waste paper whatsoever since forest residues are so abundant. It is known, for example, that in the western region at least one mill makes its entire tissue production from sawdust, mill wastes, and stump residues. In contrast, in the northeast and central regions of the country, little difficulty should be encountered in obtaining tissue manufactured with substantial percentages of waste paper as furnish.

Bleached and Unbleached Kraft. Table G-10 presents the regional utilizations of waste paper in the manufacture of bleached and unbleached kraft paperboard. Both the northeast and western regions have only one range of waste paper utilization listed, and the central region has none at all. No discrete utilization distributions are provided for these regions, therefore. It seems likely that the data are presented in this way to insure non-disclosure of individual mill data. Note that the production in both these regions is a small share of the national total. The northeast region produces less than one percent of the national total, the western region produces less than 17 percent of the total, and no production is reported in the central region.

The southern region of the country, shown in the third section of Table G-10 and in Figure G-27, manufactures more than 83 percent of the total production of these grades. More than 78 percent of the bleached and unbleached kraft paperboard produced in this region utilizes 5 percent or less waste paper in its furnish. Less than 9 percent of the total production of kraft paperboard produced in this region uses more than 10 percent waste paper in its furnish. Note that the total waste paper consumption in this region represents only 2.6 percent of the total production of these grades.

As with similar figures showing only a few ranges of waste paper utilization, Figure G-27 may be easily misinterpreted for the reasons previously discussed. Figure G-27 should be seen as showing that only about 9 percent of the total production uses 10 percent or more waste paper as furnish. Figure G-22 presents the cumulative utilization profiles for all four regions. The lack of detail in the raw data is evident. The souhern section figure should help clarify the correct interpretation of Figure 27, nonetheless.

Table G-10

REGIONAL WASTE PAPER CONSUMPTION
IN BLEACHED AND UNBLEACHED KRAFT PAPERBOARD, 1976

Northeast

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 100%	9.4	30.0	100.0%	100.0%
TOTAL	9.4	30.0	100.0%	
AVERAGE			31.3%	

Central

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent

None

South

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 5%	72.8	11,164.9	78.2%	78.2%
5 - 10%	135.7	1,871.8	13.1%	91.3%
10 - 100%	162.4	1,244.3	8.7%	100.0%
TOTAL	370.9	14,281.0	100.0%	
AVERAGE			2.6%	

West

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 100%	130.1	2,865.0	100.0%	100.0%
TOTAL	130.1	2,865.0	100.0%	
AVERAGE			4.5%	

1/ Waste paper consumed as a percent of kraft paperboard produced.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

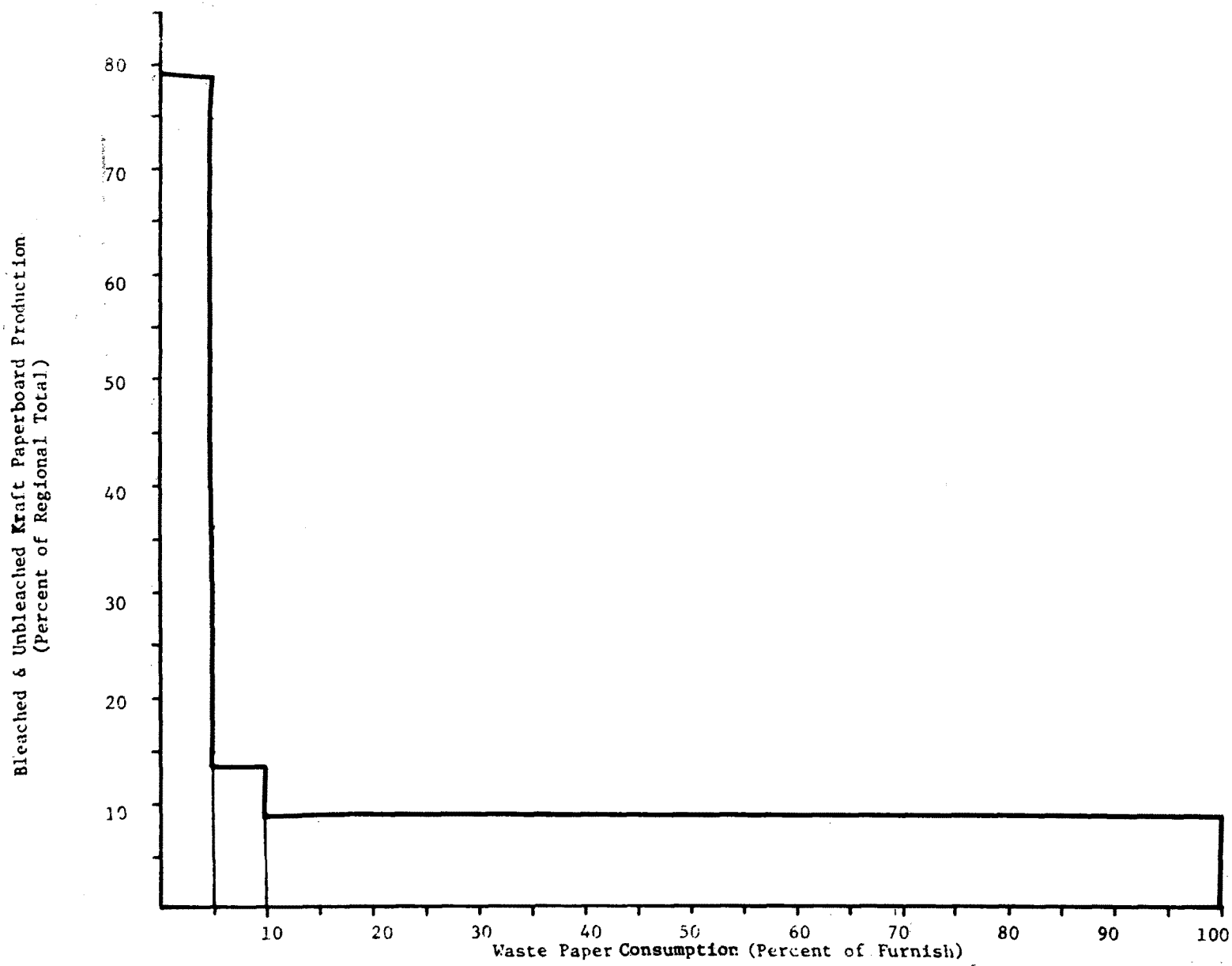

Figure G-27. Waste paper consumption in bleached & unbleached kraft paperboard, Southern Region, 1976.

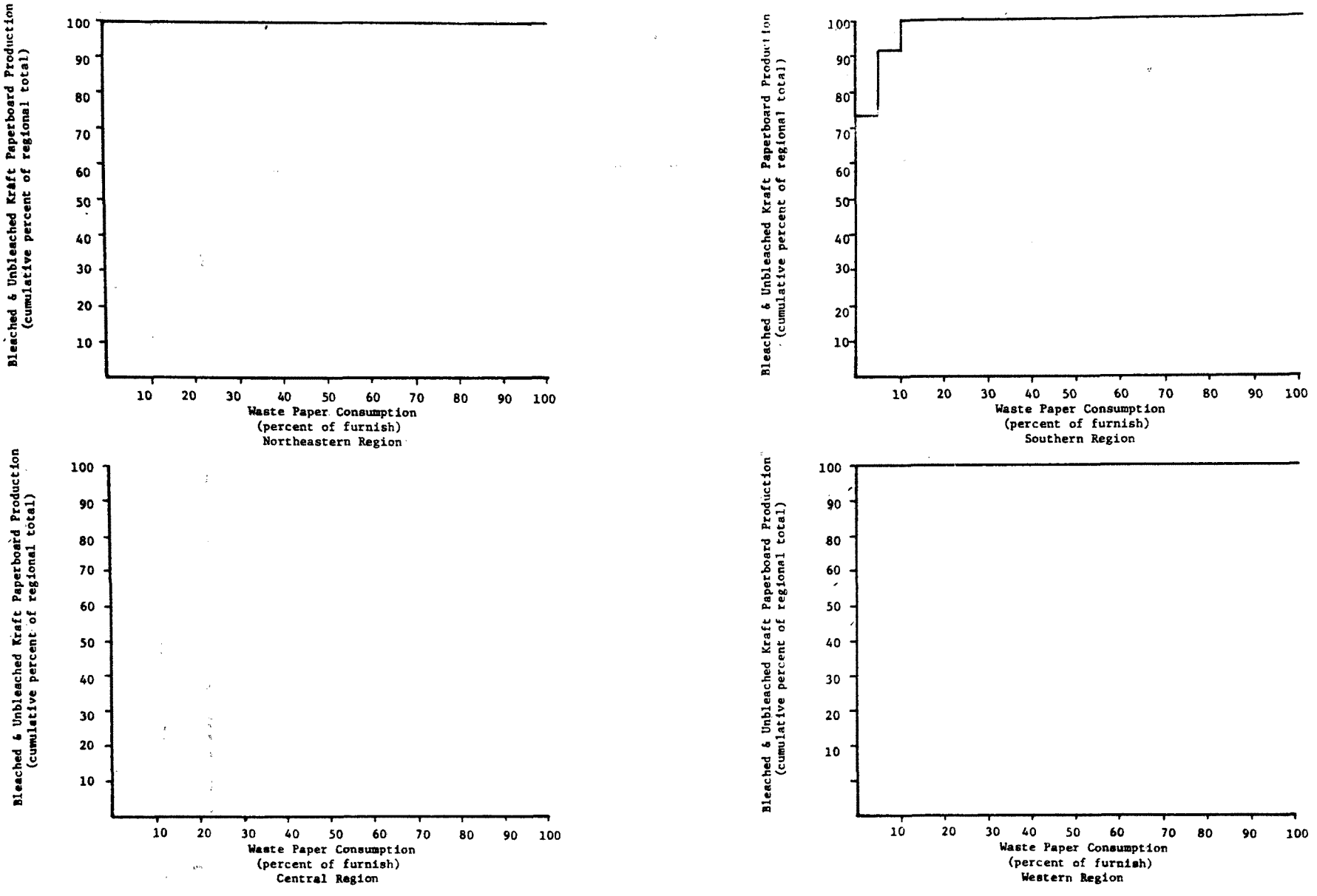

Figure G-28. Cumulative consumption of waste paper in bleached and unbleached kraft paperboard production, by region, 1976.

