Chapter 4

Source Separation for Materials and Energy Recovery

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Source Separation for Materials and Energy Recovery

Introduction

Definitions and Issues Addressed

Source separation* is "the setting aside of recyclable materials at their point of generation (e.g., the home, or places of business) by the generator. Once recyclable materials are separated, they may be transported to a secondary materials dealer or manufacturer by the generator, municipal collection crews, private haulers, or community organizations.'"(l) Some familiar approaches to source separation are curbside collection of newspapers, cans, and glass; commercial recycling of waste office paper, corrugated cardboard, and computer cards; and communit y dropoff centers,

By comparison with mechanical separation of collected mixed wastes in centralized resource recovery plants, source separation is labor intensive, produces relatively uncontaminated materials for recycling from a portion of the waste stream, and requires greater cooperation by waste generators. Centralized resource recovery, on the other hand, is capital intensive, and can accept most kinds of collected waste thus reducing the need for cooperation. Because source separation can put a greater burden on collection, the most costly part of municipal solid waste (MSW) management, successful source separation programs require considerable attention to design and implementation strategies.**

*'*Source separation" is a misnomer, Rather than separation, householders and other generators of waste simply avoid mixing waste prior to collection.

**Design and implementation strategies for centralized resource recovery plants, are discussed in detail in chapters *6, 7,* and *8.*

Four principal questions are addressed in this chapter:

- Is source separation an economically and technically feasible approach to resource recovery, and what are its potentials for materials recovery and energy savings?
- What issues and problems arise in connection with source separation?
- How does source separation interact with other approaches to resource recovery, recycling, and reuse?
- What Federal policy options are available or necessary to facilitate, stimulate, or regulate source separation?

Advantages, Disadvantages, and Impediments to Source Separation

The advantages and benefits of the source separation approach to recovery and recycling of materials are that it:

- produces high-quality waste products*** that can bring a premium price if markets are available and if recovered products meet market specifications;
- is the only method currently available for the recovery from MSW of recyclable newspaper, office paper, corrugated cardboard, color-sorted glass, plastics, and rubber;
- conserves energy by recovering materials whose production from virgin sources is energy intensive;
- requires very little capital investment as compared with centralized resource recovery;

***Curbside collected materials may need to be upgraded to meet market specifications.

. can be implemented with little delay in comparison with centralized resource recovery facilities; and
• may be the only way a small or remote community could recycle materials if the population is too small to support a centralized resource recovery plant.

Some local independent trash haulers, scrap dealers, and scavengers might find source separation more attractive than centralized resource recovery because it protects the part of their income derived from sales of high-grade waste materials.

The possible indirect advantages of source separation include:

- Decrease air and water pollution from landfill activity.
- Net savings from avoiding negative impacts on the environment, on worker health, on energy, and on resources from the production of virgin materials.
- Improved balance of trade from substituting recycled for imported virgin materials.
- Communities with source separation programs are seen to be forward-looking,
- Benefits from a sense of personal involvement in conservation activities.

Some of these benefits such as the reduced use of virgin materials and of landfill space are also true for centralized resource recovery.

The disadvantages of source separation are:

- Only a portion of the waste generated can be recovered.
- It leaves a mixed waste residue that has a somewhat lower fuel content than unseparated mixed waste.
- It strongly depends on individual participation and cooperation.
- It requires modification of the costly collection equipment used by both municipal and private haulers.

The chief impediments to implementing source separation are:

- Uncertainty about cooperation in the short- and long-term by householders, businesses, and others who generate waste.
- The uncertainty of markets for recovered materials along with the reluctance of consumers of recycled goods to sign long-term purchase contracts (in view of uncertain community participation and the problems associated with recycled materials meeting market specifications).
- The costs of transporting recovered materials from remote communities to the fabricating plants of potential purchasers.
- Inadequate attention by the Federal Government to the innovative design of programs, incentives, and contaminant control research so that source separated materials can meet market specifications.
- The belief that low-income and urban householders will not cooperate with source separation programs.

The rest of this chapter examines these advantages, disadvantages, and impediments to source separation and discusses possible policies for dealing with them.

