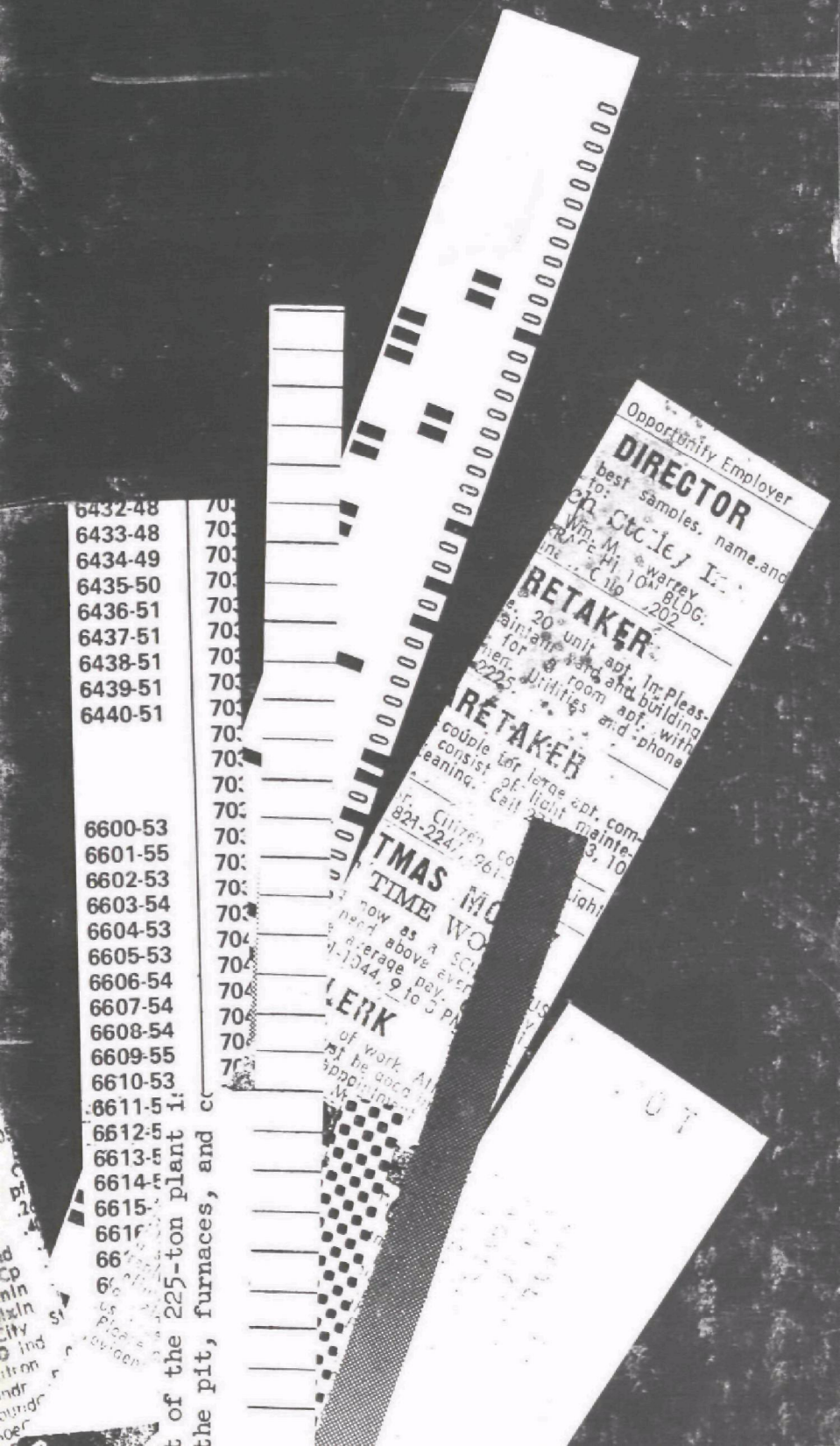
separating

# paper

at the waste source
for recycling



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Recyclable materials can be recovered from the solid waste stream through a variety of techniques. Some involve new and complex technology, but others depend mainly on the personal separating out of recyclable materials by householders and other waste generators. The latter methods are by far the predominate ones for recovery of paper.

This setting aside of recyclable waste materials at their point of generation by the generator has been termed "source separation." Separation is followed by the transporting of the materials to a secondary materials dealer or directly to a manufacturer by the generator himself, by city collection vehicles, by private haulers and scrap dealers, or by voluntary recycling organizations.