Considering the small amount of waste paper consumed for the production of bleached and unbleached kraft paperboard, it would appear that attempts to obtain large amounts of these grades containing more than 5 percent recycled fiber would be difficult. Even in the southern region of the country where the waste paper utilization in this grade is the greatest, it still represents less than 3 percent of the total regional production of these grades.

While the waste paper utilization rate in the northeast region of the country is about 31 percent, the total production of this region represents only 0.2 percent of the total national production of these grades of paper. Hence, the northeast region of the country represents a relatively insignificant source of recycled kraft paperboard even though the data presented in Table G-5 might seem to indicate otherwise.

Semichemical Paperboard. Table G-11 presents the waste paper consumption data for semichemical paperboard manufacture for the four regions of the country. In the northeast and western regions, only one range of waste paper utilization is given. Hence, there are no discrete utilization profile figures provided for these two regions. As with other such instances, non-disclosure of individual mill data is the probable reason for this lack of detail.

Note that in the northeast region, the total use of waste paper represents 29.2 percent of the total regional production. In the western region, waste paper utilization represents 19.1 percent of the total production in that region. The utilization of waste paper in the central and southern regions falls between these two figures. Thus, overall, there are apparently few regional differences in waste paper utilization. It seems likely that technical reasons may account for this apparent uniformity.

The data for the central region, shown in the second section of Table G-11, are portrayed as a discrete distribution profile in Figure G-29. Only two ranges of waste paper utilization are provided in the data, and Figure G-29 is potentially confusing as the result. While it would appear from Figure G-29 that more waste paper is recycled in the central region than in other regions, this is an erroneous impression. As may be seen more clearly in the appropriate section of Figure G-31, showing the cumulative utilization profile for all four regions, the data indicate that only roughly half of the semichemical paperboard produced in the central region uses less than 30 percent waste paper, and roughly half uses more than 30 percent waste paper. The misleading appearance of Figure G-29 results from only two ranges of waste paper consumption being provided, and the production in each of those ranges coincidentally being roughly equal.

Table G-11

REGIONAL WASTE PAPER CONSUMPTION
IN SEMICHEMICAL PAPERBOARD, 1976

Northeast

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 100%	47.9	164.0	100.0%	100.0%
TOTAL	47.9	164.0	100.0%	
AVERAGE			29.2%	

Central

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 30%	117.2	647.2	55.8%	55.8%
30 - 100%	183.7	511.8	44.2%	100.0%
TOTAL	300.9	1,159.0	100.0%	
AVERAGE			25.7%	

South

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 10%	27.1	503.3	22.8%	22.8%
10 - 25%	148.7	687.4	31.2%	56.0%
25 - 30%	174.9	618.3	28.0%	82.0%
30 - 100%	169.3	397.0	18.0%	100.0%
TOTAL	500.0	2,206.0	100.0%	
AVERAGE			22.7%	

West

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 100%	109.8	576.0	100.0%	100.0%
TOTAL	109.8	576.0	100.0%	
AVERAGE			19.0%	

1/ Waste paper consumed as a percent of semichemical paperboard produced.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

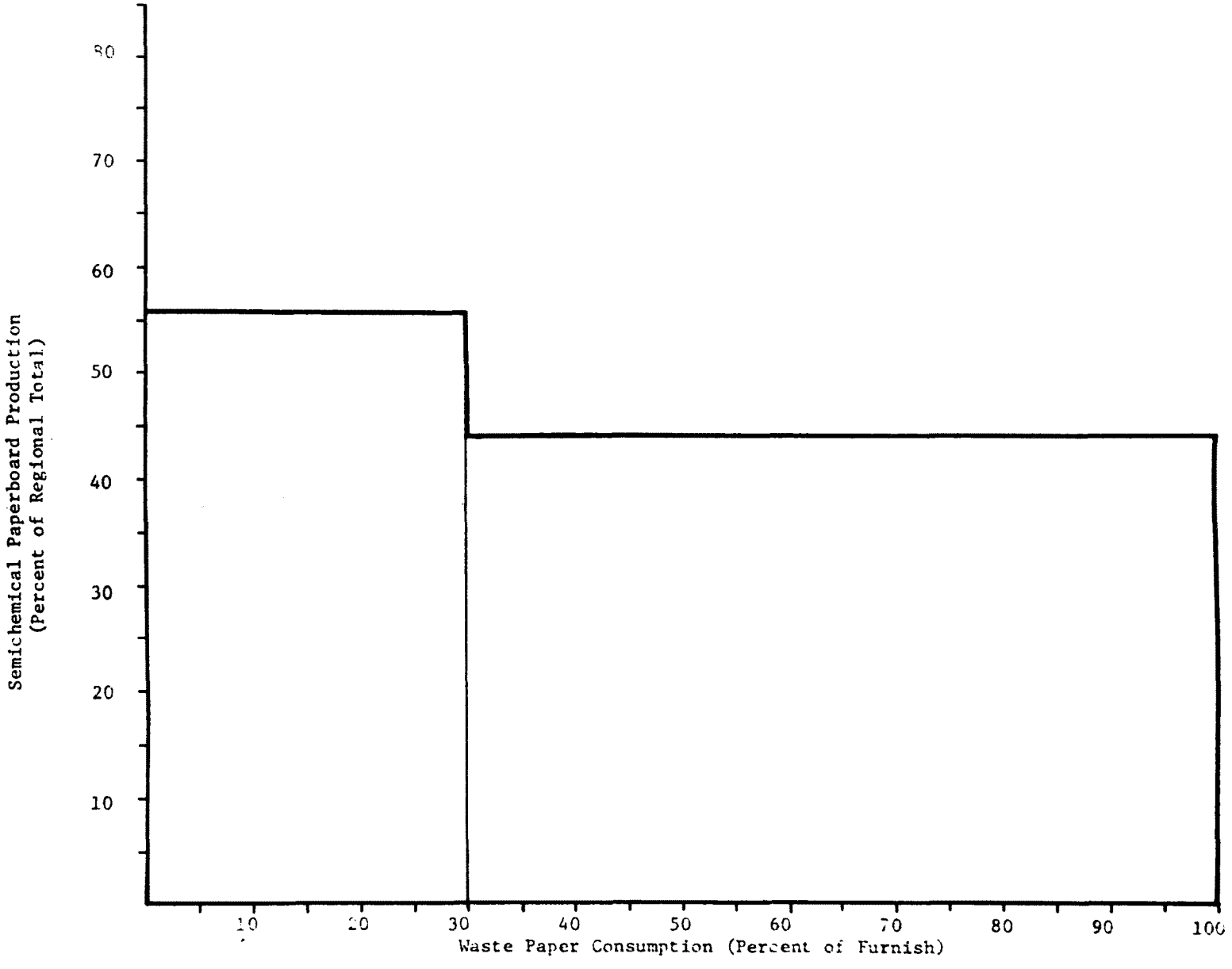

Figure G-29. Consumption of waste paper in semichemical paperboard, Central Region, 1976.

