

III. MATERIALS RESOURCE RECOVERY

CHAPTER A - SOURCE SEPARATION OF HOUSEHOLD RECYCLABLES

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Abstract

Source separation is a tested method of recyclable materials recovery. In most source separation programs, households are required to separate materials into separate containers: one for glass, one for metals, and one for newspapers. These materials are then separately collected by a flatbed truck for recycling. The average household needs about 16 minutes per week to prepare materials for collection. Assuming that 30 percent of the residential solid waste stream can be recycled through source separation, almost 900,000 tons can be saved every year in the Bay Area. Source separation is dependent on public participation. For source separation to be a successful means of materials recovery, prevailing household habits, attitudes and values regarding trash disposal and resource recovery must change from what they are at present.

Introduction

During World War II, newsprint, ferrous and nonferrous metals were separated from the solid waste stream in many households. Many people are still doing this today through recycling centers, with over 200 centers in California alone (see section III, Chapter B).

Source separation is defined here as the sorting out of recyclable waste materials at their point of generation (in this report, the household) for separate collection and transport to specialized waste processing sites or final manufacturing markets.

The State Solid Waste Management Board and County Solid Waste Management Plans give greater consideration to other solid waste management techniques than is given to source separation.

Advantages of Source Separation

Source separation is a tested method of resource recovery. California has about six curbside pickup programs of metal, glass, and newspaper, while there are twice as many programs that have curbside pickup of newspaper only.

Mechanical front-end systems (separation of resources from mixed waste through a series of mechanical processes) are currently effective in removing iron and a low grade of glass from a mixed refuse. Separation of clean, color-sorted glass is still in the pilot demonstration phase (U.S. EPA, 1977). Also, once contaminated by garbage, paper obtained from these front-end recovery systems is low grade. Marketability

of such paper appears to be limited to use in relatively low grade construction papers (U.S. EPA, 1977, p. 53). Source separation provides a cleaner, purer product than our present machinery for mixed waste separation can offer.

There is a more complete conservation of resources, including energy, if solid waste materials are recovered rather than converted into energy. Separating usable materials from solid waste may not significantly diminish our energy recovery potential either. Within the range of paper recovery rates presently experienced (10 to 20 percent paper recovery), the reduction in total energy available in the solid waste stream is less than 10 percent (Skinner, 1976). The energy saved by recycling one average glass bottle will light a 100 watt light bulb for four hours (E.C.ology, 1978).

A source separation program will reduce the volume of refuse for disposal in our landfills by 10 to 30 percent (ACSWMA, 1977, pp. 1-7). Forty percent of landfill site capacity in the Bay region will be filled within ten years (ABAG, 1977). The amount of virgin material needed in the manufacture of new products will also be lessened with such a program. For example, a three-foot stack of newspapers, when recycled, saves one small tree (E.C.ology, 1978).

Another advantage of source separation is that hauling costs of unrecycled wastes are reduced. Marblehead, Massachusetts has a curbside pickup program of recyclable materials, and the city pays a private hauler \$18.95 per ton of refuse to be disposed. For each ton of materials recycled there is a ton that doesn't have to be disposed of, resulting in a savings of \$18.95, in addition to the revenues made by the sale of the material (see Table 1).

Table 1
Marblehead Program Economics,
January-September 1976

Month	Revenues from sales	Diverted disposal savings	Incremental collection costs*	Net savings
January	\$1,870	\$2,990	\$2,930	\$1,930
February	2,560	3,390	3,570	2,380
March	3,790	3,680	4,450	3,020
April	3,500	3,640	4,470	2,670
May	3,400	3,390	3,850	2,940
June	3,730	3,850	4,240	3,340
July	3,280	3,350	4,040	2,590
August	4,340	3,850	4,240	3,950
September	3,360	3,580	4,050	2,890

*Includes labor costs as well as operation, maintenance, and capital amortization for the compartmentalized trucks and all other equipment added as a result of the source separation program.

