Environment Canada
Environmental Protection Service

Environnement Canada
Service de la protection de l'environnement

Supplement to the Guide for the Recovery of High Grade Waste Paper from Federal Office Buildings Through At-Source Separation

Economic and Technical Review
Report EPS 3-EC-78-3

Environmental Impact Control Directorate
December 1978

ENVIRONMENTAL PROTECTION SERVICE REPORT SERIES

Economic and Technical Review Reports relate to state-of-the-art reviews, library surveys, industrial inventories, and their associated recommendations where no experimental work is involved. These reports will either be undertaken by an outside agency or by the staff of the Environmental Protection Service.

Other categories in the EPS series include such groups as Regulations, Codes, and Protocols; Policy and Planning; Technology Development; Surveillance; Training Manuals; Briefs and Submissions to Public Inquiries; and, Environmental Impact and Assessment.

Inquiries pertaining to Environmental Protection Service Reports should be directed to the Environmental Protection Service, Environment Canada, Ottawa, Ontario, Canada. K1A 1C8

SUPPLEMENT TO THE GUIDE FOR THE RECOVERY OF HIGH GRADE WASTE PAPER FROM FEDERAL OFFICE BUILDINGS THROUGH AT-SOURCE PREPARATION

by

Middleton Associates

and

Boston, Gilbert, Henry Associates

for the

Waste Management Branch
Environmental Impact Control Directorate
Environmental Protection Service
Environment Canada
Ottawa

Report EPS 3-EC-78-3
December 1978

Cat. No. En46-1/78-3

ISBN 0-662-10412-9

ABSTRACT

The purpose of this report is to provide back-up material to The Guide for the Recovery of Office Waste Paper from Federal Office Buildings Through At-Source Separation. It contains technical information (not included in The Guide) essential to a clear understanding of the issues surrounding office waste paper recovery programs.

RÉSUMÉ

Le présent rapport renferme des renseignements complémentaires au "Guide de récupération par tri à la source des papiers de rebut de qualité supérieure dans les immeubles administratifs fédéraux". On y trouvera certains renseignements techniques (non compris dans le Guide) qui permettent de bien saisir comment mettre en oeuvre la récupération de papier de rebut dans les bureaux.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

The Guide and The Supplement both concentrate on recovery of high grade waste paper generated by federal government office employees at their desks. The separation of paper from specialized areas such as computer rooms is not discussed separately, but is considered as part of the overall office building program.

The Supplement includes information on other office separation programs which served as the basis for the estimates and recommendations in The Guide. In addition, background information on the nature of the waste paper market in Canada is provided, along with the names and addresses of waste paper dealers and mills. Comments are also included on factors which could effect the implementation of an office waste paper recovery program: the potential problem arising from the use of xerographic paper by de-inking mills; the use of computer printout made of low-grade groundwood pulp; the introduction of fractionation equipment capable of mechanically sorting high grade waste paper from mixed office waste.

Throughout The Guide and The Supplement, the "collection of coloured ledger" refers to the collection of white and coloured ledger together.

Although all the figures given in The Guide were expressed in both Metric and British units, only British units appear in The Supplement as the figures obtained were so expressed.

2 REVIEW OF OTHER PROGRAMS

Although a large number of offices routinely sell their computer or printing room waste paper for recycling, only a few in Canada currently separate more than these particular wastes. In the United States, experience with office waste separation programs is much more advanced, with over 500 existing programs estimated in 1977 (1). Fortunately, a number of these U.S. programs have been studied and were described in a recent report (2). Additional information has been obtained on a number of other American programs as well as on several programs currently operating in Canada. This information was gathered by personal contacts with various paper recovery program managers in all cases except those on which a detailed report became available (3).

Estimates from previous studies on the quality and composition of the waste from a number of government buildings in Ottawa and Toronto were also used (5,6). These studies were designed to evaluate the potential for the recovery of high grade waste paper where paper recovery was minimal or non-existent (Table 2).

Table 1 summarizes the information gathered on the composition and quantity of high grade waste paper generated and recovered in the various office buildings studies. Table 2 summarizes the information reported on the composition and quantity of waste generated in 34 office buildings. The abbrevaitions used in Table 1 and 2 are defined in Tables 3 and 4.

Further details on case studies 1-12, in Table 1 and case studies 21-54 in Table 2, are available from studies previously referred to (2,5,6). Some further information on case studies 13-20 is given below.

2.1 Case Study 13

Place Vincent Massey, Hull, Quebec

Start-up Date	September, 1976
No. of Buildings	1
No. of Floors	21
Avg. Recovery Effectiveness	79%
Est. Overall Reduction	52%

Costs:

Desk-top Holders ($1.75 x 955)	$1,671
Central Containers ($17 x 4 x 21)	$1,428
Jute Bags (reused 40-50 times)	$0.40 each
Management & Administration	n/a

Revenues:

Total revenues are $90-$100/ton. Since the contractor, charged $56/ton collection and processing fees, net revenue was between $35 and $45/ton.

A rough breakdown of the paper recovered from special areas within this building was available. Of the total paper recovered, approximately 8% was from the wastes of the small in-house printer, 12% from the computer room and 18% from the occasional discard of obsolete files. Each of the five employees in the printing room thus recovered about 9.8 lb/employee/day and each of the fifteen employees in the computer room recovered about 4.9 lb/employee/day. Thus, of the 0.64 lb/employee/day generated by the entire building, 0.05 lb/employee came from the printing room, 0.08 lb/employee from the computer room, 0.10 lb/employee from obsolete file discards with the remaining 0.52 lb/employee/day from all the other areas of the building.

The case study outlined above has been well documented in a study available from Environment Canada (3).

TABLE 1 SUMMARY OF OFFICE PAPER SEPARATION PROGRAMS

Case Study Number (see Code)	Type Bldg	No Emp	Mode of Rec	Waste Gen Per Emp Per day lb/emp/day	Grade of Paper Rec	Amt Grade Rec tons/month	Per Emp Gen lb/emp/day	Composition of Waste								
								WL	CL	RE	CPO	TC	Other High	News	Other Paper	Other Waste
1	Bank/Ins	9000	C.C.	2.42	TC,CL,M	175 (89 CL)	1.77									
2	Bank/Ins	1200	C.C./S	4.49	TC,CL,WL	9 (6.5 CL/ WL)	0.85									
3	Bank/Ins	1700	D.T./ M.P.	0.90	TC,WL, CPO	13.5 (9.5 WL)	0.70									
4	Bank/Ins	1180	C.C./S	2.44	TC,CPO, WL,CL,M	38.9 (4.2 WL/CL)	1.71									
Avg (1-4)				2.31				30	5	NR	30	17	-	3	8	7
5	Gen Off	1200	D.T.	2.18	TC,CPO, WL	6.8 (6.3 WL)	0.63									
6	Gen Off	2000	C.C./ M.P.	0.72	WL,CPO, CL	6.8 (3.7 CPO/WL)	0.30									
7	Gen Off	7500	D.B.	1.44	M	20	0.25									
8	Gen Off	6040	D.B.	2.44	TC,WL/CL	42 (31.2 WL/CL)	0.68									
9	Gen Off	1900	C.C.	3.14	M	10.8	0.53									
Avg (5-9)				1.55				33	6	NR	7	3	-	16	20	15
10	Multi Displin	550	D.T.	7.60	TC,WL	3.1 (2.1 WL)	0.53									
11	Multi Displin	1200	D.B.	6.74	TC,M, NEWS	8 (6M)	0.61									
12	Multi Displin	7000	C.C./S	1.38	TC,CPO, WL,CL, NEWS	19 (7 WL/CL)	0.25	Buildings Too Diverse To Sample								
Avg (10-12)				5.23												

TABLE 1 (CONTINUED) SUMMARY OF OFFICE PAPER SEPARATION PROGRAMS

Case Study Number (see Code)	Type Bldg	No Emp	Mode of Rec	Waste Gen Per Emp Per day lb/emp/day	Grade of Paper Rec	Amt Grade Rec tons/month	Per Emp Gen lb/emp/day	Composition of Waste								
								WL	CL	RE	CPO	TC	Other High	News	Other Paper	Other Waste
13	Gen Off	955	D.T.	1.18	CL	5.8	0.64	44	23	NR	NR	NR	NR	NR	33	
14	Gen Off	10	D.T.		WL	0.02	0.26									
15	Gen Off	21	D.T.		WL	0.03	0.11									
16	Gen Off	2700	D.T.		TC/CPO/ WL	13.3	0.49	40.2	3.3	NR	10.6	0.7	-	12.5	19.0	13.8
17	Gen Off	5000	D.T.		WL	14.0	0.28									
18	Gen Off	2000	C.T.		TC/CPO/ WL/CL	12.0	0.6									
19	Gen Off	1600-3000	D.F.		WL	8.0	0.30									
20	Gen Off	2500	C.T.		TC/CPO/ WL	46.4	1.9									

TABLE 2 SUMMARY OF OFFICE WASTE COMPOSITION STUDIES

Case Study Number (see Code)	Type Bldg	No Emp	Waste Gen Per Emp Per day lb/emp/day	Paper Per Emp Gen lb/emp/day	Composition of Waste								
					WL	CL	RE	CPO	TC	Other High	News	Other Paper	Other Waste
21	Gen Off						44.0*				32.9		23.1
22	War/Stor						40.1				33.1		26.8
23	Lab/Admin						54.8				22.4		22.8
24	Special Consid Consid						99.4				0.0		0.6
25	"						40.4				51.1		8.5
26	"						36.8				37.3		25.9
27	"						85.9				5.9		8.2
28	"						62.6				15.9		21.5
29	"						28.2				52.2		19.5
30	"						37.9				43.1		19.0
31	"						25.3				33.1		41.6
32	Printing						87.2				12.1		0.7
Avg (21-32)					23.6		12.5	7.7	4.4	8.2	7.8	23.3	12.5
33	Gen Off	300	1.75	1.02			58.5				11.1		30.4
34	Gen Off	1000	1.31	0.62			47.4				16.9		35.7
35	Gen Off	800	2.42	1.35			55.8				14.8		29.4
36	Gen Off	400	1.88	0.77			40.9				21.8		37.3
37	Gen Off	350	0.50-0.64	0.18-0.22									
38	Gen Off	800	0.53	-			-				-		-
39	Gen Off	1800	0.99	0.33			33.7				13.6		52.7
40	Gen Off	700	2.50	1.28			51.3				20.7		28.0
41	Gen Off	1400	1.43	0.66			46.4				18.0		35.6
42	Gen Off	1200	1.15	0.67			58.6				13.1		28.3