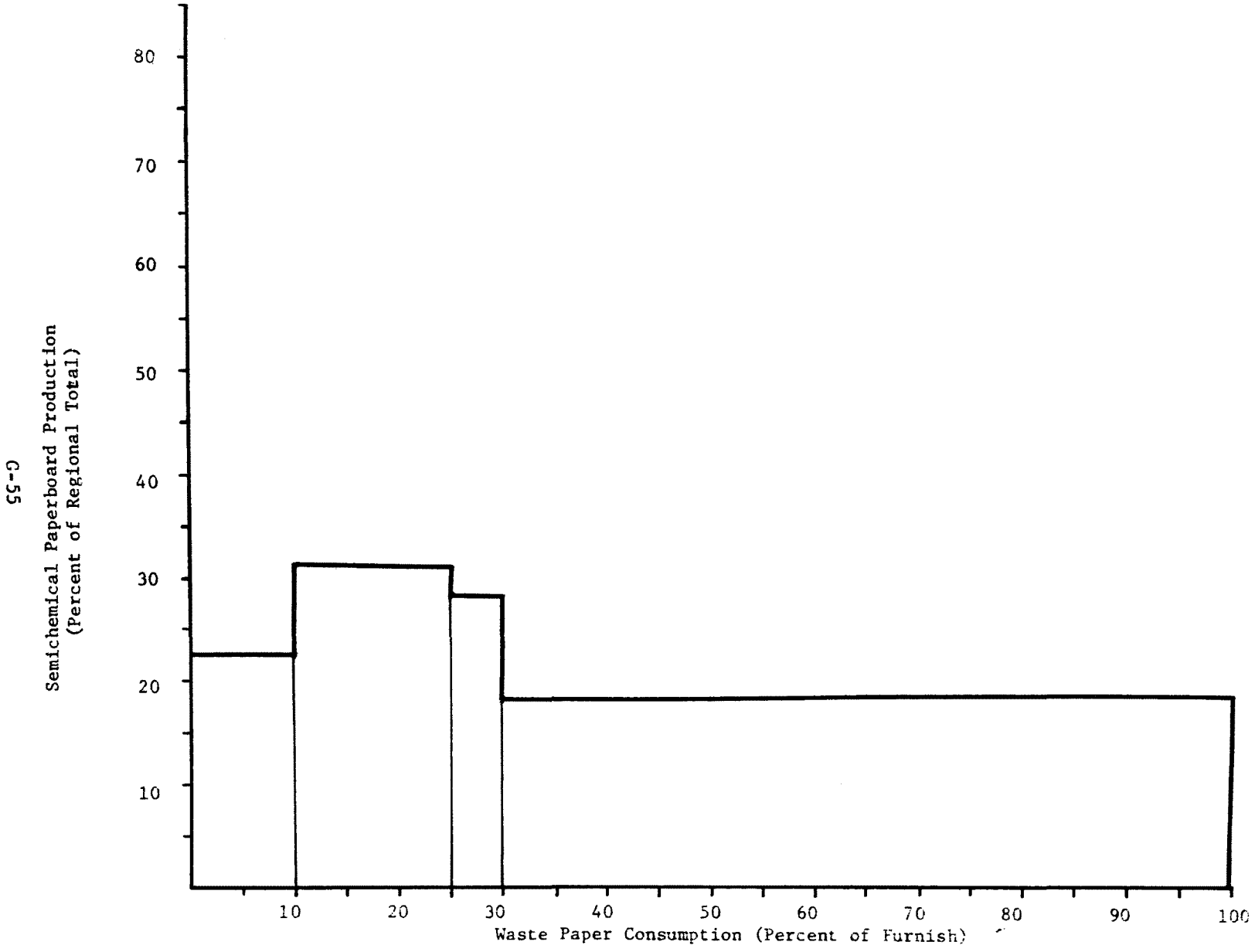

Figure G-30. Consumption of waste paper in semichemical paperboard, Southern Region, 1976.

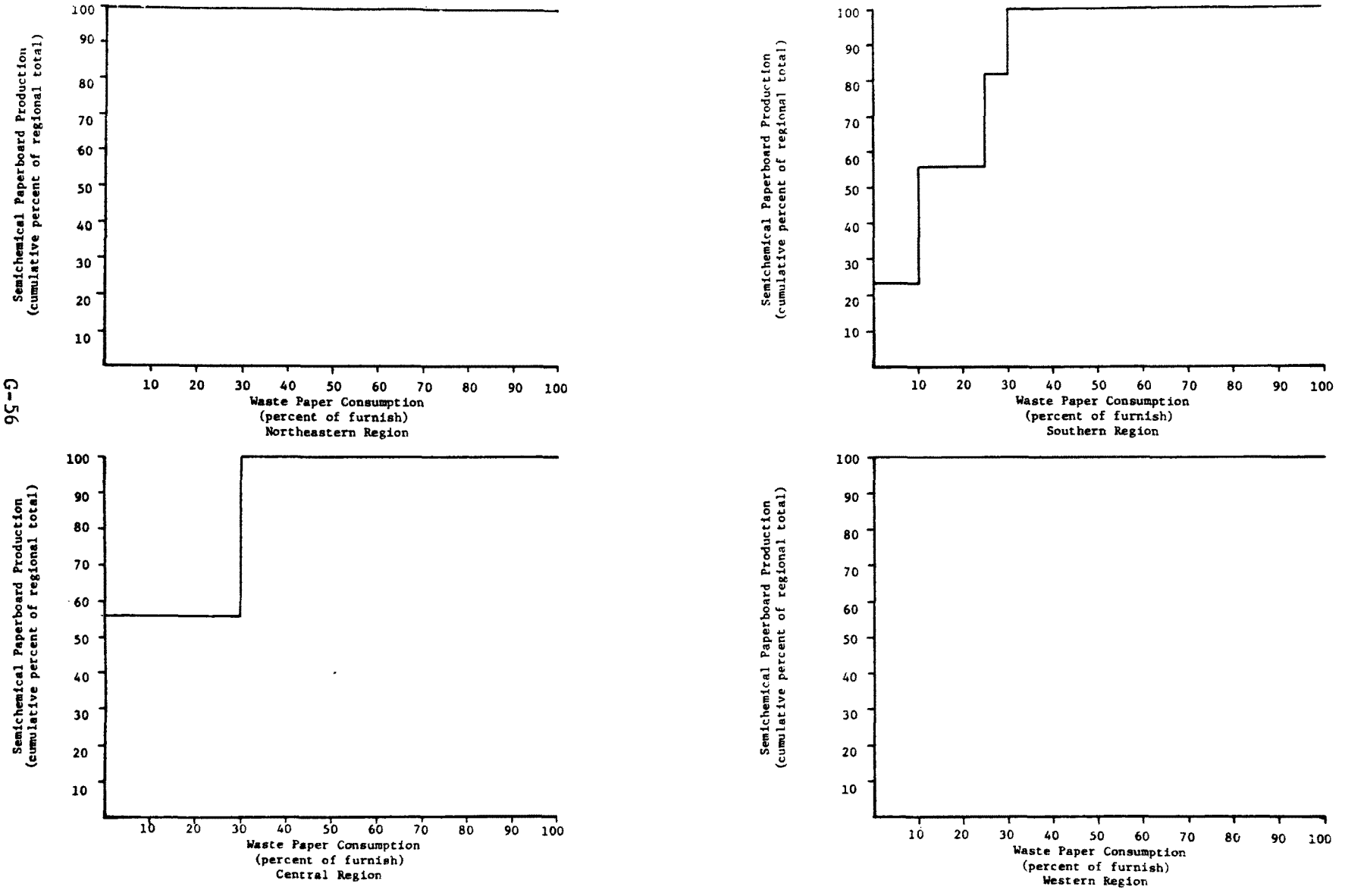

Figure G-31 Cumulative consumption of waste paper in semichemical paperboard production, by region, 1976

Semichemical paperboard production for the southern region is found in the third section of Table G-11 and is portrayed in Figure G-30. The "bulge" occurring between the 10 and 30 percent waste paper utilization levels probably reflects the technically optimum concentration of waste paper in the furnish for semichemical paperboard. Note that only 18 percent of the semichemical paperboard produced in this region uses more than 30 percent waste paper.

Kraft and Special Industrial Papers. Table G-12 presents the waste paper utilization data for the production of kraft and special industrial papers for the four regions of the country. Figures G-32 through G-34 display the discrete utilization profiles for the northeast, central, and southern regions, respectively. There is no profile shown for the western region since only one range of waste paper utilization is listed. The cumulative utilization profiles for all four regions are presented in Figure G-35.

As may be seen in Figure G-32, approximately 65 percent of the kraft and special industrial paper made in the northeast region uses 10 percent or less waste paper. Approximately 15 percent of the production in this region uses between 25 and 40 percent waste paper, but less than 2 percent of the production uses more than 80 percent waste paper as furnish in this region. The total use of waste paper represents 15.4 percent of the regional total production.

Although only two utilization ranges are shown for the central region of the country, approximately three-fourths of the total production in this region uses 35 percent or less waste paper. That is, only one-fourth of the total production in this region uses more than 35 percent waste paper. This is apparent from inspection of Figure G-35, although interpretation of Figure G-33 alone may be somewhat confusing.

The relatively small use of waste paper in the production of kraft and special industrial papers is even more pronounced in the southern region of the country, where almost 90 percent of the production uses 5 percent or less waste paper, and only 2 percent of the production in this region uses more than 25 percent waste paper. This may also be clearly seen in Figure G-35, as well as in Figure G-34.

In the western region of the country, note that only about 0.3 percent of the total production of kraft and special industrial papers consists of waste paper as furnish, although the utilization range is not specified. About 18 percent of the total production of these grades comes from this region.

It may be concluded that in the northeast and central regions, kraft and special industrial papers are produced in sizeable quantities using up to approximately 35 percent waste paper. In sharp contrast, in the southern and western regions of the country, very little of these grades of paper use more than 5 percent waste paper as furnish. It is entirely likely that most of the mills in the 0 to 5 percent utilization range may be closer to 0 percent than to 5 percent, especially in the western region.