Source: EPA, 1977 p.35

Material Generation

Estimates of the amount of solid waste recyclable through source separation ranges between 10 and 50 percent of the residential solid waste stream, with an average of about 30 percent (see Table 2). One study estimates that 1.61 pounds (0.73 kg) of residential solid waste is generated per capita each day. This estimate is quite a bit lower than the national average of 2.5 pounds (1.1 kg) per day, but excluded in the study's estimate is the weight of yard trimmings (SCS Engineers, 1975, p. 9). Estimates of residential (household) waste generation based upon surveys conducted by the Oakland Scavenger Company in 1973 indicated that per capita generation in 1975 might be as high as 5.1 pounds (2.3 kg) per day. (ACSWMAC, 1975, p. VIII-3). In Los Angeles, yard trimmings comprise 33 percent of the total solid waste in residential areas. (SCS Engineers, 1975, p. 10). Subtracting 33 percent from the Oakland Scavenger Company's estimate would lower it to 3.4 pounds (1.5 kg) per person per day in 1975. It is estimated that 4.8 million people are living in the Bay Area, so it is conceivable that householders are generating some 8160 tons (7418 MT) of solid waste in the Bay Area every day. Assuming that 30 percent of the solid waste can be recycled, 2,450 tons (2,225 MT) can be recovered by the Bay Area every day, and 890,500 tons (812,300 MT) would be saved every year. Alameda County alone estimates that it can recover 124,700 tons (123,363 MT) per year at a market value of \$3.21 million. Using this figure, the Bay Area would be able to save \$22.47 million every year.

Programs and Funding

There are many curbside pickup programs of recyclable materials in California. The State Solid Waste Management Board has funded programs in Santa Rosa and El Cerrito with \$45,000 grants. A Berkeley pilot program was conducted in March, 1976 by the League of Women Voters and Berkeley Public Works Department with a grant from the Environmental Protection Agency (EPA). A source separation program in Modesto (considered one of the finest in the state) started out without significant capital and raised money through general fund-raising activities. Modesto's only government subsidy has involved the assignment of two CETA employees in addition to an \$18,000 grant from the EPA to increase city-wide participation to 60 percent through better publicity, and to develop routes in unincorporated parts of the urban area which are characterized by numerous apartment buildings.

Vehicle Design and Utilization

Most curbside collection programs use separate collection vehicles, primarily flatbed or pickup trucks with 50 gallon (190 liter) drums in which to place the recyclables. Modesto is able to use a flatbed truck with a trailer attached to the rear to increase the carrying capacity on each run. El Cerrito found that the use of a trailer was not feasible due to the hilly terrain of sections of the city, and also because the narrow streets and courts made turning around difficult. The Santa Rosa program is experimenting with a specially designed truck with separate compartments for each material in the rear. Initial tests show this vehicle to be favorable. The cost of this vehicle is about

\$7,500, which is less than one-third the cost of a standard packer garbage truck (\$25,000-\$35,000). Chuck Papke, director of the El Cerrito program, suggests that collection vehicles have flat beds and be low to the ground for easy loading and handling. A vehicle similar to an airport vehicle might be considered for future programs.

Participation Requirements

Most programs require householders to place glass and cans in separate boxes or bags. Newspaper is also either bundled or stuffed into paper bags. The City of Santa Rosa is also experimenting with a new container design. It will introduce a standard container to selected households in June of 1978. These households will receive a set of three brightly colored containers, one for newsprint, one for glass, and one for cans. These units will be interlocking and mobile, so that they can be wheeled to the curbside on pickup days. This might attract more people's participation by eliminating the unsightliness of cardboard boxes and paper bags that are normally left out at the curb in such source separation programs. El Cerrito is now selling 10 gallon (39 liter) plastic cans with its "E.C.ology" sticker on the side to promote participation. These cans are also of different colors to help stimulate sorting. The colored cans will also make it easier for collection vehicle drivers to find materials left out at the curb to be picked up, cutting down on backtracking.

Curbside pickup of separated materials is basically limited to single family dwellings and duplexes, although the Modesto recycling center staff is presently working on a plan to include apartments in its collection routes.

Public Participation

El Cerrito's curbside pickup program began in September, 1977, to add to its drop-off recycling center which has been in operation for five years. El Cerrito originally started out with a subscription fee of one dollar per month or ten dollars a year per household. The program hoped to gain 1200 subscribers, but obtained 650. The program eliminated the fee in April, 1978, anticipating the increase in recyclable materials collected from the rise in participation to cover the loss in revenue. Participation has soared to 2,300 households, which is about 10 percent of the city. All of the other programs in the state are free of charge as well.