Newspapers from homes, corrugated containers from commercial and industrial establishments, and mixed and high-grade papers from offices are the grades of paper which are readily recoverable through source separation; they are also the grades of used paper which are most desirable for recycling. These categories of paper constitute approximately 50 percent of the paper which is discarded from residential, commercial, and industrial establishments.

The various techniques for source separation of paper, as well as the related environmental,

energy, and conservation issues, are summarized in this report.

## SOURCE SEPARATION OF NEWSPRINT

### Background

Historically, newsprint has flowed back into the manufacturing cycle primarily through two channels. One is collection of newspaper from homes through paper drives conducted by civic and religious organizations and through the efforts of private waste haulers. The second is diversion of "over-issue news"—newspapers printed but never sold—into recycling channels. Also, in recent years many householders have brought their newspapers to neighborhood recycling centers.

While these channels are still active and important, in the last 2 to 3 years a new method of source separation has appeared that holds great promise for providing additional quantities of old newspapers for recycling, and doing so on a continuous basis. The technique, separate newspaper collection, is growing rapidly in significance.

### Separate Newspaper Collection

Separate newspaper collection is the curbside collection of used newspapers on a regular basis by municipal or private waste collectors. Newspapers are kept separate from other waste in the household, bundled and tied, placed at the curb, and collected regularly just like other solid wastes.

Two methods are presently used to collect the newspaper: (1) trucks are dispatched which pick up only newspaper. These are usually regular compaction trucks, but open-bodied trucks can also be used; (2) racks to hold the newspaper are installed beneath the bodies of standard collection trucks. The newspaper and other refuse is collected simultaneously. This is the so-called "piggyback" method of separate collection. In 1970 only three separate collection programs were in opera-

tion in the entire United States; by April 1974, the U.S. Environmental Protection Agency had identified 125 communities with separate newspaper collection programs.

## Requirements for Separate Newspaper Collection

**Planning.** Implementation of a successful separate newspaper collection system requires relatively little expenditure of capital, but proper planning, coordination, and administration are essential. The plans should include the following key elements: (1) markets must be available within a reasonable distance; they should be investigated in advance and assured by contract; (2) whether the program is mandatory or voluntary, citizen cooperation must be thoroughly solicited by making sure that citizens know of the program's existence and purpose and the exact nature of their requested participation; this requires an active publicity campaign usually involving both media (TV, radio, newspapers) and citizen groups (scouts, ecology groups, religious and service organizations); (3) the changes in the existing collection procedures which will be required must be properly planned and carried out, including provisions for handling the newspaper after it is collected; (4) a special ordinance may have to be drafted to prevent any party other than the municipal collection crew (or contracted private hauler) from picking up the old newspapers.

**Capital and Labor.** Theoretically both capital outlays and increased labor are necessitated by the division of the waste stream into two components. For a piggyback system, metal racks must be purchased at a cost of about $80 to $250 per vehicle, and more time—on the order of 14 seconds per stop—will be required in collection. (In some places the rack fills up before the route is completed. Limited case study data show that approximately 10 minutes of unloading and off-route time is required each time the rack becomes

full. The newspaper is stored temporarily in bulk containers that have been placed along or near the collection route.)

Equipment requirements for a separate truck system will vary widely depending on frequency of both regular and newspaper collection, number of households participating, type of truck used, and other factors. It is therefore almost impossible to generalize about truck requirements. In case studies the ratio of regular to newspaper collection trucks has ranged from 6:1 for once-per-week newspaper collection to 29:1 for once-per-month collection.[1] However, both higner and lower ratios have been observed elsewhere.

In the cities now using separate collection, few additional trucks have been purchased and very few new employees hired, though the length of time spent on the route has generally increased. In other words, most cities practicing separate collection have found underutilized equipment and labor which could be utilized in the collection of newspapers, thus in essence increasing the productivity of existing labor and equipment. This might not be possible in every instance, of course; it depends on the amount of "slack" in a collection system and the specific labor situation.

**Costs and Savings**

The equipment and labor costs of separate collection must be balanced against the proceeds from the sale of the newspaper and the savings in disposal costs.

Generalizations about costs or savings are difficult because of the variance from city to city in the market price for old newspapers, disposal cost, type of collection used before and after initiation of separate collection, and other factors. Each community must estimate the economics under the conditions which exist in that community.