Table G-12

REGIONAL WASTE PAPER CONSUMPTION
IN KRAFT AND SPECIAL INDUSTRIAL PAPERS, 1976

Northeast

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 10%	4.2	313.4	65.4%	65.4%
10 - 25%	4.2	30.8	6.4%	71.8%
25 - 40%	23.9	71.3	14.9%	86.7%
40 - 85%	33.5	56.3	11.8%	98.5%
85 - 100%	8.0	7.2	1.5%	100.0%
TOTAL	73.8	479.0	100.0%	
AVERAGE			15.4%	

Central

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 35%	21.7%	373.2	74.3%	74.3%
35 - 100%	102.4	128.8	25.7%	100.0%
TOTAL	124.1	502.0	100.0%	
AVERAGE			24.7%	

Table G-12 (con't)

REGIONAL WASTE PAPER CONSUMPTION
IN KRAFT AND SPECIAL INDUSTRIAL PAPERS, 1976

South

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 5%	26.7	3,142.8	89.2%	89.2%
5 - 25%	18.8	328.9	9.3%	98.5%
25 - 100%	23.7	52.3	1.5%	100.0%
TOTAL	69.3	3,524.0	100.0%	
AVERAGE			2.0%	

West

Percent[1/] Waste	Waste Paper Consumption (000 tons)	Production (000 tons)	Percent	Cumulative Percent
0 - 100%	2.6	996.0	100.0%	100.0%
TOTAL	2.6	996.0	100.0%	
AVERAGE			0.3%	

1/ Waste paper consumed as a percent of tissue produced.

Source: American Paper Institute, Capacity Department and Franklin Associates, Ltd.

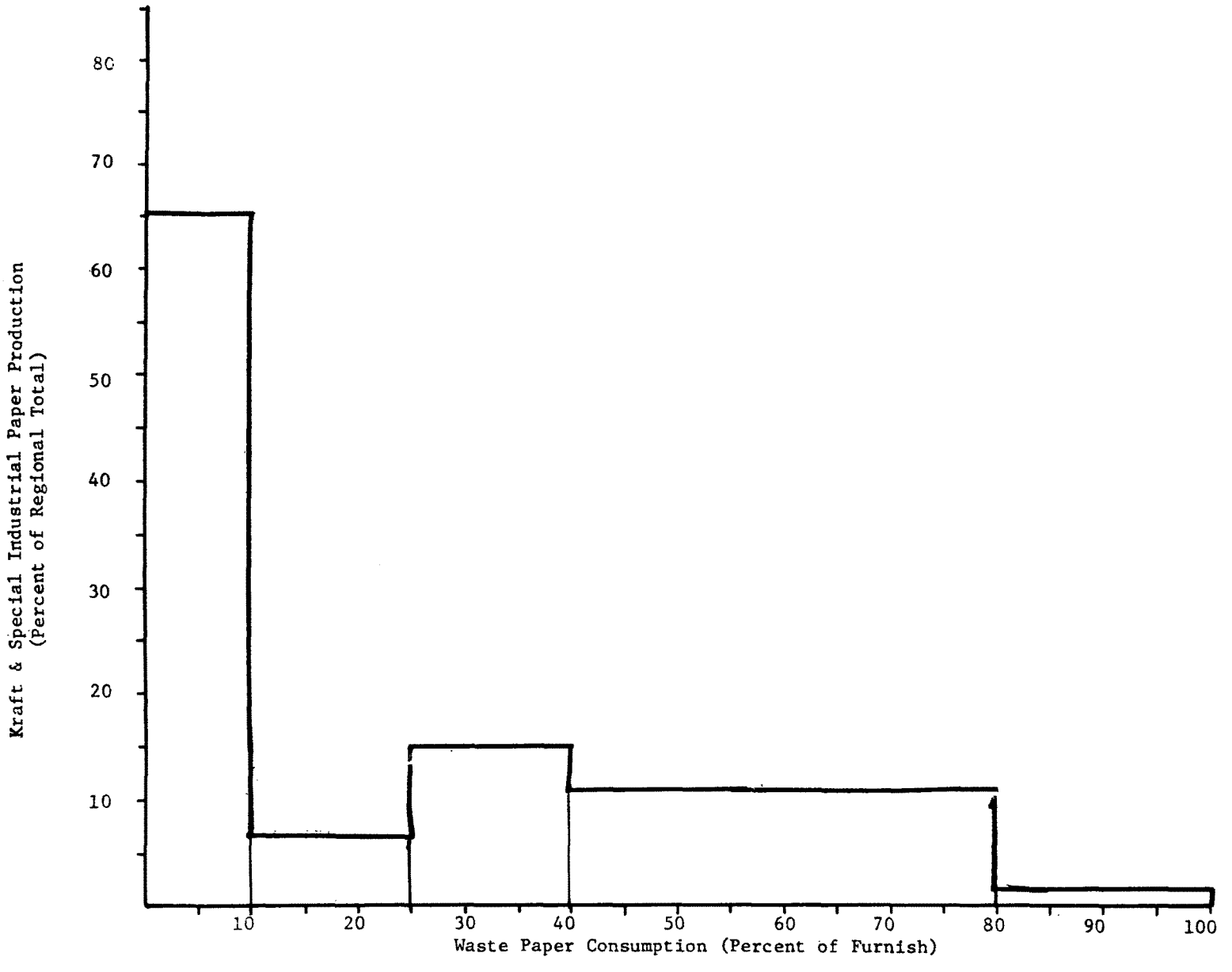

Figure G-32. Consumption of waste paper in kraft and special industrial paper, Northeast Region, 1976.

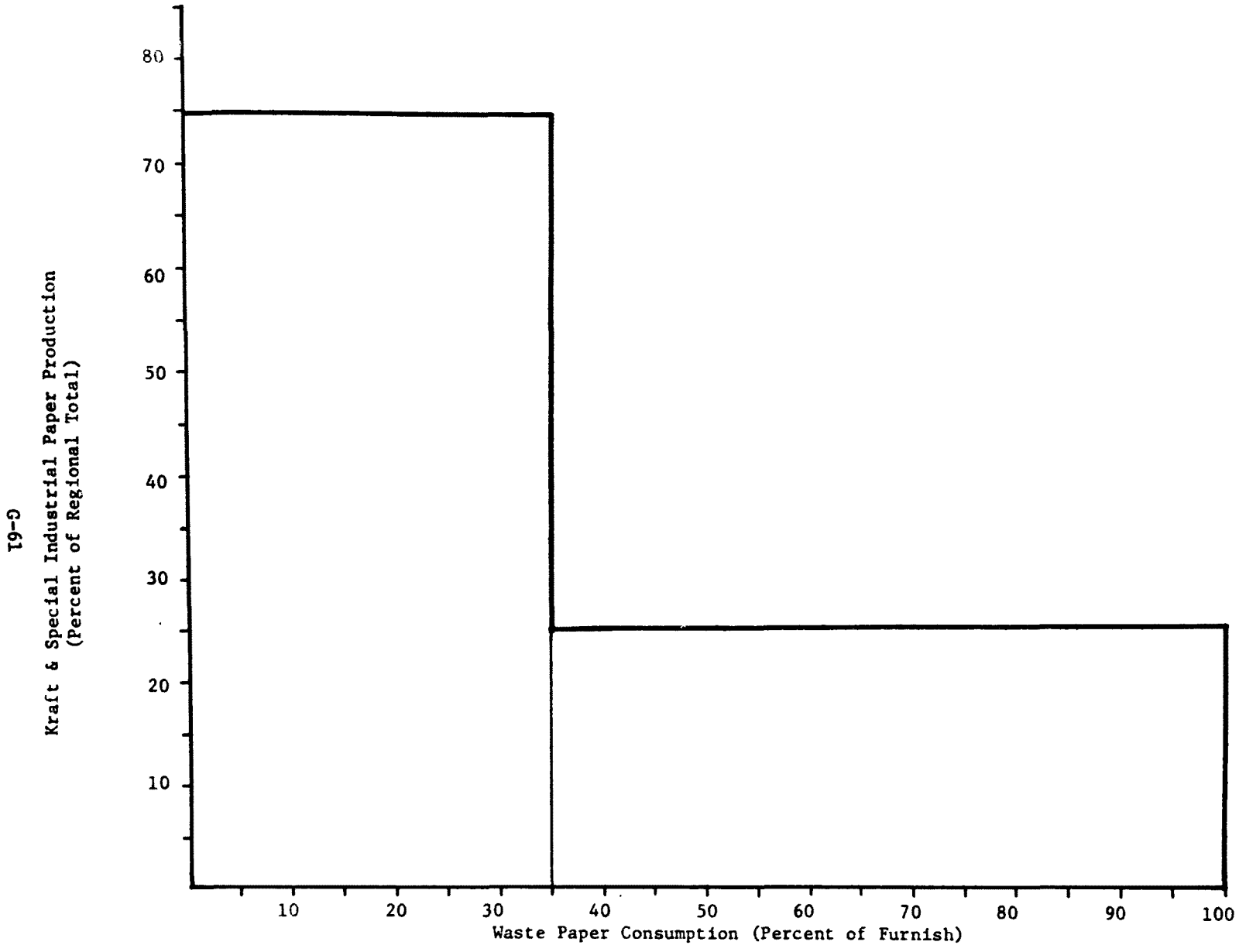

Figure G-33. Consumption of waste paper in kraft and special industrial paper, Central Region, 1976.