TABLE 2 (CONTINUED) SUMMARY OF OFFICE WASTE COMPOSITION STUDIES

Case Study Number (see Code)	Type Bldg	No Emp	Waste Gen Per Emp Per day lb/emp/day	Per Emp Gen lb/emp/day	Composition of Waste								
					WL	CL	RE	CPO	TC	Other High	News	Other Paper	Other Waste
43	Gen Off	4500	1.78-2.00	1.06-1.19				59.5				16.4	24.2
Avg (33-43)			1.49										
44	Lab/Admin	200	0.38-0.50	0.14-0.18				36.3				16.0	47.7
45	Lab/Admin	760	1.64	0.87				53.0				21.9	17.9
Avg (44-45)			1.04										
46	War/Off	70	1.43	-				-				-	-
47	War/Off	195	0.51-0.64	0.23-0.29				45.5				6.6	47.9
Avg (46-47)			1.01										
48	Postal Stns	750	1.23	-				-				-	-
49	"	900	1.61	-				-				-	-
50	"	2500	1.30	0.60				46.2				9.7	44.1
51	"	4500	1.78	0.68				38.0				20.8	41.2
52	"	150	0.67	0.04				5.5				15.1	79.4
53	"	60	1.25-1.67	-				-				-	-
54	"	90	2.78	-				-				-	-
Avg (33-54)			1.49	0.72	18.4		12.1	13.5	0.9	3.7	13.6	7.3	30.5

*Percentages of high grades paper varied from 0 - 80% for 49 buildings surveyed

TABLE 3 BUILDING CODE AND LOCATION

Case Study Number	Building Name	Location	Reference
Table 1			
1-4	Bank of America	Northeast	2
	Sentry Insurance	West	2
	Wells Fargo Bank	Midwest	2
	Not Identified	West	2
	National Bureau of Standards	Rocky Mt	2
5-9	New Jersey Bell	East	2
	Oregon State Capitol	Northwest	2
	Washington State Capitol	Northwest	2
	Western Electric	West	2
	Donaldson Co., Inc.	Midwest	2
10-12	University of Oregon	Northwest	2
	World Trade Centre	East	2
13	Place Vincent Massey	Hull, P.Q.	3
14	Waste Management Advisory Board	Toronto, Ont.	6
15	Resource Recovery Br.	Toronto, Ont.	6
16	EPA	Washington D.C.	2,4
17	City Hall	Los Angeles	-
18	Western Electric	Sunnyvale, Cal.	2
19	A.T. & T.	Basking Ridge N.J.	-
20	Southern New England Telephone	Hartford, Conn.	-
21	Summary of 49 Federal Buildings	Ottawa	5
22	Summary of 3 Federal Buildings	Ottawa	5
23	Summary of 11 Federal Buildings	Ottawa	5

TABLE 3 (CONTINUED) BUILDING CODE AND LOCATION

Case Study Number	Building Name	Location	Reference
24	CPO Finance Annex	Ottawa	5
25	G.P.O. No. 1	Ottawa	5
26	Airlines	Ottawa	5
27	Data Centre	Ottawa	5
28	Dominion Bureau of Statistics	Ottawa	5
29	G.P.O. No. 2	Ottawa	5
30	Archives Building	Ottawa	5
31	DVA Records	Ottawa	5
32	Printing Bureau	Ottawa	5
33	Dept. Supply and Service	Toronto	6
34	Min. of Health (7 Overlea)	Toronto	6
35	Min. of Health (15 Overlea)	Toronto	6
36	Min. of Environment	Toronto	6
37	Sir William Mulock	Toronto	6
38	RCMP	Toronto	6
39	Mackenzie	Toronto	6
40	Dominion Public	Toronto	6
41	A. Meighan	Toronto	6
42	G. Drew	Toronto	6
43	Queens Park Complex	Toronto	6
44	Health Protection Branch	Toronto	6
45	Atmospheric Envir. Service	Toronto	6
46	Falaise Armory	Toronto	6
47	Lakeview Complex	Toronto	6
48	M.P.P. Progress Ave.	Toronto	6
49	M.P.P. South Central	Toronto	6
50	M.P.P. Gateway	Toronto	6
51	City Delivery/Terminal A	Toronto	6
52	Weston P.O.	Toronto	6
53	Rexdale P.O.	Toronto	6
54	Downsview P.O.	Toronto	6

TABLE 4 ABBREVIATIONS IN TABLES 1 and 2

Type Bldg - Building Type	-	Gen Off - General Office
	-	War/Stor - Warehouse or Storage Building
	-	Lab/Admin - Laboratory with General Administration Office
	-	Special Consid - Special Consideration Building
	-	Bank/Ins - Bank or Insurance Building
	-	Multi-displin - Multi-disiplinery Office Building
	-	War/Admin - Warehouse with a General Administration Office
No Emp	-	Number of Employees
Mode of Rec - Mode of Recovery	-	C.C. - Central container
	-	D.T. - Desk-top
	-	D.B. - Double basket
	-	D.F. - Desk drawer folder
	-	M.P. - Mail personnel used for collection of paper
	-	S - Secondary sort on paper performed
Waste Gen per Emp per Day	-	amount of solid waste generated per employee per day for the office
Grade of Paper Recovered	-	TC - tab cards
	-	CPO - computer printout
	-	WL - white ledger
	-	CL - coloured ledger
	-	M - mixed paper
	-	N - news
	-	/ - collected together
	-	, - collected separately
Amt Grade Gen	-	Amount of grade collected that is generated
Amt Grade Rec	-	Amount of grade recovered
Per Emp Gen	-	Amount of grade generated per employee
Per Emp Rec	-	Amount of grade recovered per employee
% Composition of Waste	-	WL - white ledger
	-	CL - coloured ledger
	-	RE - reproduction paper (NR - not reported)
	-	CPO - computer printout
	-	TC - tab cards
	-	Other High - other high grades of paper
	-	News - newspapers
	-	Other Paper - cardboard, coated containers, carbon paper, etc.
	-	Other Waste - glass, metal, plastic, etc.

2.2 Case Study 14

The Waste Management Advisory Board, Ministry of the Environment, Toronto, Ontario.

Start-up Date	July, 1976
No. of Buildings	1
No. of Floors	2 (partial)
Avg. Recovery Effectiveness	n/a
Est. Overall Reduction	36%

Costs:

10 Desk-top Holders ($2 each)	$20
Orientation Time	10 minutes each
Administration	Absorbed

Revenues:

Due to the small volumes generated, paper is still being stored. However, the W.M.A.B. had samples analysed by two different paper dealers. One dealer priced the white ledger grade at $60/ton picked up, or $70-75/ton delivered. His price for coloured ledger grade is $40/ton. The following contaminants were considered to be a problem: cellophane window envelopes, manilla folders, green graph paper, reproduction paper.

The other dealer termed the samples as high-grade white ledger for which he put the market price at $85/ton. He estimated that $45 would be deducted by dealers for pick-up and processing. The minimum regular pick-up requirement is 0.5 tons. Contaminants included: manila envelopes, staples, reproduction paper.

2.3 Case Study 15

Resource Recovery Branch, Ministry of the Environment, Toronto, Ontario

Start-up Date	July, 1976
No. of Buildings	1
No. of Floors	2
Avg. Recovery Effectiveness	n/a
Est. Overall Reduction	n/a

Costs:

21 Desk-top Holders ($2 each)	$42
Other	n/a

Revenues:

Since the Waste Management Advisory Board and Resource Recovery are involved in a joint program, it is assumed that the grade collected is similar. The lower recovery rates experienced by Resource Recovery result from field staff who do not spend large amounts of time in the office. The anticipated revenue would be about $75/ton.

2.4 Case Study 16

Environmental Protection Agency, Washington, D.C.

Start-up Date	November, 1975
No. of Buildings	East & West Towers, Mall
No. of Floors	n/a
Avg. Recovery Effectiveness	75%
Avg. Overall Reduction	40%
Method Used	Desk-top
Grade Collected	White Ledger & Computer/Printing

Costs:

Equipment	Absorbed by Shade Information Systems
Labour	5 hours/days

Revenues:

The paper is being sold to Shade for approximately $75/ton. Contaminants include: coloured paper, glue-bound manuals, glossy materials, heavy poster-like materials.

This program is briefly reviewed in a study available on the quantity and composition of the waste from different parts of the complex (4).

2.5 Case Study 17

City Hall, Los Angeles, California

Start-Up Date	March, 1977
No. of Buildings	3
No. of Floors	53
Avg. Recovery Effectiveness	60%
Est. Overall Reduction	20%

Costs:

200 of 25-gallon Metal Drums	$4,000
5,000 Corrugated Containers	$500
3 roll-off Bins (3 cu. yds.)	n/a
Posters, flyers, stickers	$250
Employee Orientation	10 minutes each
Management & Administration	n/a

Revenues:

The revenue is $100/ton with the Industrial Paper Stock Company. The contract is for 2 years. Computer/printing papers are sold separately.

2.6 Case Study 18

Western Electric, Sunnyvale, California

Start-up Date	December, 1972
No. of Buildings	7
No of Floors	11
Avg. Recovery Effectiveness	n/a
Est. Overall Reduction	n/a

Costs:

Capital Investment (150 central containers, 9 barrels)	$2,000
Analysis	$1,000
Literature & Printing	$500
On-going Labour	$200/month

Revenues:

During the first 12 months of operation, 145 tons of high-grade paper were sold for $2,500, or about $17/ton. The estimated reduction in disposal costs for this period was about $10,000.

2.7 Case Study 19

A.T. & T., Basking Ridge, New Jersey

Start-up Date	June, 1976
No. of Buildings	n/a
No. of Floors	n/a
Avg. Recovery Effectiveness	n/a
Est. Overall Reduction	10%

Costs:

3,000 Desk-drawer Folders (70¢ each)	$2,100
200 Central Plastic Containers ($24 each)	$4,800
Literature & Education	n/a
Labour	$170/week

Revenue:

Paper is sold for approximately $60/ton

2.8 Case Study 20

Southern New England Telephone, Hartford, Conn.

Start-up Date	1972
No. of Buildings	5
No. of Floors	n/a
Avg. Recovery Effectiveness	n/a
Est. Overall Reduction	n/a

Costs:

Equipment	Nominal
Literature & Logo	n/a
Total	$5,000

Revenue:

The total revenue in 1976 from the sale of 557 tons was $25,796, a per-ton value of $46.

2.9 Other Case Studies

In addition, some preliminary information was available on two separation programs and one mixed paper recovery program which were recently initiated in federal office buildings in Canada.

The Energy Mines and Resources building at 580 Booth Street in Ottawa recently begun source separating high grade office paper. The program is modelled after the established system at the Place Vincent Massey Building in Hull, Quebec. The E.M.R. Building has 21 floors and approximately 1,100 employees. Total program start-up costs approach $3,850 and include the cost of 1100 desk-top holders, 100 plastic containers, 500 jute bags and various printing materials. In addition the building contractor was contracted to service the floor containers. A contract was signed to remove the separated paper on a regular basis (twice a week pick-up) and to pay the Receiver General for Canada $26.00/ton. Initial indications are that the building is averaging a recovery of 0.76 lbs/employee/day.

The Fontaine Building in Hull, Quebec has also recently begun source separating coloured ledger grades. The Fontaine Building has 14 floors and houses about 650 employees of the Department of Fisheries and the Environment. This too is a desk-top and centrally controlled system that utilizes plastic holders manufactured by Oxford Pendaflex Ltd. Bilingual stickers are placed on the sides of the holder listing acceptable and non-acceptable papers. Jute bags are used for storage and collection. Revenues are in the neighbourhood of $35.00/ton.