By the end of 1973 mills in many parts of the country were paying $50-$60 per ton for baled

newspaper.[2] Discussions with municipal officials indicate that most municipalities were receiving $20-$40 per ton from wastepaper dealers for loose newspaper. At these prices many communities will find separate collection profitable or at least a break-even proposition. Case studies have been done of the effect of separate collection (using separate trucks) and sale of newspaper on the collection costs in 10 communities.[1] Assuming a $25-per-ton market price, the effect would range from a decrease of 13 percent to an increase of 14 percent in collection costs; on the average, there would be a decrease of just over 1 percent. In March 1974, when the average price received by the 10 communities was $32 per ton, there was an average decrease in collection system costs of 5 percent. Three piggyback systems studied were found to result in similar overall cost reductions. (These are net savings after accounting for all additional costs actually experienced and all revenues and disposal savings.) Though continued market prices at these levels cannot be guaranteed, many communities have been able to secure 1- to 5-year contracts with guaranteed floor prices which they found acceptable.

The participation rate—the percentage of households setting out their newspapers separated as requested—has an important bearing on system economics. It is of prime importance that as many householders cooperate as possible. Participation rates rise over time with a good publicity campaign. There are indications that participation rates in an ongoing program will rise above 50 percent on a purely voluntary participation basis. This is probably in part due to the desire of many citizens to contribute to environmental improvement, combined with the fact that demands placed on the resident are minimal. An EPA study shows that only about 2.3 minutes per week of the householder's time is needed for extra handling of the newspapers.[1]

## Opportunity for Increased Recovery

**Supply.** In 1973, according to preliminary estimates, there were approximately 2.5 million tons of newspapers recycled in the United States[3] and an additional 100 to 150 thousand tons of old newspapers exported.[4] In relation to domestic consumption of newsprint this constitutes about a 25 percent recycling rate. Newspapers account for about 20 percent, by weight, of all paper discards in the nation.[5]

About 4.6 million tons of newspaper were discarded by households in the nation's urban areas in 1973 and not recovered; this amount represents the primary potential for additional newspaper recovery.[5] If at least half of this quantity had been recovered, then newspaper recovery in 1973 would have been doubled.

**Demand.** Obviously, if these newspapers are to be recycled, there must be a demand for them in the paper industry. In 1973, for the first time in years, combined domestic and foreign demand for old newspapers appeared to exceed the supply of recovered paper.

The latest capacity survey of the American Paper Institute indicates plans for a 7 percent increase in domestic old newspaper consumption from the beginning of 1974 through 1975—a steady but not dramatic growth.[3] Foreign demand, which surged in 1973, is expected to continue to increase. There is also strong interest by several companies in adding to the present U.S. capacity for manufacture of newsprint solely from old newspapers. The question of supply availability seems to be the major deterrent to these companies at present.

How these factors will ultimately balance out is difficult to predict. Based only on the demand increases presently projected by the American Paper Institute, it would seem that the prices received by municipalities for old newspaper will probably retreat somewhat from the record-

high 1973 levels. However, there are no indications of a return to the demand and price levels of 2 years ago, which were generally considered to be depressed. Furthermore, buyers are increasingly willing to guarantee floor prices to ensure supply.

While nationally the signs are positive, the individual community must consider markets on a local basis, and markets may not be available if there are no consuming mills in places to which the freight costs would be within acceptable limits Thus, an exploration of local markets is still the first requirement for communities considering separate newspaper collection. Some communities have found that consuming mills in their area are interested in other paper wastes from households besides old newspaper and have thus collected and sold mixed household paper as well as newspaper.

## SOURCE SEPARATION OF CORRUGATED PAPER

### Background

In contrast to newspapers, which are discarded primarily from residences, used corrugated containers are discarded primarily from commercial and industrial sources. Recovery from these sources has been practiced for many years and has been carried out primarily by wastepaper dealers rather than through volunteer channels. Some supermarkets and other commercial and industrial generators have separated and baled their corrugated containers, but waste haulers have also obtained large quantities in the past through hand separation of corrugated paper from other waste at disposal sites or processing stations.

Rapidly increasing labor costs have made hand-sorting by haulers less feasible, but separation by the generator has increased in importance. Now most of the country's major supermarket chains separate corrugated paper from other waste

for recycling, as do many auto assembly plants and other commercial and industrial establishments. The continuance and growth of this practice is vital if the future needs for old corrugated paper are to be met.

**Methods of Separation and Collection**

There are two major methods of source separation of corrugated paper. The first is baling by the generator. There are a number of techniques for baling corrugated paper; they differ in the size of bales produced, method of storage, and method of collection. Large bales are suitable for direct consumption by a paper mill; small bales, generally under 500 to 700 pounds, have to be rebaled by a hauler or wastepaper dealer prior to mill consumption.