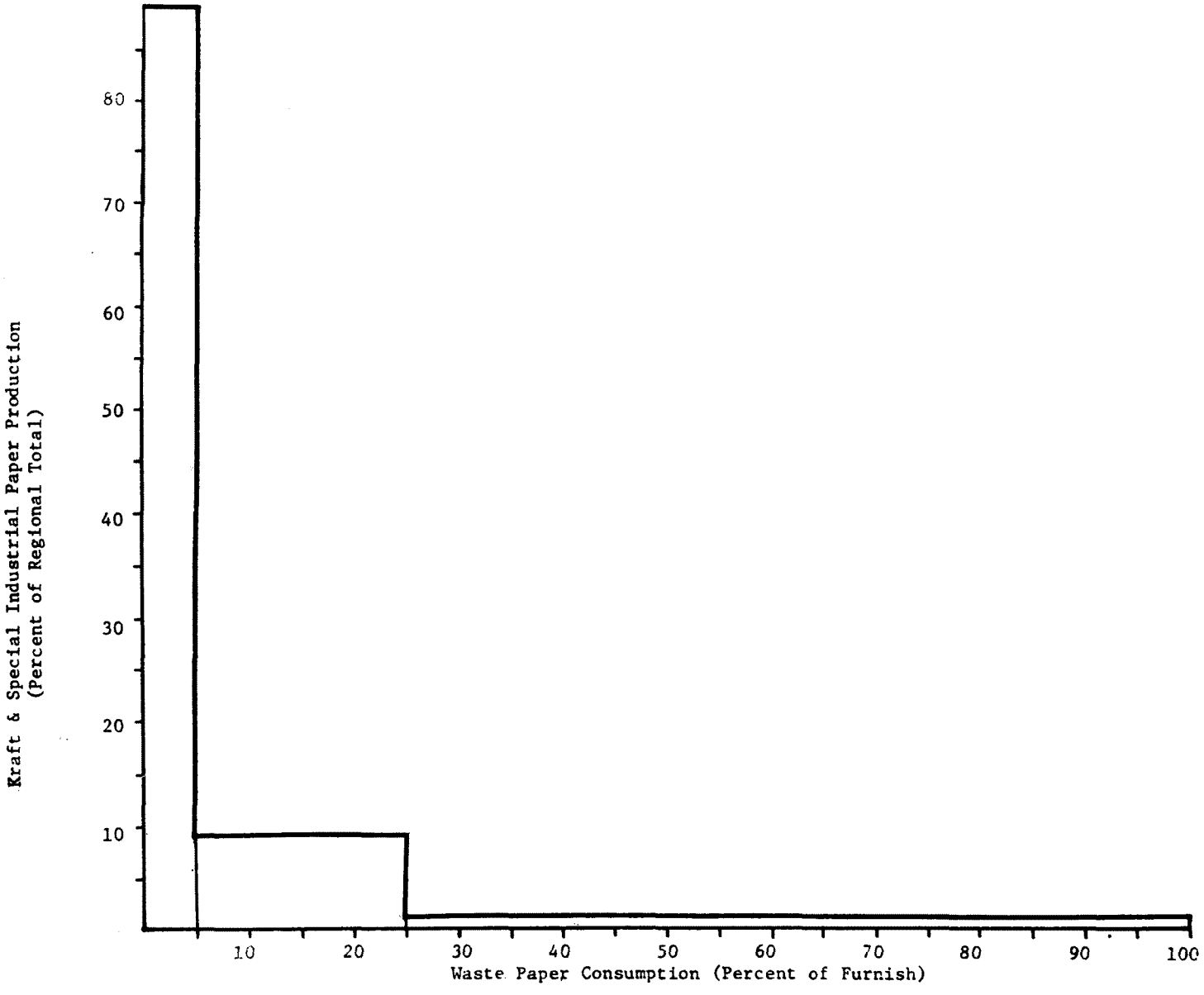

Figure G-34. Consumption of waste paper in kraft and special industrial paper, Southern Region, 1976.

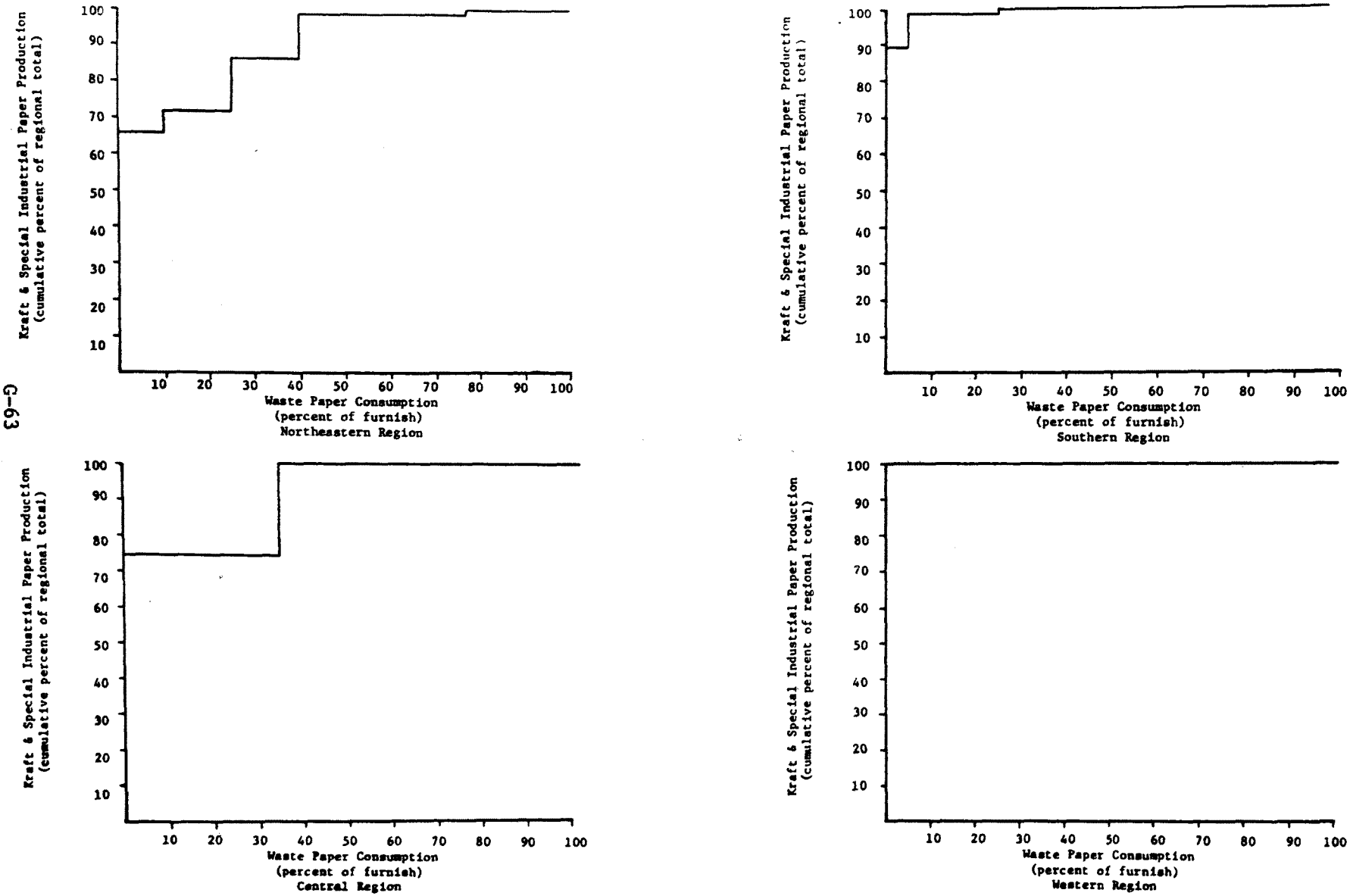

Figure G-35. Cumulative consumption of waste paper in kraft and special industrial paper production, by region, 1976.

While kraft and special industrial papers are relatively less interesting to the purposes of this study than are the grades of printing and writing papers or sanitary papers, the regional differences shown by these papers clearly demonstrate the type of problem which may be encountered in specifying waste paper content in specific grades of paper.

CONCLUSION

From the data presented in this appendix, it can be seen that significant amounts of forest and manufacturing residues are incorporated in virtually all wood pulp production, and hence in most paper and paper products. Amounts vary from 0 to 100 percent. Further, the utilization of forest and manufacturing residues is spread relatively uniformly across all utilization ranges. It may appear that little difficulty would be encountered in procuring papers containing high levels of wood residue.

Although this conclusion may appear correct based upon national aggregate data, regional data indicate that some difficulty may be encountered if exceptionally high wood residue levels are specified in certain regions of the country. While less extreme in degree than for waste paper utilization, wood residue utilization varies from region to region. This implies that it may be easier for paper products purchased in some regions to meet a specified level of industrial and manufacturing waste fiber utilization than if purchased in other regions.

It may be concluded that the current utilization levels of waste paper in the manufacture of various grades of paper and paper products are very low, with the exceptions of tissue paper and semichemical paperboard. However, in the tissue category, utilization of waste paper tends either to be very high or to be very low, depending upon the region in which the tissue is made. For the production of semichemical paperboard, the utilization of waste paper tends to be more uniform. The principal difference between regions is the degree to which mills deviate from the average of about 30 percent waste paper utilization.