There are also thirteen federal government buildings in the Ottawa-Hull area that are presently selling mixed grade office paper on a two year contractual basis. The estimated total quantity per year is 3,299 tons. It is believed that at-source separation could substantially increase the revenues received and this is presently under investigation.

2.10 Conclusions

After analysing all the data available from the various programs which were received, the following estimates were made of the quantity of different grades recoverable from a general administrative office building:

White ledger	0.3 lb/emp/day
White ledger & CPO	0.5 lb/emp/day
Coloured ledger*	0.6 lb/emp/day
Mixed paper	1.1 lb/emp/day

*Includes white ledger and CPO

It is fully recognized that there are a large number of site-specific factors which could have a significant impact on the actual amount of high grade paper recoverable from an office building. The Guide attempts to resolve some of these variables by giving separate estimates of the amount of paper anticipated from a few specialty sites. As a result those buildings without such facilities can make a more accurate estimate of their waste.

Increased accuracy can be obtained for each specific office by estimating the following three variables:

(a) The amount of waste generated by the building

Waste collection records may be available which give the quantity (in tons) of waste generated by the building. However, it will often be necessary to make your own estimates. This can be done by weighing a known estimated percentage of the total number of bags or containers generated over a period of time (e.g. 10 of the 100 bags generated in a day). Alternatively, the total volume of waste generated by the building can be estimated by a visual inspection of all the waste containers and converted to weights using an average density of 150 lb/yd (3).

(b) The composition of the waste

This can be determined by the following steps:

STEP 1 Select a representative sample of mixed office waste of about 50 lbs. from a collection cart or storage bin and place it in a container of known weight. If waste is in plastic bags, select three or four bags randomly. If necessary to reduce weight, divide the contents of each bag into two representative halves; discard one half and combine retained halves to make up the sample.

STEP 2 Divided the sample into the following groups: High-Grade Paper (white, coloured, computer tab cards, computer printout, manila folders), Low-Grade Paper (corrugated, newsprint, bags and wrappers, towels, cups, tissues, cardboard, books, other), Non-Paper (food, organic wastes, metals (containers, etc.) plastics (containers etc.) textiles, wood, other).

STEP 3 Weigh each group separately and record weights, being careful to subtract weight of the containers. Also separate the coloured stock from the high grade paper and weigh it separately since the amount of coloured paper in the waste could determine whether only white ledger or a mixture of white and coloured leedger is recovered (see page 27).

(c) The percentage of waste recoverable

Previous studies indicate that about 80% of the available high grade of waste paper can be recovered using a desk top separation method.

The sampling and weighing in (a) and (b) should be repeated on different days. For each new sample, weights should be added to previous totals and new averages computed. Sampling can be stopped once the averages appear to become stable (i.e. when new data fails to cause a significant change in the averages).

The amount of waste paper recoverable can then be calculated by multiplying weight of the total waste (a) times the percentage of the waste that is high grade paper (b) times a recovery efficiency (c).

3 ALTERNATIVE RECOVERY METHODS

Although every source separation program may differ slightly, there are four prime collection methods. These are briefly reviewed in this chapter.

3.1 The Desk-Top Method

With this system each employee receives a container which stands vertically on the top of the desk. High-grade paper waste is placed here as it is generated. All other classes of waste are disposed of in the normal waste basket. The separation paper will normally be collected by the custodial staff when they are doing the office cleaning. They are trained to keep these papers in separate containers (usually of a different colour type than those used for mixed waste). The papers collected are moved to the central storage location by the cleaning staff.

Experience has shown that there is normally very little extra time required to accommodate the handling of separated papers by the custodial staff. In most case studies examined this time is easily absorbed within the cleaning function.

Any method which employs the desk-top container offers advantages over other methods. Because of the prominent position of the container, people tend to view the collected papers as a resource. If the collected papers are being placed on the floor (as with a second waste basket), people are more likely to think of the material as "garbage". A second advantage of the desk-top system is that a large supply of scratch paper is kept handy and this tends to promote significant reuse prior to recycling. Lastly, low contamination and high participation rates are usually found in programs that use desk-top containers. Because of the open ended and upright design of these holders any contaminants are readily visible and can be removed.

3.2 The Dual Waste Basket

With this method, two waste baskets are kept beside the working place: one for the high-grade papers to be collected, the other for all other waste. This system requires collection by the cleaning staff who are also responsible for keeping the two classes of material separated. Case studies have shown that lower participation and higher contamination tends to result with the two waste basket system and it is therefore losing its popularity. As mentioned earlier people tend to regard papers that are kept in a waste basket on the floor as garbage rather than as recyclable material that has been temporarily displaced. Because of the lower visibility with a second waste basket, materials tend to get mixed up and other wastes find their way into the high-grade.

3.3 The Central Container Approach

With this system each employee collects separable papers at his/hers working place until such time as he/she is required to make a trip past a centrally located container to deposit his/hers collected papers. In a general office setting there are problems with this system in that there is no convenient method of keeping the paper separated at the desk. In operations that are not desk oriented such as printing ships, computer rooms, sorting functions, etc. a central container system may be indicated. The custodial staff is responsible usually for moving the paper from the containers to a central storage area. As with other collection functions this can be handled fairly efficiently and no additional labour should be required. This is especially true when the central container is on wheels and can be replaced with an empty container. Contamination problems tend to be encountered with this type of system as casual passersby often throw other wastes into the containers.

3.4 Desk-Top Plus Central Container

This system utilizes the desk-top containers and makes the separation the responsibility of the generator but it differs in the collection process from the pure desk-top system. The employee is responsible for moving the contents of his desk-top holder to a strategically located central container. Handling from the central containers to a storage area is the responsibility of the custodial staff (cleaning staff). If employees move the paper from their desk-top holders only when it is convenient, i.e. as part of another necessary trip, the labour involved in this combined system will be less than with any other. The labour required of the custodial staff can actually be less than if no source separation program is in place.

3.5 Post-Collection On-Site Processing

Dealers will often sort the paper from office recovery programs to remove contaminants or up-grade it to increase its value. It will almost always be compacted into bales before being shipped to a paper mill and may even be shredded. This post-collection processing is expensive - both in terms of labour and equipment.

There are three steps which can help avoid a second (expensive) sorting: (1) thoroughly educate your employees about acceptable and non-acceptable papers, (2) make periodic visual checks during collection, (3) be sure the storage area is well marked and that other wastes are not left there.

Compacting and baling is one way of reducing volume to simplify handling and shipping. However, the cost is only justified with a very large volume of paper. The cost of equipment varies with capacity and whether or not the equipment is hand-fed or chute-fed. The former is less expensive but calls for more direct labour.

Compacting and baling can sometimes be avoided by packing paper uniformly and maximizing its density. Baling equipment should never be purchased solely for source-separated papers unless a dealer offers a significant premium over and above the current market price for unbaled paper. Most dealers prefer that paper not be baled because it makes it more difficult to check for contamination and to grade.

The cost of a paper shredder is usually prohibitive. However, when large volumes of high-grade confidential or classified records and documents are available, a shredder may prove economical because it avoids the destruction costs that are otherwise involved (i.e. incineration under security).

4 ECONOMICS OF SOURCE SEPARATION PROGRAMS

Although there are compelling environmental reasons for source separating high-grade paper for recycling, the economic viability of such programs is obviously important. This chapter analyses the economics of source separation programs and describes the minimum conditions that will usually ensure their economic viability. It should be stressed that even if these conditions are not satisfied, source separation may still be justifiable on environmental grounds. In such cases it is advisable to examine the expected costs and revenues in order to estimate the net economic cost of the project. The projected loss must then be balanced against the benefits of promoting resource and energy conservation.

It is, however, important to note that the majority of programs already in operation are profitable.

4.1 Program Costs

The following costs are based on those incurred by the various recovery programs which were reviewed.

The basic costs consist of the following elements:

4.1.1 Start-up costs.

- Management time - Approximately 1 man-month appears to be required to set up a workable program involving 1000 employees. At a rate of $7.50/hour or $15,000/year, this component is about $1,200.
- Administration/Publicity/Education - Based on the case studies examined, the best estimate of the cost for the time and materials (flyers, posters, etc.) necessary for carrying out the public education campaign is about $300.
- Equipment and Materials - As indicated in The Guide, desk-top holders should cost $1.50-$2 each. Bags and central containers add an additional $1-$1.50/employee for a total of $3/employee.
- Employee Orientation Time - It was estimated that about 15 minutes were required to educate employees at briefing sessions. Assuming an average wage of $6/hour, this aspect would cost $1.50/employee. This is, however, a discretionary cost item which may or may not be included in a cost equation. Many program managers have considered this a general administrative expense which is not charged against a particular budget.

4.1.2 On-going costs.

- Management and Administration - Once a program is set up, the program co-ordinator will be required to spend some time monitoring and stream-lining it. A cost of $0.02/employee/month appears to have been sufficient for a number of programs and has thus been used in the economic equations which follow.

  Other estimates have put the cost as high as 5% of the administrator's time or $750/year for a building with 1000 employees. This higher, less optimistic figure was the one used in The Guide.
- Equipment and Materials Replacement - The only material requiring significant replacement will be the jute bags. Assuming the cost of $0.50 per bag, four bags per central container and one central container per twenty employees, the cost of bags would be $0.10/employee/year.

Table 5 summarized these costs and estimates the yearly amortized cost of the program (over 5 years at 10%) to be $390 + 1.41/employee.

4.2 Program Revenues

The revenue that can be expected from the sale of office waste paper is location specific. Dealer prices for a certain grade can differ from one region to another because of different mill locations and requirements. Even dealer prices within a specific region may vary according to individual operating efficiencies. The lack of uniformity in market price means that it is important to determine the dealers' prices in any given area. There are two U.S. publications that keep track of mill and dealer prices respectively in major U.S. cities. These are the Officials Board Markets and the Fibre Market News.

Both publications can be consulted for general trends in paper stock prices. The current (June, 1977) prices for white and coloured ledger grades paid by dealers in Central Canada have been estimated at $75 and $40/ton respectively. These prices have been cited in the chapter but the calculations necessary to use other price figures are also given.

In order to arrive at an accurate cost-revenue equation, disposal savings have been treated as revenues which accrue to the source separation system in the detailed economic equation included in The Guide and in the following analysis. This item was, however, excluded from the rough economic calculation in The Guide since it may or may not, depending on the occupancy status, accrue to the organization undertaking the separation program. It has been demonstrated that disposal costs are generally not reduced in direct proportion to the quantity of waste diverted (2). Percentage savings typically average about one half the percentage waste reduction. For the purpose of this study, disposal costs are assumed to be approximately $30/ton. Disposal savings are therefore $15/ton of waste diverted.

4.3 Break-Even Number of Employees

Based on the amortized costs of setting up and maintaining a program developed in the previous section, the number of office employees required to make a separation program economically viable can be calculated.