In the second method of source separation loose corrugated paper is placed in stationary compactors—large metal containers attached to a stationary hydraulic ram. The hauler or wastepaper dealer must at a minimum empty the container and bale the corrugated paper. If the generator has mixed other waste with the corrugated paper, then hand-sorting must also be done. In the latter case the generator has in fact done little or no source separation.

The method which is most attractive to a particular generator depends on the quantity of paper generated, the space available to the generator for handling the paper, and other factors. In a recent study of supermarket waste management practices sponsored by the U.S. Department of Agriculture, baling was found to be the most attractive method among supermarkets for handling corrugated paper.[6] Many large warehouses and large industrial generators have also found baling to be the most attractive approach. However, some other generators, such as large department stores, have tended to lean toward use of

stationary compactors, leaving the baling and perhaps the separation to the hauler.

Baling results in a higher price for the paper but generally requires more personnel time and a larger investment, while use of separate containers requires little change in normal waste discard procedures but results in less revenue for the paper.

**Costs and Savings**

Though systems involving baling vary, many generators received enough revenue from baled corrugated paper in 1973 to pay the full capital cost of a baler within a year. The demand for old corrugated paper has been so great over the past year that prices at the mill rose to over $60 per ton in most parts of the country.[2] Such prices turn a generator's waste into a valuable commodity. As one store manager was reported to have said, "Sometimes I think there is more profit potential in the box than in its contents." A generator should not assume that such prices will always hold, however.

In addition, in the past year many generators were offered balers free of financing and dollar outlay, with payment for the baler taken in the form of the corrugated paper generated. Guaranteed minimum floor prices and 1- to 5-year purchase contracts were frequently offered as well. Under such conditions baling of corrugated paper can be a waste management technique of considerable appeal to the commercial generator.

Some generators tend to think of separation of corrugated paper for recycling more as a waste management alternative to on-site incineration or regular waste hauling than as a profit-or-loss issue. The study of supermarket waste management found that baling was the lowest cost method of waste management for corrugated paper, even though prices for the paper at that time (1972)

were at only about half the levels prevailing at the end of 1973.

## Opportunities for Increasing Recovery

**Supply.** Preliminary estimates for 1973 show recovery of old corrugated paper totaled roughly 5.2 million tons.[3] Approximately 35 percent of this came from industrial converting operations where corrugated boxes are fabricated; the remainder consisted of consumer discards.[7, p. 55-56] The latter amount represents about 23 percent of the corrugated paper that is used. Corrugated containers constitute about 26 percent, by weight, of all paper discards.[5]

Waste corrugated paper not recovered from commercial and industrial establishments in the nation's urban areas represents the primary potential for additional recovery. Assuming that 80 percent of commercial and industrial activity is concentrated in Standard Metropolitan Statistical Areas, unrecovered corrugated paper in these areas would have amounted to approximately 7.5 million tons in 1973.[5] Recovery of half of this material, or 3.75 million tons, would double the amount of used corrugated paper currently recovered.

**Demand.** Demand for old corrugated paper rose significantly in 1973 as production of corrugating medium (the fluting material in corrugated boxes) from old corrugated increased by 16.6 percent over the 1972 level; this was almost double the percentage increase in total corrugating medium production.[8] The most recent capacity survey of the American Paper Institute shows that the largest capacity gain among all paper and board industry segments will occur in recycled paperboard and primarily in grades made from old corrugated containers. Consumption of old corrugated paper in the 1972 to 1975 period is projected to grow by 34 percent.[3] Thus, there

should be strong demand for this material over at least the next 2 years. Relatively high prices should continue, although, as new supply sources are developed, the record-high prices which existed in 1973 may moderate.

## SOURCE SEPARATION OF OFFICE WASTEPAPER

### Background

"Office wastepaper" here includes not only printing and writing papers but also the discards of out-of-date forms and reports and the growing quantities of computer tab cards and printout paper. Presently there is relatively little actual source separation of this waste with the exception of computer tab cards, for which the reported prices are over $200 per ton. Most of the separation occurs at processing plants of wastepaper dealers or waste haulers. Depending on the composition of the waste and degree of separation practiced, it is sold either as "mixed," i.e., low grade, or as "high grades" of wastepaper. The extent to which such hand separation by the dealer is feasible depends primarily on the market price of these wastepaper grades.

### Methods of Source Separation

Source separation of office paper consists primarily of keeping certain discarded papers separate from other trash such as plastic beverage cups, soft drink cans, and the like. (In addition, tab cards would generally be kept separate from other paper waste in the computer center.) The basic technique for doing this is to provide separate containers for discards of paper and other trash. There has been little experience with this technique so far; there are only a handful of offices in the country where such separation is known to be practiced.