Further, there are marked regional differences in the utilization of waste paper between various grades of paper. These differences must be considered in specifying papers made in these regions, since difficulty may be encountered in meeting waste fiber utilization percentages in some cases.

Since transportation costs are a significant factor in the distribution of most paper products, specification of waste paper utilization rates which cannot be met by local or regional paper mills may result in significant purchasing difficulty. Specification of such levels may force paper to be transported into the region from distant regions at significant expense. This would increase the cost of the product, perhaps significantly.

One solution might be to set the waste paper utilization levels within the current utilization levels, or at levels only slightly higher than are currently implemented. This would imply that paper procurement specifications would vary from region to region, depending upon the delivery point of the product. Obviously, significant administrative problems would be associated with such regionally-established procurement specifications.

Appendix H

RECYCLING CAPACITY IN TWO PRODUCT SEGMENTS OF THE PAPER INDUSTRY

An important consideration in this study is the capacity of the paper industry to produce paper products containing postconsumer waste. This is of interest to compare with the results from Appendix G, where the actual use of secondary fibers is assessed. The capacity analysis allows a determination of possible idle or unused capacity to recycle, which could be brought back into production with little or no capital expense.

The methodology employed was to analyze the mill descriptions of all of the paper mills in the U.S. listed in Lockwood's Directory of the Paper and Allied Trades, 1978, published by the Vance Publishing Company of New York. Mills manufacturing fine and printing paper and sanitary papers were identified for this study.

Mills producing products in the fine and printing papers and sanitary papers can utilize a variety of fiber sources, which includes virgin slush pulp, virgin market pulp, pulp substitute grades of waste paper, and postconsumer waste paper. The fiber source of crucial interest in this study is postconsumer waste paper (PCW). There is no precise way of identifying mill capacity to use PCW, but a good estimate is the capacity to produce deinked pulp. Tables H-1 and H-2 and accompanying maps showing the location and deinking capacity are presented here.

Table H-3 was developed to summarize the capacity data by geographical region. For fine and printing papers, it can be seen that the recycling capacity is concentrated in the central region, with additional significant capacity primarily in the northeast. A similar situation exists for sanitary papers with only 8 percent of the capacity in the south and west. This is important because it implies that transportation costs from recycling mills to many Federal installations could be substantial. In addition, recovery of waste paper from Federal installations in the south and west would have to be transported back to the recycling mills to provide a balance for the supply-demand situation. Thus, there will undoubtedly be increased costs to Federal procurements that will cause greater transportation of products and of waste paper.

A potential serious problem with the analytical procedure used is that some companies with deinking capacity view their deinking as an unimportant part of their operation and would not necessarily list it in Lockwood's directory. In these mills, there is frequently an absence of equipment dedicated to deinking.

Table H-1

Deinking Capacity Listed in Lockwood's Directory

Fine and Printing Papers

Location	Company	Listed Production	Comments
California			
Pomona	Potlatch Corporation	280 TPD	50 TPD deinked pulp
Ripon	Simpson Paper Company	90 TPD	100% recycled paper
Massachusetts			
Boston	Diamond International Corp.	150 TPD	Deinked pulp
Fitchburg	Fitchburg Paper Co.	200 TPD	Deinked pulp, recycled paper
Michigan			
Kalamazoo	Georgia Pacific	400 TPD	Deinked pulp
Vicksburg	Simpson Paper Co.	100 TPD	100% recycled text papers
New York			
Newton Falls	Newton Falls Paper Mill	400 TPD	Deinked pulp
Ohio			
West Carrollton	Bergstrom Paper	160 TPD	Deinked pulp
	Miami Paper Corp.	210 TPD	Deinked pulp
Washington			
Vancouver	Boise Cascade	274 TPD	Deinked pulp
Wisconsin			
Appleton	Riverside Paper Corp.	95 TPD	60 TPD deinked pulp
Merrill	Ward Paper Co.	60 TPD	Deinked pulp
Neenah	Bergstrom Paper	300 TPD	Deinked pulp

Deinking Capacity Listed in Lockwood's Directory

Fine and Printing Papers (TPD)

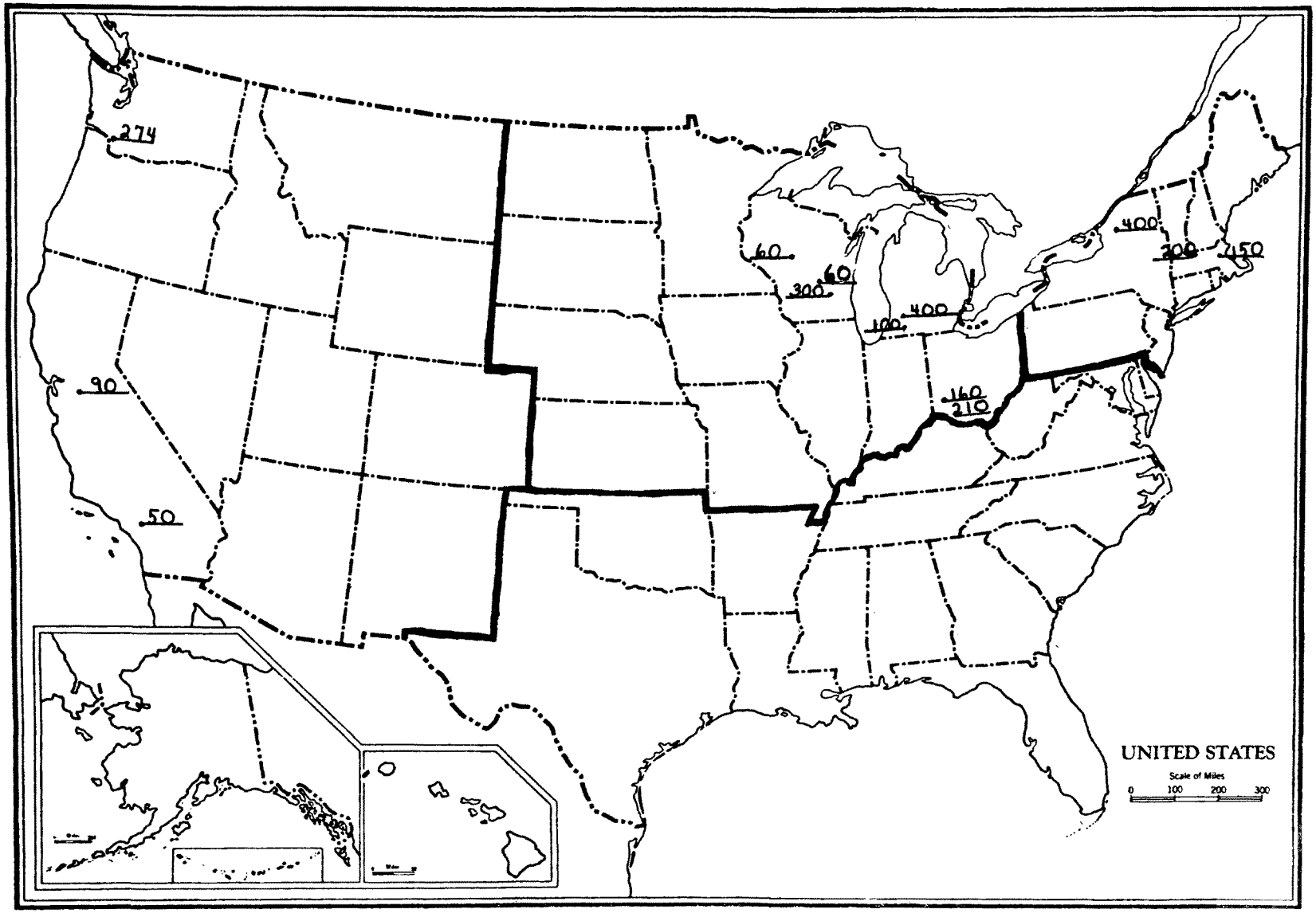

Table H-2

Deinking Capacity Listed in Lockwood's Directory

Sanitary Papers (tissue)

Location	Company	Listed Production	Comments
Arizona			
Flagstaff	Ponderosa Paper Products, Inc.	50 TPD	Deinked pulp
Indiana			
Gary	Georgia Pacific Corp.	74 TPD	All deinked pulp
Maine			
Augusta	Statler Tissue Co.	150 TPD	Deinked pulp
Massachusetts			
Baldwinville	Baldwinville Products	73 TPD	Deinked pulp
Erving	Erving Paper Mills	100 TPD	Deinked pulp
New Hampshire			
Hinsdale	Hinsdale Products	25 TPD	Deinked pulp
New Jersey			
Elmwood Park	Marcal Paper Mills	265 TPD	Deinked pulp
New York			
Battenville	Bio-Tech Mills	54 TPD	Deinked pulp
Carthage	Crown Zellerbach	145 TPD	Deinked pulp
Greenwich	Skybel Tissue Mills	65 TPD	Deinked pulp
Niagara Falls	Nitec Paper Corp.	250 TPD	120 TPD deinked pulp
South Glen Falls	Patrician Paper Co.	130 TPD	Deinked pulp
North Carolina			
Rockingham	Carolina Paper Mills	40 TPD	Deinked pulp
Oklahoma			
Pryor	Rabel Tissue Mills	100 TPD	Deinked pulp
Oregon			
Oregon City	Publishers Paper Co.	30 TPD	Deinked pulp
Vermont			
Putney	Putney Paper Co.	34 TPD	Deinked pulp
Wisconsin			
Ashland	American Can Co.	51 TPD	Deinked pulp
Eau Claire	Brown Co.	160 TPD	Deinked pulp
Green Bay	Fort Howard Paper	800 TPD	Deinked pulp
Ladysmith	Brown Co.	30 TPD	Deinked pulp
Menasha	Wisconsin Tissue Mills	85 TPD	Deinked pulp