TABLE 5 SUMMARY OF SYSTEM COSTS FOR AT-SOURCE SEPARATION

Cost Element	Basic Assumption	Basic Costs	Yearly Amortized cost (5 years at 10%)
Start-up Management Time	1 month @ $7.50/hr.	$1200	$390/yr
Administration/ Publicity/ Education	Time + Materials (flyers, posters, buttons, etc)	$ 300	
Start-up Equipment and Materials (desk-top holders, bags, containers, etc.)	desk-top holder @ $1.50-$2.00 other $1-$1.50	$3/emp	$1.17/emp/yr
Employee Orientation Time	15 minutes/employee @ avg. $6.00/hr	$1.50/emp	
Management and Administration	$0.02/employee/month	$0.24/ emp/yr	$0.34/emp/yr
Equipment Replacement	$0.10/emp/year	$0.10/emp/ yr	
Total Annual Amortized Costs	5 year payback period @ 10%	$1500 + $4.50/ emp + $0.24/ emp/yr	$390 + $1.51/ emp/yr

Figure No. 1 on page 26 illustrates the number of employees required for the economic justification of programs for the recovery of white ledger, white ledger plus computer print-out, coloured ledger (with white paper and computer print-out), and mixed paper using different prices for the waste paper. The figure indicates, for instance, that for coloured ledger selling for $25/ton, 265 employees are required whereas only 16 people are required if coloured ledger could be sold for $50/ton.

It should be noted that these calculations are based on the assumption that the cost of the program for the recovery of the four different grades of waste paper is the same. Although the program costs may be expected to change due to additional education or perhaps the necessity of a post-separation sort, the scope of this investigation did not permit such a cost breakdown. It should also be noted that a $15/ton disposal savings has been included as a revenue in calculations used to derive this figure.

4.4 Economics of Collecting Coloured and White Ledger Together

The decision of whether to collect white ledger only or to collect coloured ledger with it can be considered from an economic point of view. Although white ledger can be sold for more money than coloured ledger, the amount of coloured ledger available for sale plus the savings attributed to reduced disposal of the remaining waste result in a higher revenue. Assuming that the cost of each program is the same, a simple break area formula can be derived.

Let Pw = Price received for white ledger ($/ton)
Pc = Price received for coloured ledger ($1/ton)
Vc = % of coloured stock in high grade paper waste
Ds = Disposal cost for waste ($/ton)
T = Tons of high grade paper

Then revenues for collection of white ledger will be

T.Pw (1-Vc) revenue from sale
+T.Ds (1-Vc) savings in disposal

The revenues for collection of coloured ledger with whites included will be

T.Pc (1) revenue from sale
+T.Ds (1) savings in disposal

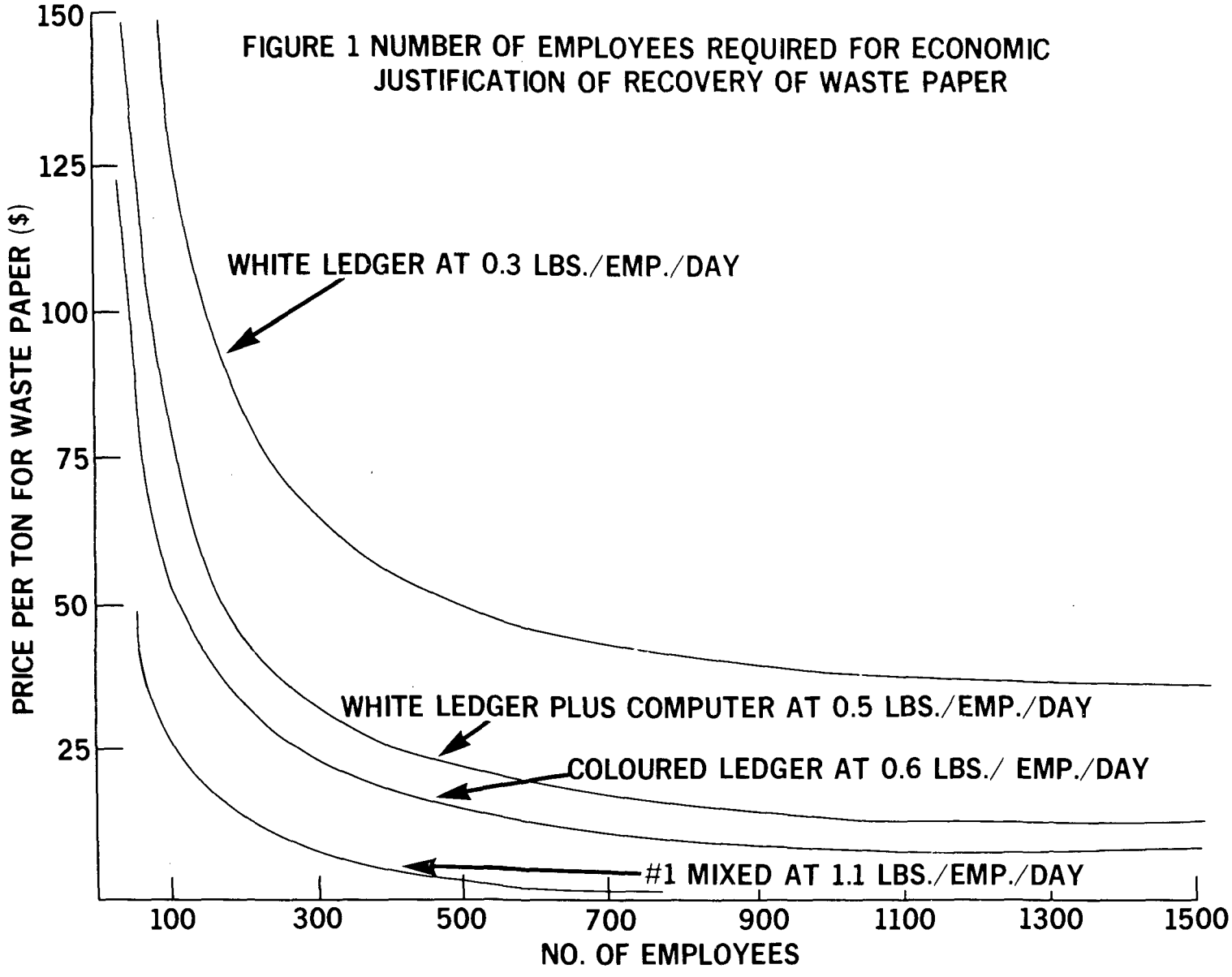


FIGURE 1 NUMBER OF EMPLOYEES REQUIRED FOR ECONOMIC JUSTIFICATION OF RECOVERY OF WASTE PAPER
PRICE PER TON FOR WASTE PAPER ($)
150
125
100
75
50
25
WHITE LEDGER AT 0.3 LBS./EMP./DAY
WHITE LEDGER PLUS COMPUTER AT 0.5 LBS./EMP./DAY
COLOURED LEDGER AT 0.6 LBS./ EMP./DAY
#1 MIXED AT 1.1 LBS./EMP./DAY
100
300
500
700
900
1100
1300
1500
NO. OF EMPLOYEES

At the breakeven point these revenues will be equal

$$T.Pw\ (1-Vc) + T.Ds\ (1-Vc) = T.Pc\ (1) + T.Ds\ (1)$$

Simplifying,

$$Pw - Pw.Vc + Ds - Ds.Vc = Pc + Ds$$

and

$$Pw - Pc = Vc\ (Ds + Pw)$$

$$Vc = \frac{Pw - Pc}{Pw + Ds}$$

Figure 2 shows the breakeven percentage of coloured stock required to justify the collection of coloured vs white ledger for different ratios of Pw/Pc. This figure is based on the price received for white ledger (Pw) of $75/ton and a disposal savings (Ds) of $15/ton. The percentages in Figure 2 are based on the amount of the high grade waste paper that is coloured stock, not the amount of the total office waste that is coloured paper.

It should be noted here that the price paid by dealers for the coloured ledger recoverable from an office building may be greater than the price they quote for other coloured ledger. This is because the grade from an office building will contain large amounts of white ledger which may increase its value. In fact, some dealers classify the coloured ledger from an office as manifold coloured ledger, due to its high content of white ledger, and pay $10-$20 more for it per ton than for No. 1 rated coloured ledger.

5 THE WASTE PAPER MARKET

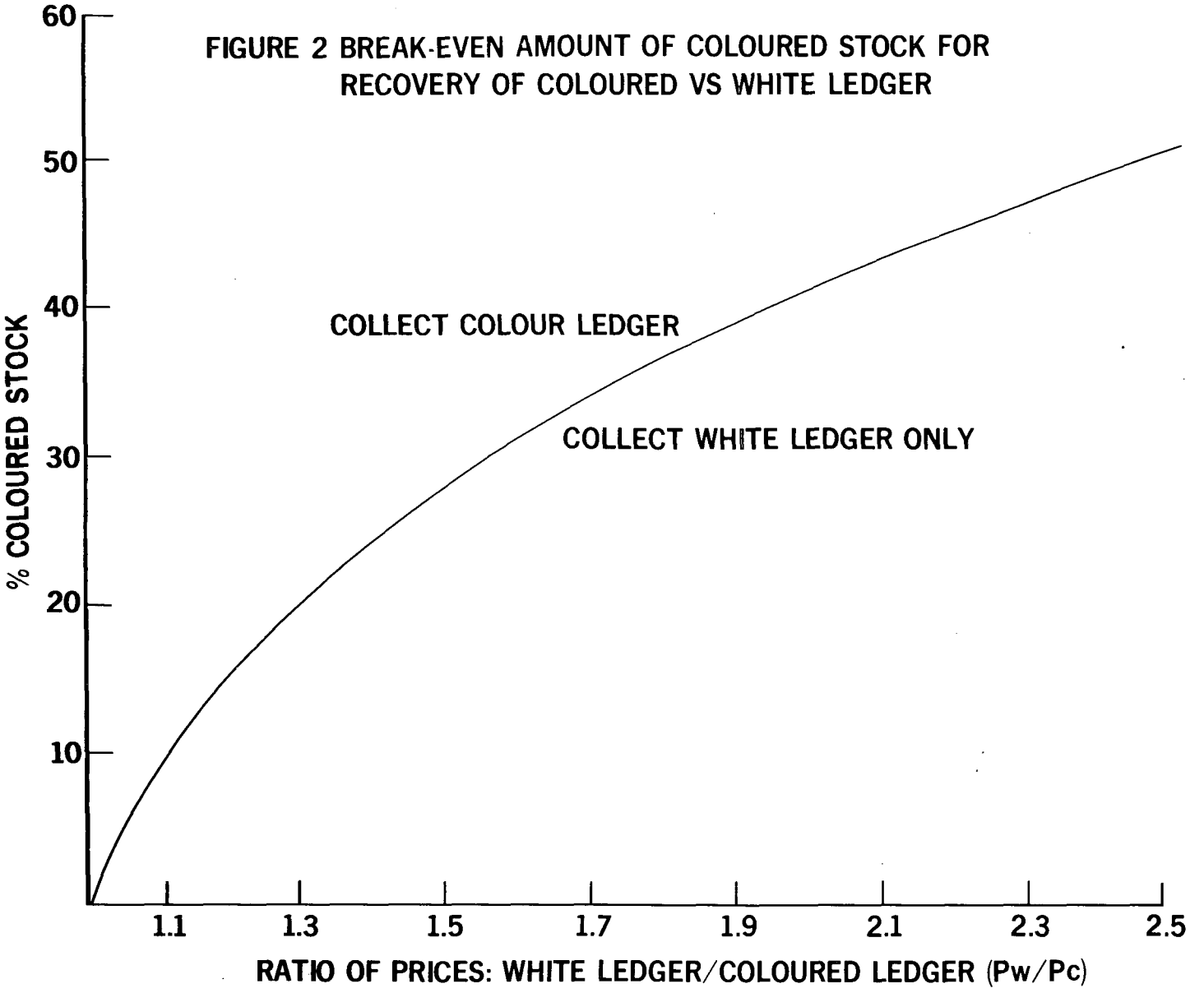
Canada is the second largest producer of pulp and paper in the world. Although most of this production comes from virgin fibre, some waste paper is also used.