However, there appears to be growing interest in the technique, and at least one company who markets business forms has developed a program for separating and collecting office papers.[9] Their technique (and a similar one reported to be successful [10]) involves small desk-top containers for white ledger and bond discarded during the day; these are emptied into larger containers at the end of the day. Such separation, if it is practical, would probably allow office waste recovery under less favorable market conditions than would costly hand sorting at a processing plant.

Markets for high grades such as tab cards and clean ledger or bond were very strong in 1973 and supplies of such waste were short. The demand for "high grades and pulp substitutes," as evidenced in industry plans reported to the American Paper Institute, shows only about a 5-percent increase in the 2-year period from the beginning of 1974 through 1975.[3] However, many industry observers believe that more such paper could and would be used if it were obtainable.

## BENEFITS OF PAPER RECYCLING

Paper recycling results in three major benefits which argue for its continuance and expansion—environmental benefits, reduced solid waste volumes, and conservation of resources.

Environmental benefits accrue from the generally lower levels of emissions into the environment that stem from the manufacturing of products from recycled paper rather than virgin woodpulp. A recent study sponsored by EPA examined the total systems, from forest or waste collection to final product, for four major paper industry products. Preliminary data on uncontrolled emissions shows that there are generally lower air and solids emissions and, in some cases, lower water

emissions with use of secondary as opposed to virgin fiber.[11]

The volume of solid waste which must be disposed of by municipalities is reduced when paper is recycled. Paper constitutes 31 percent of residential and commercial waste by weight and well over half by volume.[5] Therefore, recovery of even small percentages of paper can to some degree extend the life of landfills, reduce the loads that must be handled by incinerators, and avert the environmental damages which often result from improper disposal.

Trees are a renewable resource, but there is currently debate over whether our forests can meet the needs of our nation for lumber and lumber products in the future, whether cutting increasing quantities of timber from national forests is justified, whether using increasing quantities of land, some presently used as wildlife refuges, for commercial timber operations is desirable, and whether forestry practices such as clearcutting damage the land. All of these questions have arisen because of pressure on the nations' forests to supply growing amounts of paper and wood products. Paper recycling can help relieve the pressure on forests, help relieve doubts about adequacy of future timber supplies, and reduce the need to expand timber harvesting in ways which may be detrimental to wildlife or the land.

## ENERGY RECOVERY VERSUS PAPER RECOVERY

Generation of energy through combustion of municipal solid waste is also an important resource conservation and waste management technique. However, source separation for removal of paper from waste should be practiced even when energy

recovery is employed because (1) it will increase the environmental and conservation benefits which can be achieved and (2) the market value of wastepaper is several times higher as a fiber than as a fuel.

Removal of recoverable paper through source separation does not significantly compromise the value of municipal waste as an energy source. The major reasons are: (1) paper constitutes only about 39 percent, by weight, of the combustible fraction of municipal waste and (2) even with optimum source separation systems for newspaper, corrugated paper, and office papers, only 25 to 35 percent of the paper in the waste stream could be recovered, and this would constitute only 10-14 percent of the combustible fraction. Even with a 35 percent recovery rate, the reduction in heat content per ton of waste input into an energy recovery plant has been calculated by EPA to be no greater than 10 percent.[5]

It obviously makes sense to recover the paper as a fiber if possible. In later cycles through the production system this wastepaper may well appear in packaging and other types of paper products not readily recoverable and could then be converted into energy. Recycling of paper back into new paper thus increases the useful time of the fiber.

## CONCLUSIONS

Source separation is presently the most feasible means of removing paper from the waste stream for recycling. Newspaper, corrugated containers, and certain types of papers from offices typically accumulate in relatively high concentration and homogeneous form at the points of generation. Their separation from other waste will usually be of only slight inconvenience to the

generator and may result in savings to them in waste disposal costs.

The most significant new opportunities for source separation lie in municipal programs for source separation and separate collection of old newspapers from residences, in separation of corrugated containers by commercial and industrial establishments, and in separation of high-grade paper in offices. According to EPA's best estimates, it would be practically feasible to recover enough additional newspaper and corrugated paper to double the amount currently being recovered. Although communities must consider markets on a local basis, nationally the demand for these materials is growing.

For manufacture of many paper products, use of recycled paper rather than virgin fiber results in reduced emissions into the environment. Other benefits include the reduction in the volume of solid waste that municipalities must dispose of and the conservation of forest resources.

Newspapers, corrugated containers, and office papers should be recycled as a fiber if possible rather than converted to energy. There will still be ample heat-producing potential in the remaining waste to allow its recovery as energy.

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