Deinking Capacity Listed in Lockwood's Directory

Sanitary Papers (tissue) (TPD)

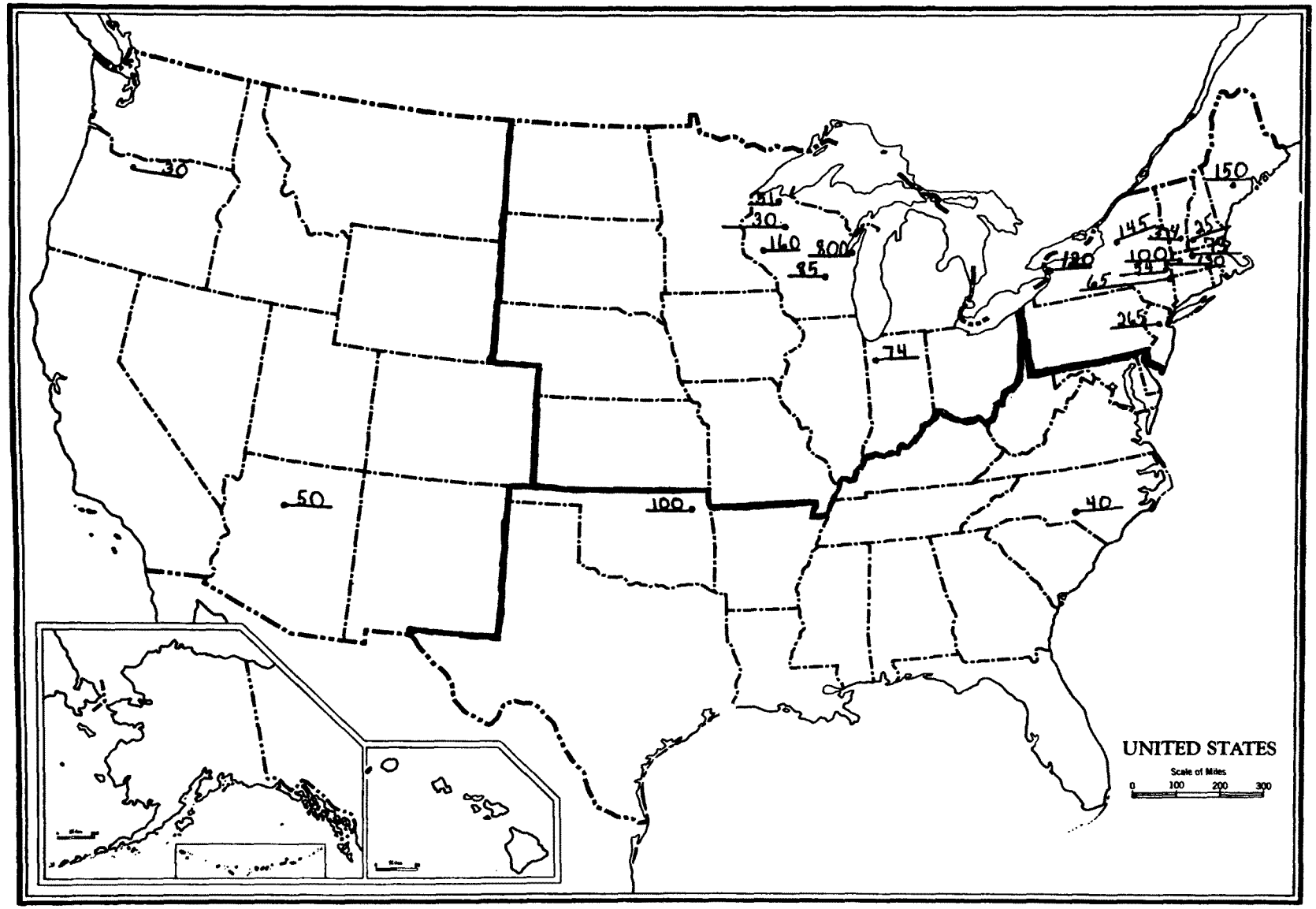

Table H-3

DEINKING CAPACITY BY REGION FOR TWO PRODUCT CATEGORIES

	Fine and Printing Papers		Sanitary Papers	
	(TPD)	(% of Total)	(TPD)	(% of Total)
Northeast	750	30	1,161	45
South	0	0	140	5
Central	1,290	53	1,200	47
West	414	17	80	3
Total	2,454	100	2,581	100
Annual Capacity (at 350 days)	860×10^3 tons		900×10^3 tons	

Source: Lockwood's Directory of Paper and Allied Trades, 1978, Vance Publishing Corp., New York, 1978, with estimates in some cases by Franklin Associates, Ltd.

Table H-4 was developed to cross-check the deinking capacity listed in Lockwood's directory. The first line is the annual capacity calculated by summing the daily capacities listed in Tables H-1 and H-2 and multiplying by 350 days. The second line lists waste paper consumption for 1976 as listed in the Capacity Survey of the American Paper Institute. The third line is line 2 divided by line 1 multiplied by 100. The results in this line show a close match between total waste paper consumption and deinking capacity for fine and printing papers, but not for sanitary papers.

A close correlation between deinking capacity and total waste paper consumption is expected. In deinking mills, the installed equipment is frequently used for deinking grades of waste paper as well as for pulp substitutes which are not deinked, and also for market pulp. The 1 to 1 correspondence of total waste paper consumption and deinking is encouraging, although not solid proof that any estimates of deinking capacity are valid. However, the 41 percent mismatch for sanitary papers implies that there is some deinking capacity that is not identified in Lockwood's.

In any event, this analysis implies that if there is any idle deinking capacity, it must be quite small.

Table H-4

WASTE PAPER USE IN TWO PRODUCT CATEGORIES

	Fine and Printing Papers	Sanitary Papers
Annual Deinking Capacity (at 350 days)	860×10^3 tons	900×10^3 tons.
Total Waste Paper Consumption	869×10^3 tons	$1{,}269 \times 10^3$ tons
Total Waste Paper as a Percent of Capacity	101	141
Estimated Postconsumer Waste Paper 1/	360×10^3 tons	560×10^3 tons
Postconsumer as a Percent of Total Waste Paper	41	44

1/ Calculated as 10 percent of pulp substitutes (mostly tab cards) plus deinking grades.

Source: 1976-1979 Capacity; Paper, Paperboard and Woodpulp Fiber Consumption, American Paper Institute, with estimates by Franklin Associates.

Appendix I

ENVIRONMENTAL IMPACTS OF VIRGIN AND RECYCLED PAPER AND PAPERBOARD MANUFACTURE

When considering national policy, it is important to consider the total effects of proposed action, at least to the extent possible. In this appendix, an assessment will be made of possible impacts of replacing virgin paper products with their recycled counterparts. The categories examined will be air pollution, water pollution, industrial solid wastes, and post-consumer solid wastes.

An accurate assessment of these issues is not possible for several reasons. One reason is that environmental impacts vary greatly between mills, so to do an accurate assessment it would be necessary to consider individual mills. Another difficulty is that the industry is presently undergoing rapid change with application of pollution controls now in advanced stages of completion. New equipment being installed means that the environmental impact on the nation as a whole changes almost daily.

Another problem is that the environmental impact of virgin and recycling mills is not entirely of the same type. For example, a serious problem with many virgin mills is the release of malodorous sulfur compounds, which recycling mills do not produce. A serious problem with some recycling mills that use old magazines as a raw material is that they must dispose of large quantities of solid waste in the form of minerals used to coat magazine papers. Virgin mills do not have this problem. It is not possible to say at this point in time which of these environmental problems is the more serious. Nevertheless, both problems can be solved in an environmentally acceptable manner.

An important feature of virgin and recycling paper and paperboard mills is that their environmental impacts tend to be of the same nature, with the two important exceptions as noted in the previous paragraph. The air pollutants tend to be primarily fuel related, or the same types of pollutants as are generated by fuel combustion. Water pollutants are primarily those caused by discarded wood fiber components. Industrial solid wastes are primarily related to water pollution treatment or other discarded wood fibrous material. Thus, except for the two environmental problems previously mentioned, the impacts are of a similar nature.

Although no detailed quantitative evaluation of environmental impacts will be attempted here, some general statements can be made. These statements are based on one key document* as well as substantial unpublished and confidential data available to Franklin Associates. Replacement of virgin fibers with secondary fibers tends to result in less air pollution, almost without exception. Recycling also reduces postconsumer waste to the extent that postconsumer waste is used as a raw material. Recycling also leads to a reduction of water pollution and industrial solid waste when clean "high grades" of waste paper are used as raw materials. However, use of postconsumer grades can in some cases create a water pollution and or solid waste problem greater than for competitive virgin materials.