Waste paper can be broken down into six major categories. They are ranked in order of quality:

(a) Mill Wastes (or Broke)

These wastes are generated in the mill and are usually recycled directly by the mill. They have no bearing on an office waste paper separation program.

FIGURE 2 BREAK-EVEN AMOUNT OF COLOURED STOCK FOR RECOVERY OF COLOURED VS WHITE LEDGER



(b) Pulp Substitution

This includes waste paper that can be directly substituted for virgin fibre. Examples: conversion and fabricating wastes (envelope cuttings, shavings) and tabulating cards.

(c) De-inking

This includes waste paper that can either be de-inked and used to produce fine paper and tissue paper, or it can be used directly in the production of such products as boxboard. Examples: waste from printing operations, coloured and white ledger (bond, envelopes, writing paper, etc.), printed book stock, obsolete files.

(d) Container

This includes conversion waste such as boxboard and corrugated cuttings, as well as post consumer wastes.

(e) News

This includes over-issue news, news blanks and used newspaper.

(f) Mixed

This includes any or all of the above grades, plus larger amounts of foreign matter than are permitted in other categories.

Almost all post-consumer waste falls into one of the last four categories (c) (d) (e) or (f). The essential difference between the de-inking and container wastes - both of which are made up of long and strong chemical pulp fibres - is that paper in the de-inking category has been bleached from its natural brown colour. The paper in the news category is made up of short and relatively weak fibres produced mainly from mechanical pulp. Mixed grades contain both strong and weak fibres.

Figure 3 shows the tonnage of waste paper consumed in Canada by the five categories in 1976 (6).

As can be seen, the container category makes up more than 63 percent of the waste paper consumed. The de-inking grades which are the principal categories of waste in office buildings, make up less than 7 percent of the total.

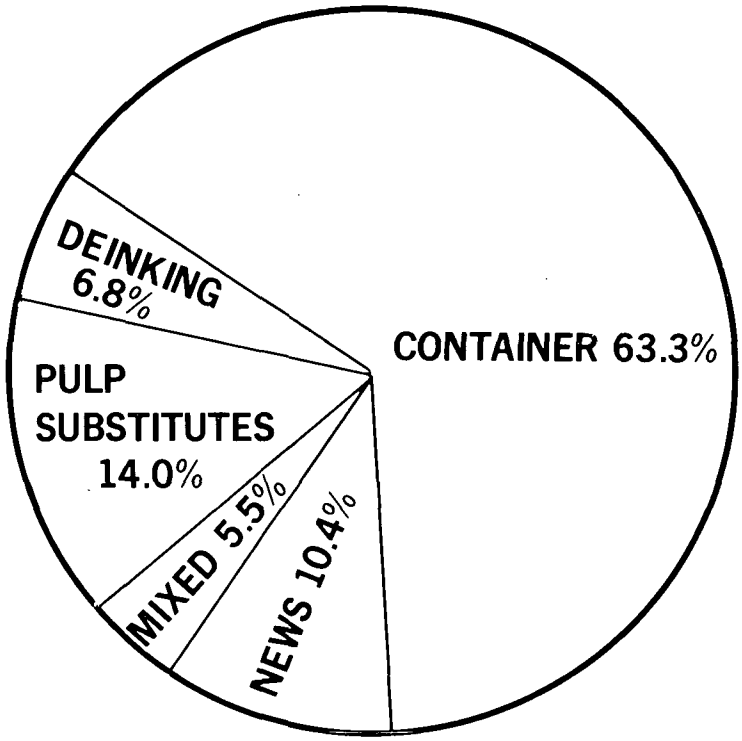


FIGURE 3 WASTE PAPER CONSUMPTION BY CATEGORY CANADA-1976 (6)

Eight principal types of paper and paper board are produced in Canada. The vast majority is made from virgin fibre. A number of mills use virgin fibre primarily but also use small amounts of waste paper. Some mills in Canada, particularly those near urban communities, use waste paper almost exclusively. Table 6 shows the major uses of each of the main categories of waste paper in 1973. The only principal type of paper not included in Table 6 is kraft paper (which is used to make products such as paper bags) because an insignificant amount of waste paper was used in its production.

TABLE 6 MAJOR CATEGORIES OF WASTE PAPER BY END USE CANADA - 1973

Category	Box-Board	Liner-Board	Corru-gating Medium	Print-ing/ writing	Tissue	News-Print	Building Materials	Total
				Use %				
Pulp Subs.	32.9	19.5	-	14.2	13.4	6.3	13.7	100
De-inking	38.9	3.1	-	40.1	10.9	0.6	6.4	100
Container	40.0	22.2	16.8	-	0.4	-	20.6	100
News	53.9	2.0	1.0	-	2.0	13.7	27.4	100
Mixed	21.4	-	-	-	-	9.0	69.6	100

The principal uses for the de-inking grades of waste paper are in the production of printing/writing paper and boxboard. The amount of de-inking grades used in the production of tissue is low in Table 6 because it does not include a number of tissue de-inking mills built since 1973. Note, also, that the uses for lower grades of waste paper (container, news and mixed) are principally in boxboard and building materials. The huge boom and bust in the market for these grades in 1973-74, which surprised many municipalities and community groups collecting newspaper, can be partially explained by the extreme fluctuations in demand for boxboard and building materials in times of growth and recession.

Among the high grades of waste paper, the three most common in office buildings are tab cards, white ledger and coloured ledger. In 1976, the estimated Canadian consumption of these three office grades was 21,300 tons, 8,149 tons and 30,848 tons respectively (6).

The potential for increased consumption by paper mills of high-grade waste paper from office buildings is confirmed by the fact that Canada is a large net importer of these grades. In 1976, 66% of the 64,414 tons of brown kraft paper (composed of about 35% tab cards) and 23% of the 60,968 tons of soft white and ledger waste paper used in Canada was imported (6).

The number of expansions, and planned expansions, of paper mills in Canada will lead to a growing demand for the grades of waste paper found in office buildings. The potential market for sorted office waste grades could rise from 75,000 tons/year in 1976 to between 161,000 tons/year in southern Ontario and Quebec in the next few years (6).

The production of cellulose insulation is also expanding the market for waste paper. This grey, fluffy insulation, made by grinding the paper and adding fire retardant chemicals, has very good insulating properties. Although news is the principal grade used, small amounts of the de-inking grades are also used to manufacture cellulose insulation which is sprayed on walls and ceilings of commercial buildings.

The Paper Stock Institute of America defines 47 grades of waste paper. These definitions also include percentages of outthrows ("all papers that are so manufactured or treated or are in such a form as to be unsuitable for consumption as the grade specified") and prohibitive materials ("any materials which, by their presence is a packaging of paper stock in excess of the amount allowed, will make the packing unusable as the grade specified, or any materials that may be damaging to equipment"). Although these definitions are the only formal ones in common use, slightly different "word of mouth" definitions usually are developed by dealers and mills. The only way to know exactly what a dealer wants in a particular grade of waste paper is to talk to him directly.

5.1 Waste Paper Classifications

The majority of waste paper generated in an office building would be classified under one of the following two ledger grades:

	Dealer's Price ($U.S.*/ ton) Fibre Market News (Oct. 7, 1977)	Survey of Canadian Dealers ($/ton) Oct. 1977
No. 1 Sorted Coloured Ledger		
Consists of printed or unprinted sheets, shavings and cuttings of coloured or white sulphite or sulphate ledger, bond, writing and other papers which have a similar fibre and filler content. This grade must be free of treated, coated, padded or heavily printed stock.	$30 $55	$20 $40
Prohibitive materials: None permitted		
Total outthrows may not exceed: 2%		

	Dealer's Price ($U.S.*/ ton) Fibre Market News (Oct. 7, 1977)	Survey of Canadian Dealers ($/ton) Oct. 1977
No. 1 Sorted White Ledger		
Consists of printed or unprinted sheets, shavings, guillotined books, quire waste, and cuttings of white sulphite or sulphate ledger, bond, writing paper, and all other papers which have a similar fibre and filler content. This grade must be free of treated, coated, padded, or heavily printed stock.	$40 - $60	$30 - $70
Prohibitive materials: none permitted		
Total outthrows may not exceed: 2%		

*Averages of prices quoted for New Yord, Philadelphia, Pittsburg, Boston,Chicago and Pacific Coast.

Four other grades of high-grade waste paper will also be present in varying amounts:

	Dealer's Price ($U.S.*/ton) Fibre Market News (Oct., 7, 1977)
Coloured Tabulating Cards	
Consists of printed coloured or manila cards, predominantly sulphite or sulphate, which have been manufactured for use in tabulating machines. Unbleached kraft cards are not acceptable.	$50 - $105
Prohibitive materials: None permitted	
Total outthrows may not exceed: 1%	
Manila Tabulating Cards	
Consists of printed manila coloured cards, predominantly sulphite or sulphate, which have been manufactured for use in tabulating machines. This grade may contain manila coloured tabulating cards with tinted margins.	
Prohibitive materials: None permitted	
Total outthrows may not exceed: 1%	

	Dealer's Price ($U.S.*/ton) Fibre Market News (Oct. 7, 1977)
Computer Printout	
Consists of white sulphite or sulphate papers in forms manufactured for use in data processing machines. This grade may contain coloured stripes and/or computer printing, and may contain not more than 5% of groundwood in the packing. All stock must be untreated and uncoated.	
Prohibitive materials: None permitted	
Total outthrows may not exceed: 2%	
Sorted Brown Kraft	
Consists of baled clean sorted brown kraft papers free from twisted or woven stock, sewn edges and heavy printing. Examples: brown envelopes, file folders etc.	
Prohibitive materials: None permitted	
Total outthrows may not exceed: 2%	

Containers and news grades will also be present in varying degrees in offices and warehouses;

No. 1 News	
Consists of baled newspapers containing less than 5% of other papers	$5 - $25
Prohibitive materials may not exceed: 1/2 of 1%	
Total outthrows may not exceed: 2%	
Corrugated Containers	
Consists of baled corrugated containers having liners of either jute or kraft.	$13 - $15
Prohibitive materials may not exceed: 1%	
Total outthrows may not exceed: 5%	

It is possible to collect mixed grades of waste paper rather than concentrate on any one grade. However, the much lower price for these grades almost always justifies the separation and collection of the higher grades. There are three grades of mixed paper:

	Dealer's Price ($U.S.*/ton) Fibre market News (Oct. 7, 1977)
No. 2 Mixed Paper	
Consists of a mixture of various qualities of paper not limited as to type of packing or fibre content.	Nominal
Prohibitive materials may not exceed: 2%	
Total outthrows may not exceed: 10%	
No. 1 Mixed Paper	
Consists of a baled mixture of various qualities of paper containing less than 25% of groundwood stock, coated or uncoated.	Nominal
Prohibitive materials may not exceed: 1%	
Total outthrows may not exceed: 5%	
Super Mixed Paper	
Consists of a baled clean sorted mixture of various qualities of paper containing less than 10% of groundwood stock, coated or uncoated.	Nominal
Prohibitive materials may not exceed: 1/2 of 1%	
Total outthrows may not exceed: 3%	

5.2 Waste Paper Dealer - Mill Role

The lack of experience with post-consumer sources of waste paper means that both waste paper dealers and paper mills will need to experiment and learn how to make the best use of the large quantities of high-grade waste paper available from office buildings.