The Technical and Revenue Potentials of Source Separation

Five kinds of programs for source separating materials are: (i) separate curbside collection of materials from residences—newspapers only or multimaterials (paper, cans, glass); (ii) multimaterial recovery in community recycling/reclamation centers; (iii) industry sponsored recycling programs; (iv) office paper recovery programs; and (v) commercial and industrial source separation activities. These types of programs make possible the recovery from the waste stream of such materials as: newspapers, books and magazines, corrugated paper, office paper,

glass containers and other glass, steel containers, aluminum containers, and yard waste. The following sections examine source separation's potential for recovering materials, saving energy, and earning revenue.

Materials Recovery

The potential of source separation to achieve its main goals of reducing the flow of solid waste to disposal and of conserving natural resources has been estimated by OTA. This estimate only attempts to convey the sense of what might be accomplished. It does not purport to forecast the actual future levels of source separation activities.

Table 21 shows the amounts of major source separable materials in MSW along with estimates of the amounts recoverable at each of two national average levels of participation. * These estimates suggest that at 50-percent participation as much as 37.4 million tons, or 27 percent by weight, of the gross discards of MSW might be recovered. According to estimates by the Environmental Protection Agency (EPA), only 6.3 million tons of MSW were actually recycled in 1975.

The potential of source separation may be underestimated in table 21 because products such as plastics, paper packaging, and other paperboard might be added to the list. In addition, wastes such as miscellaneous glass, noncontainer iron and steel, and aluminum foil could be recovered with the basic components. It should be noted, however, that the most successful source separation programs recover only 2 or 3 categories of materials at a time from the waste stream. A total of 26,1 million tons of yard wastes have been included in table 21. Much of this waste (leaves, grass clippings, garden waste, etc.) can be separately recovered for conversion to compost and mulch, providing both a soil conditioner and a partial substitute for chemical fertilizer. At even 25-percent participation in the separate collection of yard waste, the MSW total could be reduced by 6,5 million tons (about 5 percent).

From the estimates for recoverable materials in table 21 it can be seen that while source separation can substantially reduce a community's total wastes, more than half will still have to be disposed of by other methods. Thus, source separation can only serve as part of of a community's waste management program,

Energy Savings

In order to produce basic materials (from virgin or secondary materials) energy is needed to process and transport fuels, to mine and process raw materials, to operate waste collection and separation plants, to heat and light operating facilities, etc. Recovering materials for recycling by means of source separation can save energy. The energy saved would come from the difference between the energy needed to produce a given amount (e.g., 1 ton) of a basic raw material (e. g., steel) from virgin raw materials and the energy needed to produce an equal quantity of the same basic material from recycled raw materials. Estimates of the potential savings in million 13tu per ton of recovered materials are summarized in column 2 of table 22. From the data, it can be seen that a large amount of energy is saved in recycling aluminum, somewhat less with steel and paper, and considerably less with glass. Table 22 also shows the energy that could be saved per ton of waste generated for both 25- and 50-percent participation in source separation programs. Energy savings compared with landfilling range from 0.7 million to 1.4 million Btu per ton of generated waste. (The interaction of centralized resource recovery and source separation is discussed later in

*Participation is used here to mean the fraction of each waste component that is recovered. Thus, 25-percent participation would occur if one-fourth of the population recovered all of the recoverable components of its waste or if half of the population recovered half of the recoverable components of their waste on the average. Since the major recoverable components make up 55 percent of total waste (see table 21), 25-percent participation in a comprehensive program would result in recovery of one-fourth of this 55 percent, or about 14 percent of total waste. Likewise, 50-percent participation would recover about 28 percent of total waste.

Table 21.-Major Source-Separable Components of MSW, 1975

Material	Amount in MSWa		Amount recoverable by source separation (million tons)		Recycling experience in 1975 (All methods)a	
	Percent	Million tons	25% participation	50% participation	Million tons	% recycled
Newspaper	$.5	8.9	2.2	4.5		20
Books and magazines	2.3	3.1	0.78		6	8
Corrugated paper	9.2	12.5	3.1			22
Office paper						13
Glass containers		1				
Steel containers	4.0		1.4	2.8		
Aluminum containers	0.4		0.14	0.27	0.08	15
Yard waste		26.0	6.5	13.0		
Total major source-separable materials	55.1%	74.2	18.5	37.4	6.3[d]	

source; Table 4 .Latest year for which data are available.
Includes all aluminum cans and aluminum parts of bimetallicp cans
An unknown amount of yard waste is collectedseparatly and used as compost or mulch
an additional 1.7 million tons of other materials from MSW wererecycled in 1975
NOTE: These estimates assume no action to institute product disposal charges, madatory cotainer deposits, or centralized resource recovery plants.

this chapter.) For the entire Nation these savings are equivalent to 0.1 to 0.2 Quad* annually or to 0.14 to 0.28 percent of the Nation's energy use.