The curbside pickup program in Santa Rosa came into existence in January of 1978, and is already functioning at a level of participation of 25 percent of the 22,000 residents offered the service. The Recycle 3 staff expects participation to increase to 50 percent when standardized containers are introduced.

Selected residents of Berkeley had a four-month pilot program offered to them. There was a favorable response from the hill residents (57 percent participation) and lesser cooperation from the two flatland pilot areas (41 and 8 percent participation). The results might correlate with the socioeconomic background of the city, as the greatest participation came from areas of high income and education.

Table 2
Quantities of Recyclable and
Non-recyclable Materials*

	Recyclable Materials				Non-Recycl.		TOTAL
	Glass	Tin/Alum. Metal	Alum.	News- paper	Total	Materials	
lbs/cap/day	0.19	0.07	0.01	0.51	0.78	0.83	1.61 lb
Kg/cap/day	0.086	0.032	0.004	0.23	0.35	0.37	0.73Kg
lbs/house- hold/wk	4.5	1.7	0.3	12.2	18.7	19.8	38.5 lb.
Kg/house- hold/wk	2.0	0.77	0.14	5.54	8.5	9.0	17.5 Kg

* Excludes yard trimmings.

Source: SCS Engineers, 1975 p.9

Modesto's program has been in operation for about six years, and covers 95 percent of the city. Approximately 7,000 homes take part in the curbside pickup program, while 500 use the drop-off center. Of all of the city's households, one-third of the families are taking part in the service, with some neighborhoods having as high as 85 percent participation. These areas of high participation are middle-class neighborhoods, but are also ones that have a lot of contact between neighbors, so that interest is stimulated by friends, not necessarily by income or good publicity.

Table 3
Summary of Household Time
Requirements for Source Separation

Material Preparation: Operation	Average Preparation Time (Min/wk)				
	Glass	Tin/Alum. Metal	Alum.	News- Paper	TOTAL
Clean*	2.4	2.3	0.7	N.A.	5.4
Contaminant Removal	0.6	1.1	0.1	0.1	1.9
Volume Reduction	0.0	2.2	0.2	N.A.	2.4
Bundle	N.A.	N.A.	N.A.	2.3	2.3
Transport (in home)	1.6	1.4	0.3	0.6	3.9
TOTAL	4.6	7.0	1.3	3.0	15.9

N.A. = Not Applicable

*Includes time for material sorting

Source: SCS Engineers, 1975 p. 11

Materials Preparation

The reason offered by most people who do not wish to participate in a source separation program is that it is too much trouble, thinking that it will take too much time. A study by SCS Engineers of the time required in a typical household to prepare recyclable material for separate collection indicated that only 15.9 minutes per week was needed (see Table 3). This averages to just over two minutes per day. Preparation requirements vary with different programs, but the most complete separation would include: cleaning of glass containers, removal of metal rings on bottlenecks, color sorting of glass containers, newspapers bundled or bagged, metal containers cleaned and crushed, with labels removed and sorted by type of metal.

Newspaper requires the smallest amount of preparation - bundling being the only requirement. Glass is the second most efficient material to prepare, with cleaning being the most time-consuming element in its preparation. Volume reduction of glass isn't usually done, because it isn't considered safe to do in the home.

Metal takes the most time to prepare. It has to be cleaned and crushed. Aluminum cans are easy to crush, but make up a small portion (about 1 percent of the total weight) of the solid waste generated. Bi-metal cans are found to be much more difficult to prepare because the proper treatment of these containers necessitates removal of the can bottom (see Table 4).

Table 4
Householder Separation Time Requirements Versus
Quantity of Recyclable Material Generated

Material	Householder Prep. Time (% of Total Time)	Quantity Separated (% of Total Weight)	Time to Weight Ratio
Glass	29	24	1.2
Tin/Bi-metal	43	9	4.8
Aluminum	9	1	9.0
Newspaper	19	66	0.3

Source: SCS Engineers, 1975 p.12

Scavenger Problems

Unauthorized scavenging has a higher probability of occurrence when market prices are high. These scavengers are unauthorized and, often, unlawful collectors of recyclable materials designated for separate collection programs. The El Cerrito pickup program estimated that in 1977, \$2,500 in revenues was lost when such scavengers collected bundles of newspaper before E.C.ology did (E.C.ology, 1978C). In an effort to discourage this practice, E.C.ology is asking that residents place newspapers in containers (unbound), preferably with a cover to keep the paper dry.