Most of the waste paper used by mills is bought from dealers under annual agreements. These dealers collect the waste paper from a variety of sources, often perform some degree of separation, bale the paper and ship it to the mill. Mills usually prefer to use dealers because they can provide a larger volume on a more consistent basis, the characteristics of specific grades they supply are more constant, and they can supply the grade desired. A few mills in Canada, however, are known to be interested in pruchasing directly from organizations that have separation programs.

Paper brokers may be involved as well. They make arrangements between suppliers and mills, without ever actually handling the paper.

The prices paid by mills depend, of course, on the grade. In June, 1977 the price paid for coloured and white ledger was about $100 and $150/ton, respectively, FOB the dealer in southern Ontario.

There is no Canadian publication that regularly lists prices for grades of waste paper. Fibre Market News and Official Board Markets regularly publish prices for the major grades in a number of American centres:

Fibre Market News
Market News Publishing Corp.
156 Fifth Avenue
New York, N.Y. 10010

Tel: (212) 255-2277

Subscription Price: $50/year

Official Board Markets
("The Yellow Sheet")
Magazines for Industry Inc.
20 N. Wacker Drive
Chicago, Ill. 60606

Tel: (312) 782-4963

Subscription Price: $49/year

5.3 Mills Using High Grade Waste Paper

Proximity to a paper mill that can purchase the waste paper collected in an office separation program is often one of the most important factors affecting the economics of the program. For the de-inking grades, most waste paper now collected for use in paper mills is from pre-consumer sources such as conversion and fabrication operations, with the reaminder from specialty areas such as computer centres, offices with large quantities of obsolete files and records etc. The following is a list of coloured and white ledger waste paper consumers known at this time. This is a preliminary list since sufficiently detailed information was not available for all the mills in Canada and the scope of this project did not permit a nationwide survey. Six of the largest known consumers of coloured and white ledger were briefly surveyed. Relevant comments from these surveys, as well as information gathered previously, are included where appropriate.

From Table 6, it can be seen that the greatest users of the de-inking grades of paper obtainable from office waste are manufacturers of printing and writing paper, tissue and special papers, and boxboard, with smaller amounts used in the manufacture of linerboard and building materials.

5.3.1 Printed and writing papers:

Abitibi Provincial Paper Division,
John Street,
Thorold, Ontario,
L2V 3Z7

Abitibi is the only user of de-inking grades of paper in Canada. Although the amount of de-inked fibre in each grade of paper varies, the mill average is about 33%. It is significant that a relatively small amount of the waste paper they purchases is actually post-consumer waste. Although they are able to add small amounts of photocopying paper from their own office into their furnish, they had to reject some paper from some dealers because it contained too much of the dry photocopying toner.

Domtar Fine Papers Ltd.,
800 Second Street West,
Cornwall, Ontario,
K6H S5C.

Box 616,
Station J,
Toronto, Ontario
M4J 4Y4

Relatively small amounts of the ledger grade of waste paper are used at these two mills. Domtar has, however, expressed interest in adding de-inking capacity at its Cornwall mill.

5.3.2 Tissue papers:

Lennox Paper Ltd.,
8 College Road,
Lennoxville,
Québec, J0B 1Z0

A new de-inking tissue mill (which uses waste paper only) is still in the start-up phase. Lennox has found that as long as photocopying paper makes up less than 10% of the furnish, the product is acceptable.

Perkins Papers Ltd.,
75 Marie Victorin Blvd.,
Candiac, Québec,
J5R 1C2

This de-inking tissue mill also uses waste paper entirely. They have difficulty in handling any waste paper that contains more than 5% photocopying paper but have plans to try new cleaners shortly to see if the problem can be resolved. They have rejected paper from Québec government office buildings in the past due to contamination levels. Currently, they are studying plans to substantially increase their capacity.

E.B. Eddy Forest Products Ltd. (lower Mill),
P.O. Box 600,
Hull, Québec,
J8X 3Y7

Although this mill does not have any de-inking capacity, it has used waste paper in its furnish for some time with the amount used varying from each end product. The acceptability of photocopying paper depends entirely on the quality of the paper required.

Scott Paper Ltd.,
P.O. Box 500,
Crabtree, Québec,
J0K 1B0

Start-up is planned in 1978 for this new de-inking tissue mill which is designed to produce high quality tissue and sanitary paper using the most modern equipment available. Significant problems may arise in the use of waste paper containing photocopying paper.

Kimberley-Clark of Canada Ltd.,
P.O. Box 3130,
Station B,
St. John, N.B.,
E2L 4L3

Merritt Street,
St. Catharines,
Ontario,
L2T 1J4

Small amounts of coloured and white ledger are used in these two mills.

J. Ford and Company Ltd.,
Port Neuf, Québec,
G0A 2Y0

This mill, which also makes Kraft and building papers, uses both coloured and white ledger.

5.3.3 Kraft papers:

Consolidated Bathurst Ltd.,
P.O. Box 128,
Trois Rivières, Québec,
G9A 5H6

This mill has a small de-inking capacity and uses ledger grades in its kraft paper production.

5.3.4 Boxboard mills:

Belkin Packaging Ltd.,
8255 Wiggins St.,
Burnaby, B.C.,
V3N 2V7

This paperboard production facility, which has a 20 TPD de-inking mill, is a relatively large user of paper recoverable from office buildings and is in the process of initiating two projects to obtain paper from office buildings through its own dealership, Community Paper Recycling Ltd.

E.B. Eddy Forest Products Ltd., (Ottawa Mill),
Box 600,
Hull, Québec,
J8X 3Y7

Strathcona Paper Co.,
P.O. Box 130,
Napanee, Ontario,
K7R 3L6

Trent Valley Paperboard Mills,
P.O. Box 821,
Trenton, Ontario,
K8V 5R8

Continental Can Company of Canada Ltd.,
495 Commissioners Street,
Toronto, Ontario,
M4M 1A5

2 Des Signeurs St.,
Montréal, Québec,
H3J 1X3

Papeterie Reed Ltée.,
10-16 Blvd. des Capucins,
Québec, Québec,
G1J 3R4

Each mill reportedly uses small amounts of the ledger grades of waste paper. The largest mill, Continental Can in Toronto, report that most of the high grade paper they purchases is unprinted.

5.3.5 Other users of ledger grades. In addition to the mills listed above, other industry are reported to use some ledger grades of waste paper:

(a) LINERBOARD:

Kruger Pulp and Paper Ltd.,
5845 Turcot Place,
Montréal, Québec,
H4C 3J7

(b) BUILDING PRODUCTS:

Building Products of Canada Ltd.,
2 Point Douglas Avenue,
Winnipeg, Manitoba,
R3B 0C7

Highway 16A East,
Edmonton, Alberta,
T5S 3K8

(c) CELLULOSIC INSULATION

The only other industry that uses ledger grades of waste paper is manufacturers of the white spray-on cellulosic insulation. The ledger grades are sometimes used instead of the more commonly used newspaper when a white colour is desirable. Although there are only two known manufacturers of this material at present in Canada, there are indications that many more manufacturers may soon produce this material. It is also significant to note that as the price for waste newspaper continues to increase due to the increased demand for loose fill cellulosic insulation, some manufacturers may begin to use ledger grades of paper mixed either with newspaper or even with unsorted office waste paper. The three manufacturers are:

Monotherm Insulation Industries Ltd.,
1171 8th Avenue East,
Saskatoon, Sask.

National Cellulose (B.C.) Ltd.
13385 Comberway,
Newton, B.C.

Thermal-Kool Corp. (Alberta) Ltd.
8218 30th Street East,
Calgary, Alberta

5.4 U.S. and Offshore Markets

The potential for exporting ledger grades of waste paper has not yet been fully explored. There are, however, twenty de-inking mills located in bordering U.S. states which have a combined capacity of 2,930 TPD of primarily the de-inking grades of waste paper. These mills, which are listed in Table 7 represent a potential source of demand for ledger grades of paper collected in Canada. In addition to these de-inking mills there are 17 boxboard mills in bordering states potentially capable of using ledger grades of waste paper. It should, however, be remembered that the U.S. government has already initiated a program to recycle office waste paper from federal facilities and that this increased supply may swamp these markets. It is also significant to note that a lively offshore market has developed in the western provinces for the high grades of waste paper which are shipped to the Far East.

5.5 Canadian Waste Paper Dealers

This section lists all the waste paper dealers known to operate in Canada. It is based on the most recent listings in the Yellow Pages and conversations with many of the dealers. It should be noted that some volunteer waste paper collectors who may be active in certain areas may not be classified as dealers and are thus not included in this list. Relevant comments on each have been added in many cases. It should be kept in mind that even if a dealer does not handle office grades of waste paper now, he could begin to do so quite easily in the future.

5.5.1 Newfoundland:

Moffat Transport,
Topsail Road,
St. Johns. Tel: (709) 364-4251

Currently collects only large volumes of corrugated waste.

TABLE 7 DE-INKING MILLS LOCATED IN BOARDERING STATES

COMPANY	LOCATION	TPD DE-INKING CAPACITY
Statler Tissue Co	Augusta, Maine	275
Galante Paper	Mechanicville, N.Y.	100
Nitec Paper Co.	Niagara Falls, N.Y.	70
Newton Falls Paper	Newton Falls, N.Y.	125
Patrician Paper Co. Inc.	South Glen Falls, N.Y.	n/a
Miami Paper	West Carrollton, Ohio	55
Bergstrom	West Carrollton, Ohio	250
Brown Co.	Eau Clair, Wi.	200
Brown Co.	Ladysmith, Wi.	70
Fort Havard	Greenbay, Wi.	775
Riverside Paper	Appleton, Wi.	50
American Can	Ashland, Wi.	80
Wisconsin Tissue	Menasha, Wi.	100
Bergstrom	Neenah, Wi.	250
Georgia Pacific	Kalamazoo, Mich.	200
Georgia Pacific	Gary, Ind.	80
Boise Cascade	Vancouver, Wash.	90
Hoerner Waldorf	St. Paul, Minn.	75
Ward Paper	Merrill, Wis.	45
Crown Zellerbach	Carthage, N.Y.	40
	TOTAL:	2,930 TPD

5.5.2 Nova Scotia:

L. and D. Recycling Ltd.,
3236 Kempt Road,
Halifax.

Dan Lindsay

Tel: (902) 455-6249

Collects all grades of waste paper. Currently collects mixed paper from offices and tourist bureaus.