These findings are summarized in Table I-1 with plusses and minuses used for qualitative designations. As can be seen on this table, the environmental impacts of replacing virgin with recycled fibers are usually desirable, but in some cases more water pollution and industrial wastes will occur. These greater impacts generally result from use of coated waste paper (such as magazines) or badly contaminated waste paper.

* Hunt, Robert G. and William E. Franklin, "Environmental Effects of Recycling Paper," presented at the 73rd National Meeting of the American Institute of Chemical Engineers, August 27-30, 1972, Minneapolis, Minnesota, and revised by the authors July 9, 1973.

Table I-1

QUALITATIVE EVALUATIONS OF ENVIRONMENTAL IMPACTS ASSOCIATED WITH REPLACING VIRGIN PAPER PRODUCTS WITH RECYCLED PRODUCTS

	Clean Grades of Waste Paper	Coated or Contaminated Waste Paper
Air Pollution	-	-
Water Pollution	-	±
Industrial Solid Waste	-	±
Postconsumer Solid Waste	-	-

\+ replacement of virgin by recycled results in more impact

\- replacement of virgin by recycled results in less impact

Appendix J

GSA DEFINITIONS OF RECOVERED MATERIALS

Until 1978, GSA used a definition of "reclaimed fiber" in its purchase specifications which separated specified postconsumer wastes (Part I) and other secondary fiber sources (Part II). An example page from an invitation to bid (dated 9/8/77) with the definition is included in this appendix on page J-2. The subject product is "FSC Class 8540 - Paper, toilet tissue."

Subsequently, GSA changed these definitions to coincide with definitions listed in Public Law 94-580, known as the Resource Conservation and Recovery Act. An example page from an invitation to bid (dated 2/8/78) is included in this appendix on page J-3. The subject product is also "FSC Class 8540 - Paper, toilet tissue."

REQUIREMENTS FOR RECYCLED MATERIAL FOR SPECIFIED PAPER PRODUCTS

6 . (a) The following requirement applies to all products where compliance with specification UU-P-556J for PAPER, TOILET TISSUE is prescribed. The use of reclaimed fibers shall not constitute a waiver of any specification requirements.

(b) Reclaimed fiber content. The products identified in paragraph (a), above, shall have a minimum reclaimed fiber content of 50 percent of the total weight of the paper stock. A minimum of 20 percent of the total weight of the paper stock shall be of reclaimed fibers from sources listed in Part I, below. The balance of reclaimed fibers, may be from sources listed in Part 1 and/or Part II below.

(c) Fiber content certification. The percentages stated are the Government's minimum requirements. By submission of an offer, offeror certifies compliance with these minimum requirements. Failure to comply will result in the rejection of the bid on grounds of nonresponsiveness. Bidders are encouraged, however, to exceed these minimum requirements in the performance of any resultant contract.

(d) Reclaimed fiber sources.

PART I - Post-consumer wastes.

(i) Paper, paperboard, and fibrous wastes from factories, retail stores, office buildings, homes, etc., after they have passed through their end-usage as a consumer item, including: used corrugated boxes; old newspapers; old magazines; mixed waste paper; tabulating cards; and used cordage.

(ii) All paper, paperboard, and fibrous wastes that enter and are collected from municipal solid waste.

PART II - Manufacturing, forest residues, and other wastes.

(i) Dry paper and paperboard waste generated after completion of the papermaking process (i.e. those manufacturing operations up to and including the cutting and trimming of the paper machine reel into smaller rolls or rough sheets) including: envelope cuttings, bindery trimmings, and other paper and paperboard waste, resulting from printing, cutting, forming, and other converting operations; bag, box, and carton manufacturing wastes; and butt rolls, mill wrappers, and rejected unused stock.

(ii) Finished paper and paperboard from obsolete inventories of paper and paperboard manufacturers, merchants, wholesalers, dealers, printers, converters, or others.

(iii) Fibrous by-products of harvesting, manufacturing, extractive, or wood-cutting processes, flax straw, linters, bagasse, slash, and other forest residues.

(iv) Wastes generated by the conversion of goods made from fibrous material, i.e. waste rope from cordage manufacture, textile mill waste, and cuttings.

(v) Fibers recovered from waste water which otherwise would enter the waste stream.

See text for reference.

Recycled/Recovered Materials Definitions

6a Definitions. The following definitions from Public Law 94-580, 42 USC 6903, Sec. 1004 are furnished for your information and use:

(i) The term 'procurement item' means any device, good, substance, material, product, or other item whether real or personal property which is the subject of any purchase barter, or other exchange made to procure such item.

(ii) The term 'recovered material' means material which has been collected or recovered from solid waste.

(iii) The term 'recovered resources' means material or energy recovered from solid waste.

(iv) The term 'resource recovery' means the recovery of material or energy from solid waste.

(v) The term 'resource recovery system; means a solid waste management system which provides for collection, separation, recycling, and recovery of solid wastes, including disposal of nonrecoverable waste residues.

(vi) The term 'solid waste' means any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining and agricultural operations, and from community activities, but does not include solid or dissolved material in domestic sewage, or solid or dissolved materials in irrigation return flows or industrial discharges which are point sources subject to permits under section 402 of the Federal Water Pollution Control Act, as amended (86 Stat. 880) or source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 as amended (68 Stat. 923).

(vii) The term ' solid waste management' means the systematic administration of activities which provide for the collection, source separation, storage, transportation, transfer, processing, treatment, and disposal of solid waste.

6b. Recovered Material Requirements

A Solicitation Item Numbers	B Minimum Percentage of Recovered Material Required	C Minimum Percentage of total material utilized which will be recovered materials
1 thru 17	50%	

Columns "A" and "B" set forth the Government's requirements which must be met. Column "C" is to be completed by the offeror. Submission of a signed offer constitutes a certification that the percentage of recovered materials, as defined in the provision of this contract entitled "Recycled/Recovered Materials Definitions", will be furnished. Offers which indicate a percentage less than that listed in Column "B" will be considered non-responsive and rejected. The offeror's figures inserted in Column "C" will become a contract requirement if they exceed the percentage required for that item in Column "B". Percentages in excess of 50% are encouraged however, they will not be a bid evaluation factor.

See text for reference.

Appendix K

PROGRESS REPORT ON STATE PURCHASES OF RECYCLED FIBER PAPERS

INTRODUCTION

Since the initiation of this investigation several states have moved to encourage their consumption of recycled paper products. At the time this study was initiated, the states of California, Maryland, and Minnesota had actually established programs to purchase recycled paper. Since that time, the states of Missouri, Delaware, Kentucky, and Oregon have initiated procedures to purchase recycled paper products, and Kansas is now preparing a legislative proposal towards this end as well.

Of these states, Maryland and California seem to have enjoyed especial success with their efforts. Follow-up interviews were held with representatives of each of these states and their programs are discussed below.

MARYLAND

Maryland was one of the first states to implement a recycled paper products purchase program, and has had success in its efforts. During fiscal year 1978, Maryland purchased about 36,000 reams of recycled bond paper, representing about 16 percent of the estimated total bond paper purchases for the state that year. Since the recycled paper was purchased at approximately 12.5¢ per ream less than virgin bond, it is estimated that Maryland saved about $4,500 on bond paper purchases alone. Other recycled products were purchased as well, representing about 7.4 percent of total purchases of about $3,000,000, including the recycled bond purchases.

The Maryland program is apparently being received well, with projected fiscal 1979 purchases expected to include 50 percent of the bond purchases to be of recycled fiber, representing a savings to the state of about $15,500. Additionally, the Maryland provision for encouraging local government purchases to be made from state supplies is being well received. Three counties and four cities have participated so far.

Some problems have been encountered, however. Slow delivery times have been a nuisance, and there has been only one bidder for the last two contracts. (Note that the bid was price-advantageous to the state, however.) Fiber supply shortages and high paper demand were given as reasons for the delays and bidding situations. In addition, some users have been reluctant to use the less-white recycled bond. A series of education/explanation presentations have been made to user groups to encourage support for the program, and 5 percent of all user agency bond paper orders are now automatically filled with recycled stock. In the event that user resistance is not overcome by these measures, a legislative mandate to use recycled paper is being considered.

CALIFORNIA

Perhaps representing the other end of a continuum is California, with perhaps the largest paper purchases for a state government. California has also had a recycled fiber use encouragement program in effect for a good part of the 1978 fiscal year, and has also met with success and difficulty.

About 4.8 percent of California's total purchases of paper and paper products have been made under a statute which allows the state to pay up to a 5 percent premium for products meeting its recycled fiber requirements. These purchases have totaled about $1.2 million in fiscal 1978, 1.1 million of which was supplied by only three purchases. Most, but not all, purchases were made under the 5 percent premium rule, and it is estimated that the additional cost to the state totaled about $15,000, or one percent of the total expenditures for paper products.

Notably about 231,800 reams of bond paper were purchased under the program, amounting to about 44 percent of the state's bond paper usage. Recycled towels, sanitary paper, and other miscellaneous paper products were also purchased under the program.

It would appear that the principal difficulty encountered in the implementation of the California program is the unusually long delivery times offered by vendors of recycled products. No explanation is offered for these delays, but a possibility might be the need for special mill runs to meet the state recycled fiber requirements.

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