Somerville, Massachusetts has a city ordinance prohibiting scavenging. In that community, all refuse piled for collection is considered property of the city when it is set out at the curb. To crack down on the scavengers, all collection workers are instructed to record registration numbers of vehicles of individuals illegally picking up papers. A fine for the offense is being planned (EPA, SW-551).

Problems of Initiating Source Separation

Attempts to adopt source separation programs frequently meet with problems. Many people simply refuse to cooperate. Resistance from the householder stems from habits, attitudes and values. Modern technology has made disposable commodities available at a price that most people feel they can afford. The consequences of a willingness to pay for convenience is often overlooked in solid waste management planning.

Elected city officials can find it difficult, and politically unwise to force people to separate wastes. The possible incentives to bring about needed changes in public attitudes are many. Two of these which stand out are, first, that collection rates can be lowered or collection offered free to those people willing to participate. Second, collection rates can be raised for those who do not separate recyclables, with the increased revenue funding the separate collection program.

A mandatory source separation program was initiated in Marblehead, Massachusetts. An ordinance was passed so that a \$50 fine would be imposed on anyone who did not separate recyclable material. The success of this program is quite good, with an estimated 75 to 80 percent participation rate from Marblehead householders (EPA, SW-551).

In an effort to maximize participation, programs can be designed to minimize the inconvenience. Many pickup programs do not require cans to be smashed, or have labels removed. Some programs do not require sorting of kinds of metals or color of glass. Although the Marblehead program did require color sorting of glass, the program was simplified by putting clear glass and one kind of can together in one container, and colored glass and the remaining cans in the other. A third container was for paper. This system necessitated simple screening and crushing equipment to sort and process these materials into their individual components. Pickup of such materials would be done weekly. If households do not cooperate in separation then it is likely that the mixed waste would take more than one garbage can, and a substantial fee could be levied for households exceeding the one can limit.

Newspaper comprises the majority of weight of recyclable materials (66 percent) (SCS Engineers, 1975). With special racks attached to packer trucks, bundled newspaper can be collected weekly by regular refuse service. This is commonly called the piggyback system of newsprint collection. The piggyback system would utilize existing equipment and manpower as much as possible. A minor problem for such a system is that the newsprint racks usually fill before the body of the packer truck does, so the collection trucks must deposit the newspaper at neighborhood collection centers which, in turn, are serviced regularly by newsprint collection trucks.

A survey taken in Berkeley indicated that a greater percentage of households prefer a city-wide curbside pickup of recyclables every two weeks rather than weekly (LWVB, 1976). In conjunction with

piggyback newspaper collection, metals and glass can be collected bi-weekly by a separate truck. The collection vehicles for recyclable materials would have an increased route capacity by not having to pick up newspaper, and there is a savings of money by reducing collection frequency.

Current Legislation

California State Senator John Nejedly introduced Senate Bill 650, which was signed into law September 30, 1977. This legislation allocates \$4.5 million toward the expansion of recycling centers. Unfortunately, this money in the form of recycling grants is restricted to purchases of capital equipment like trucks and forklifts, and cannot be used for the payment of salaries or wages. This deals a major blow to such labor-intensive programs as source separation. For the past eight years, the state has virtually relied on volunteers to do the people's recycling.

If source separation programs are to be viable alternatives to our present solid waste management practices, encouragement will be needed to use recycled products. Removal of the existing incentives and subsidies for the use of virgin materials is one way this can be accomplished. Also possible is the establishment of new incentives, such as subsidies which encourage the development and use of recycled products. A more severe measure than either of the above would be to limit or establish quotas on the use of virgin materials.

It is the author's opinion that source separation can help curb our solid waste management problems. Such programs would make people participating conscious of the amount of materials that is being wasted. Householders would be able to see the glass, paper and metal that can be recycled. The present mix of throwaway cans and bottles is wasteful and we must not come to accept as reasonable our present garbage generation levels. But recycling is only an interim solution. Source reduction will bring larger resource and energy savings than even recycling can. As Cliff Humphrey of the Modesto recycling program has said, "Garbage must not be thought of as a normal by-product of our society" (Humphrey, 1977, p. 6).

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