Scotia Recycling,
40 Borden Avenue,
Halifax.

Lloyd Redin

Tel: (902) 463-2855

Concentrates primarily on corrugated but also some news as well as ledger grades, CPO and tab cards. Scotia has people in Sydney, Windsor, St. John, Moncton and New Glasgow who collect, sort and bale the paper.

H.J. Francis Ltd.,
Point Edward Street,
Sydney.

Gerald Pye

Tel: (902) 539-6972

Affiliated with Scotia Recycling.

Hants Recycling,
Martock Street,
Windsor

Tel: (902) 798-2983

Affiliated with Scotia Recycling.

Joseph Fritz Ltd.,
P.O. Box 185,
Kentville,
B4H 3W7

Aida Fritz

Tel: (902) 678-4796

Collets newsprint, corrugated, pulp substitutes as well as some mixed office waste.

John Ross and Sons,
7 Cummane Street,
Truro.

Tel: (902) 893-9429

Currently collects some corrugated.

5.5.3 New Brunswick:

New Brunswick Data Co. Ltd.,
P.O. Box 2119,
St. John.

Doug Donovan

Tel: (506) 657-3344

Affiliated with Scotia Recycling.

Natural Recovery Systems,
295 Baig Blvd.,
Moncton.

Al Francis

Tel: (506) 854-4038

A non-profit organization, hiring "unemployables", that collects corrugated and computer room waste from commercial and retail outlets.

5.5.4 Québec:

Québec City:

Québec Waste Paper Inc.,
1177 22ième Rue.

Tel: (418) 524-2771

Dion Paper Reg'd,
1887 Place Cote Duberger.

Tel: (418) 681-7060

Montréal:

Albert Paper Company Inc.,
300 Mountain Street,
H3C 2B1

Tel: (519) 935-7443

Apex Paper and Waste Company,
1730 Richardson Street.

Tel: (514) 923-2716

Arthur Waste Paper Inc.,
4955 Brock Street.

Tel: (514) 767-9931

Canada Waste Paper Company,
888 Montée de Liesse Road

Jack Plotnick
Tel: (514) 342-3095

Central Waste Paper Inc.,
4800 7th Avenue
H1Y 2M7

Louis Toulch

Tel: (514) 342-3095

Consolidated Fibres Limited,
141 Ann Street,
H3C 2J9

Ben Plotnick

Tel: (514) 875-6130

In the United States, Consolidated Fibres offers "full service" contracts for the collection of desk-top separated office waste paper.

Data Surplus Cards Ltd.,
2095 Scott Street.

Tel: (514) 844-6862

Kander Paper Fibres Ltd.,
300 Mountain Street,
H3C 2B1

Joe Tretault

Tel: (514) 935-2482

Affiliated with Mill Paper Fibres.

Liberty Wool Stock Company Ltd., 50 Queen Street, H3C 2N5	Seymour Fran Tel: (514) 866-4388
Montréal Refuse Paper Ltd., 7400 Notre Dame St. W.	Tel: (514) 488-1368
Nadeau Papier Rebut Inc., 9889 St. Michel Street.	Tel: (514) 326-3698
Orford Recycling Inc., 1914 Augustin-Cantin.	Tel: (514) 933-6721
Oxford Paper Company Ltd., 5250 Ferrier Street, H4P 1L4	M. Rosenthal Tel: (514) 737-3535
Papier Recycle Soucy Ltd., 9 Montcalm S. Cand.	Tel: (514) 659-9144
Papiers Recycles du Québec, 3660 Rue de la Picardie (Varennes).	Tel: (514) 652-3361
Reed Paper Ltd., Recycling Division, 11445 Rivet St. Mont. - East, H1B 1A9	Don Pickford Tel: (514) 645-8807
Ross H. Paper, 6505 Ct. St. Luc.	Tel: (514) 487-5670
S. Storozuk and Son Ltd., 515 Champlain Crescent, Fabreville Ste. Rose	Tel: (514) 625-6961
Thibert Paper Company Ltd., 4820 4th Avenue.	A. Thibert Tel: (514) 526-0401
Walker Paper Products Ltd., 101 Murray Street, H3C 2C5	Joseph Travers Tel: (514) 932-7104
Waste Sales Limited, 1116 Richmond Street, H3K 2H1	J.M. Jacobson Tel: (514) 937-9186

5.5.5 Ontario:

Ottawa:

Canada Bale Mart/Dundas
Recycling Ltd.,
3270 Hawthorne Road. Tel: (613) 731-6341

Currently collects waste paper from 13 federal buildings in Ottawa which do not have desk-top separation systems. Collects high grade paper and also some corrugated and mixed.

Florence Paper Company Ltd.,
2475 Sheffield Road,
K1B 3V6 Tel: (613) 745-9437

Collects all grades.

Pembroke:

Renfrew County Recycling Ltd., John Escott
P.O. Box 65,
K8A 6X1 Tel: (613) 732-4910

Handled only corrugated waste originally but now collects news, white manifold and bleached kraft.

Smith Falls:

Falls Iron and Metal, David Heaslip
Uphill Street. Tel: (613) 283-2240

Collects old news, corrugated and mixed paper but no ledger grades

Belleville:

Container Service Company,
R.R. No. 3. Tel: (613) 966-5516

Toronto:

M. Axler and Company Ltd,
43 Florence Street,
M6K 1P4 Tel: (416) 531-1125

Collects corrugated and news

Brunswick Waste Removal Ltd.,
276 Brunswick Avenue,
M5S 2M7

John Peters

Tel: (416) 925-4614

Collects corrugated.

Buscombe and Dodd's Ltd.,
255 Wellington Street West,
M5V 1E1

S.P. Craig

Tel: (416) 363-1444

Collects all grades

Consolidated Fibres Ltd.,
95 Commissioners Street,
M5A 1A6

Paul Clarfield

Tel: (416) 461-0211

In the United States, Consolidated Fibres offers "full service" contracts for the collection of desk-top sorted office waste paper.

The Levis' Paper Fibres Ltd.,
199 Eastern Avenue,
M5A 1H7

Don Smith

Tel: (416) 363-7241

Collects all grades.

Elliot Krever and Associates Ltd.,
150 Consumers Road,
Suite 105,
M2J 1P9

Elliot Krever

Tel: (416) 491-4147

Mill Paper Fibres Ltd.,
20 Trinity Street,
M5A 3C5

Peter Mateer

Tel: (416) 364-6255

Collects all grades. Mill is already involved in collecting mixed paper from some large office buildings in Toronto.

Reed Paper Ltd.,
Recycling Division,
451 Front Street East,
M5A 1G9

Tel: (416) 862-5131

Collects all grades.

Textile and Paper Waste Sales Ltd.,
116 George Street,
M5A 2M5.

Tel: (416) 362-1616

Collects mainly corrugated, but also some white ledger, coloured ledger and tab cards.

Mississauga:

Command Records Centre,
3161 Wolfedale Road,
L5C 1V8
Ron Well
Tel: (416) 270-3541

Data Surplus Cards Ltd.,
1860 Shawson Drive,
L4W 1R7
Ken Telford
Tel: (416) 676-9900

Collects all grades.

Dominion Recycling Company Ltd.,
1860 Shawson Drive,
L4W 1R7
Tel: (416) 676-1432

Collects all grades.

Hamilton:

Mill Paper Fibres,
162 Ferguson St. North.
Tel: (416) 522-6116

Collects from the Burlington-Hamilton area and handles all grades.

Niagara Falls:

F. Fiore and Sons Ltd.,
5731 Stanley Street.
Tel: (416) 358-5341

Cambridge Area:

Cambridge Recycling,
54 Cedar Street.
Cambridge.
Tel: (519) 622-1883

Do It Recycling,
R.R. No. 1,
Hespeler
Tel: (519) 658-2563

Collects primarily corrugated news and sometimes ledger grades.

Brantford:

Genor Ltd.,
302 Murray Street.
Norman Haac
Tel: (519) 756-5264

Collects all grades, primarily from commercial and industrial outlets.

Sonoco Ltd.,
33 Park Avenue East.
Tel: (519) 752-6591

Collects all grades.

London:

Gold Recycling Industries Inc.,
555 Bathurst Street. Tel: (519) 672-9000

Windsor:

Fibre Control Inc.,
504 Victoria Street. Tel: (519) 256-2801

5.5.6 Manitoba:

Monarch Reclaim Ltd., Ray Richter
715 Henry Avenue. Tel: (204) 786-2266

Collects high grade office waste paper from three buildings in Winnipeg and is very interested in increasing this number.

Winnipeg Paper Company, Scott Broadfoot
1350 Saskatchewan Avenue. Tel: (204) 775-2083

A very large dealership interested in purchasing additional amounts of high grade waste paper from office buildings.

Gateway Packer (1968) Ltd.,
105 Maple Street N. Tel: (204) 943-7762

Canada Waste Paper,
105 Maple Street N. Tel: (204) 943-6018

Winnipeg Rendering Archie Blank
105 Maple Street N. Tel: (204) 943-6018

(The above three are jointly owned.) Expressed limited interest in office waste separation programs due to the high contamination levels and the high cost of labour estimated.

5.5.7 Saskatchewan:

Roof Mart Western Ltd., Lyl Gingrey
155 First Avenue E.,
Regina Tel: (306) 543-7244

Collects newspaper and various high grades of waste paper for I.G. Machine in Calgary.

Castle Insulators,
1346 Rose Street,
Regina,
S4R 1Z8

Lou Strital

Tel (306) 569-2665

Primarily insulation installer, but also collects some newspaper for a cellulosic insulation manufacturer.

Capital Cosmo Industries for the Handicapped,
10 Edgar Street,
Regina.

Mike Lawrence

Tel: (306) 569-0535

Collects ledger, news, corrugated and sells as mixed paper to a cellulosic insulation manufacturer. Capital Cosmo does not pay generators for waste paper but pick up free of charge.

5.5.8 Alberta:

Paper Recycle Alberta,
Box 8723, Station L,
Edmonton.

Jim Richardson

Tel: (403) 464-3131

Has used a specially prepared audio visual presentation to educate employees in two large organizations on how to recognize and separate high grade waste paper for recycling. Also collects mixed office waste paper from some buildings and operates a series of newspaper collection depots.

I.G. Machine and Fibre,
P.O. Box 1325,
Calgary,
T28 2L2

Rich Slomka

Tel: (403) 265-2128

Handles high grades and is very interested in finding ways of tapping the large supply of high grade office waste paper. Currently looking at the feasibility of setting up programs at the university and at city hall.

5.5.9 British Columbia:

Kelowna Recycling Society,
415 Hanes Avenue,
Kelowna.

Jack Conrad

Tel: (604) 763-0778

Currently collects some high grade waste paper. A non-profit organization connected with the Recycling Council of British Columbia.

Amstrong Paper Products Ltd.,
976 Adair,
Coquitlan.

Pete Zowarich

Tel: (604) 524-9111

Deals extensively in the high grades of waste paper and currently collects waste paper from a number of office buildings. Also acts as a broker in arranging deals from Regina, Calgary and Edmonton as well as Vancouver.

Superior Recycling Ltd.,
4700 Vanguard Road,
Vancouver,
U6X 2P8

Dick Brent

Tel: (604) 273-3020

Collects some high grade paper but deals primarily in newspaper. Affiliated with Cellufibre Industries Ltd., manufacturers of cellulosic insulation.

Excelsior Paper Stock Ltd.,
95 East First Avenue,
Vancouver,
V5T 1A2

Robert Healey

Tel: (604) 876-3208

Deals in all grades of waste paper. Currently experimenting with a mechanical fractionator which reportedly will be able to separate 3 or 4 grades of paper from mixed office waste.

Community Paper Recycling Ltd.,
8255 Wiggins Street,
Vancouver,
V3N 2V7

George Russel

Tel: (604) 521-0746

Recently initiated two office waste paper separation programs using a 2 basket separation system. Affiliated with Belkin Packaging.

Modern Service Centre for
Handicapped,
1011 Cordova Road,
Vancouver.

Gerald Wise

Tel: (604) 251-4533

A non-profit organization employing handicapped people to help collect and sort waste paper. Collects mainly newspaper, and has also set up separation collection programs in 4 small offices.

International Paper Industries,
814-602 West Hastings Street,
Vancouver,
V6B 1P2

Emmie Wong

Tel: (604) 685-5614

Sells the high grade waste paper it collects all over south east Asia where reportedly there is a large demand for this material.

Recycling Council of
British Columbia,
660 Borden Street,
Suite 503,
Victoria.

Don Sher

Tel: (604) 388-7416

Once known as Project Recycle, a volunteer recycling group, the Recycling Council has now broadened its activities and handles fine, news and corrugated grades.

Allan Paper Stock Co. Ltd.,
475 Tyee Road,
Victoria,
V9A 3S3

William Allan

Tel: (604) 384-1556

Handles all grades of waste paper. Currently collects some mixed office waste paper from the provincial government as well as higher grade paper from computer rooms and confidential material.

A & A Export & Import Corp. Ltd.,
1158 Powell Street,
Vancouver.

Tel: (604) 255-6268

Acts as a broker for oversea markets and handles all paper grades. Willing to offer high prices for clean ledger delivered to the Vancouver dock.

Savage Salvage,
3641 Kingsway.
Vancouver.

Tel: (604) 437-1411

6 FACTORS AFFECTING SEPARATION PROGRAMS

6.1 Xerographic Copy Paper

The use and eventual discard of photocopy paper represents a large and rapidly expanding source of waste paper in offices. From Table 2 in Chapter 2 it can be seen that as much as 12.5% of the waste generated by an office is photocopy paper.

It has recently become apparant that the presence of xerographic or 'bond' copy papers (such as those from the dry bond copy machines manufactured by Xerox, I.B.M., etc) in waste paper causes varying degrees of difficulty for users of waste paper. The problem, it is claimed, is due to the toner-resin used in the bond paper copies which is thermally catalyzed onto the paper as part of the copying process.

Once 'burnt' onto the pages, existing mill de-inking processes have difficulty in breaking down and removing this toner. The quality of the final product required determines how much of this paper can be used. While some de-inking mills do not want any, others find 10% or even more acceptable. Boxboard mills have no difficulty with this type of paper as they are less concerned with colour spotting of their final product.

The problem of xerographic reproduction is compounded by the movement of copy technology into computer printout (CPO) functions. Honeywell, I.B.M. and Xerox are all well into the marketing of high speed CPO printing systems. Honeywell's Page-Printing System alone has a 16,000 line per minute (or 240 pages) capacity using the xerographic reproduction system. Some estimates are that such high speed systems may account for 50 to 75 percent of all CPO in five years. Obviously if current trends continue they will be difficult to alter. It is therefore important that ongoing monitoring be undertaken to keep pace with technological events relevent to the problem of xerographic paper and recycling.

Discussions have been instigated in the United States between some of the major de-inking paper mills and the large manufacturers in an effort to resolve this problem. Insufficient information is available at this time regarding the results of these efforts. Some of the approaches which have been suggested include the addition of special chemicals to the de-inking process, a change or addition to traditional de-inking equipment or a change in the type of toner used. Hopefully this problem will be resolved in the near future.

6.2 Groundwood Computer Printout

A recent development that could have a significant impact on the separation of high grade waste paper from office buildings is the use of low-grade groundwood paper instead of high grade white ledger for computer printout.

From Table 1 in Chapter 2, CPO represents as much as 13.5% of the total waste in an office. The presence of groundwood paper greatly decreases the value of paper recovered for recycling.

Although an investigation of the future degree of substitution of groundwood for high grade paper in CPO was beyond the scope of this study, it is a potential problem which should be monitored.

7 ROLE OF PRIVATE COMPANIES IN IMPLEMENTING OFFICE SEPARATION PROGRAMS

The Guide and The Supplement are intended to supply the program co-ordinator with enough information to start and run an office paper separation program. It should be noted, however, that there may be advantages to having part of all of the co-ordinator's job contracted out to a private company.

In the United States, a number of companies are offering what is termed a 'full service-contract' for the separation system start-up and the purchase of the high grade waste paper in an office building. One company, Shade Information Systems, claims to have over 500 full-service contracts throughout the U.S. Other firms offering a similar service include, Consolidated Fibres, Weyerhaueser, Hoerner-Waldorf, Fibres International and Boise Cascade. Although no Canadian companies are known to offer equipment as well as educational materials for office separation programs, many have expressed interest in this area and a few are actively pursuing the idea.

The potential advantages of a full-service contract are summarized below:

(a) Efficiency and effectiveness - These companies are able to offer experienced and proven knowledge of system design and implementation, based on work with previous programs. The savings in time and money that may result from tailoring a system for a particular building are more easily achieved by an experienced company.

(b) Broader implementation - The use of private companies can greatly reduce the role of the program co-ordinators. As indicated in The Guide, the program co-ordinator's job is a difficult one that requires a person with the time, interest and ability to carry out such a program. Such people may not be available in every office building.

(c) No capital outlay - Since the cost of setting-up the program, including the purchase of the necessary equipment, can be amortized over the life of the contract, these costs are usually deducted from the price paid for the waste paper. This means that no capital outlay is necessary to implement the program. This is a particularly important advantage if funds are not made available to departments to set-up such programs.

(d) Spin-offs - If the establishment of firms capable of providing full-service contracts were encouraged by the government, there would be an infrastructure capable of providing similar services to private industry. The total amount of waste paper directed from landfill to recovery would thus be greatly increased.

Instead of a full-service contract, private companies may be prepared to offer their assistance in setting up a recovery system and helping with the educational program. Such a system would have the first two advantages of the full-service contract and could be contracted out independent of the contract for the recovered waste paper.

8 MECHANICAL SEPARATION - FRACTIONATION

The separation of high grade office waste paper at source may not be the only way to reclaim this material in the future. "Fractionation" equipment capable of mechanically separating different grades of waste paper is currently in various stages of development. Two basic types of systems exist: wet and dry. The principal developers of the technology at this time are Black Clawson, Esher-Wyss, Voith Morden and Reed Paper. The latter company has developed equipment capable of sorting mixed waste paper into four distinct grades of waste paper. Although no information on the commercial viability of this technology has been published, a waste paper dealer in Vancouver claimed to be currently using a mechanical fractionator. However, mechanical fractionation of waste paper must still be considered an emerging technology.

There is no known detailed evaluation of the large scale utilization of mechanical fractionation. Before deciding that fractionation, if and when it becomes commercially available, makes the separation of paper at the source obsolete, five main issues require comment:

- how energy intensive are these systems compared to at-source separation, which is primarily a manual operation?
- what are the comparative contamination levels between paper mechanically separated using fractionation and paper sorted at source?

- what are the respective recovery efficiencies of fractionation and at-source separation?
- what is the cost of recovering waste paper using capital intensive fractionation versus labour-intensive at-source separation?
- what importance can be attributed to asking individuals to become personally responsible for the proper management of their own wastes?

It can thus be concluded that although mechanical fractionation may (depending on the five points above) have some impact on office waste paper separation programs in the future, the technology does not appear to be at a stage where it can be implemented on a large scale for a number of years. In the meantime, office separation programs will remain the only method for reclaiming high grade waste paper from office buildings.

REFERENCES AND BIBLIOGRAPHY

1. Office of Solid Waste, Fourth Report to Congress: Resource Recovery and Waste Reduction. U.S. Environmental Protection Agency, Washington, D.C., 1977.

2. SCS Engineers, Optimization of Office Paper Recovery Systems (Final Report and Addendum). Office of Solid Waste, U.S. Environmental Protection Agency, Washington, D.C., 1976.

3. Myslicki, John, Office Paper Recovery Through At-Source Separation. Waste Management Branch, Environment Canada, Ottawa, 1977.

4. SCS Engineers, Quality and Composition of Solid Waste Generated by U.S. Environmental Protection Agency Offices. Office of Solid Waste, U.S. Environmental Protection Agency, Washington, D.C., 1976.

5. Woods, Gordon & Co., Recycling of Mixed Office Waste from the National Capital Area. Waste Management Branch, Environment Canada, Ottawa, 1975.

6. Reed Ltd., Recycling of Wastepaper from Federal and Provincial Buildings in Toronto. Waste Management Branch, Environment Canada, Ottawa, 1977.

7. Myslicki, John and Hidiroglou, Dr. M.A., Methodology - Waste Paper Sampling Study. Waste Management Branch, Environment Canada, 1976.

8. Middleton Associates, Paper Recycling: A Socio-Economic Perspective. Pollution Probe Foundation, Toronto, 1975.

The following is a list of additional studies and reports which the interested reader should consult:

9. American Paper Institute, Office Waste Paper Recycling: A Proven Way to Increase Profits by Reducing Disposal Costs, Increasing Value of Office Waste Paper. American Paper Institute, New York, 1975.

10. Bergstrom, Wally, "Recycling Xerographic Paper". Reprography Conference, October 26-29, 1975, TAPPI, Atlanta, Georgia, 1975.

11. Bree, Sherry, et al., The Paper Paper: A Guide to Office Ecology. Recycling Information Office, Department of Environmental Quality, Portland, Oregon, 1974 (updated 1976).

12. Environmental Protection Agency, "Source Separation for Materials Recovery Guidelines". Federal Register, Vol. 41, No. 80, Washington, D.C., April 23, 1976.

13. Love, Peter, Net Energy Savings from Solid Waste Management Options. Waste Management Branch, Environment Canada, Ottawa, 1976.

14. Stearns, Robert, et al., Office Paper Recovery: An Implementation Manual. Office of Solid Waste, U.S. Environmental Protection Agency, Washington, D.C., 1977.