Revenue Potential of Source Separation Programs

The chief direct economic benefits of source separation programs are the proceeds from selling the recovered materials and the credits for avoiding part of the cost of disposal by landfill or other means. In this analysis, disposal credits are assumed to be proportional to the weight of waste removed; that is, average landfill costs are used in their estimation.

The potential gross revenues from source separation programs can be estimated by multiplying the estimates of recoverable quantities of materials in table 21 by estimates of scrap prices. Table 23, which summarizes such revenue estimates for 25- and 5C)-percent program participation, shows that these are highly dependent both on realizable scrap prices and on participation. It further shows that no single waste component produces a large share of the total revenues, although various paper types together account for well over half of them. Depending on local landfill costs, credits for avoided disposal costs can be significant.

A complete economic analysis of source separation must take into consideration all of the following factors: the direct costs of promotion and collection and the direct benefits of revenues from recovered materials and avoided disposal fees; also the indirect costs of consumer inconvenience and the indirect benefits of energy and materials savings and environmental protection. The economic implications of the interactions among source separation, centralized resource recovery, and beverage container deposit legislation must also be considered. No direct cost data are available for constructing a cost table analogous to table 23. Cost data for specific recovery programs are discussed in subsequent sections of this chapter.

*One Quad equals 10^{15} Btu = 1.055 EJ.

Status of Source Separation programs in the United States

Source Separation Methods and Approaches

Source separation programs vary depending on the sponsorship, the types of materials collected, the frequency of collection, and whether materials are collected at curb-

Table 22.—Estimated Potentiai Energy savings From Source Separation Programs

Material	Potential energy savingsa (million Btu/ton)	Potential energy savings per ton of MSW generated (million Btu/ton)	
		25% participation	50% participation
Newspaper	5.2	0.08	0.17
Books and magazines	5.2	0.08	0.17
Corrugated paper..	5.2	0.08	0.17
Office paper	5.2	0.08	0.17
Glass containersfJ	1.2	0.03	0.06
Steel containers.	7.8	0.08	0.16
Aluminum containers	259.4	0.26	0.52
Yard waste	0[c]	Oc	w
Total energy savings. . . .		0.69	1.42

OTA estimates based on data in reference(2),(3), and(4).

In this report recovery of yard waste in source separation programs Is assumed to produce only landfill Credits and neither energy savings norr net revenues. This choice is made becauae yard waste is quite varied seasonally and geographically and because experts disagree widely about the viability of yard waste utilization or sale. The effects of this choice are to underestimate by a small amount the economic and energy potentials of source separation.

side or delivered to a recycling center. Five methods of source separation are discussed below: (i) curbside separate collection programs; (ii) multimaterial recovery in community recycling/reclamation centers; (iii) industry sponsored recycling programs; (iv) office paper recovery; and (v) commercial and industrial methods of source separation.

Curbside Separate Collection Programs

STATUS

In curbside separate collection programs* recyclable materials are conveniently collected at curbside, rather than having to be transported by householders, businesses, or other generators of waste to a recycling center. Such programs fall into two categories, those that collect only one recyclable material, in most cases some form of wastepaper; and those that collect two or more. In a recent survey, EPA estimated that as of May 1978, there were 218 curbside separate collection programs in the United States. (See table 24.) Of the programs surveyed,** 99 percent collected some form of paper (76 percent collected newspaper and 23 percent collected mixed wastepaper), glass was collected by 16 percent, and metal by 14 percent. Collection was the responsibility of municipalities in 57 percent of the programs and of private collection firms and community organizations in 29 and 12 percent of the programs, respectively.(5)

In most communities, collection programs divided household waste into two, three, or four segments. Division into two segments separates newspapers from the remaining waste. (Some cities collect a mixed flat paper segment instead of newspapers alone.) Division into three segments separates cans and bottles as well as newspaper from the remaining waste; and into four segments separates newspapers, clear glass and cans, and green and brown glass and cans from the remaining waste.

The factors a community must weigh in deciding the number of segments to collect include: anticipated participation, the comparative cost of centralized separation, the

*This section discusses only curbside collection programs sponsored by municipalities or private collectors on a regular basis, There is a significant amount of activity, primarily for newspaper, in occasional curbside collection by voluntary organizations and in house-to-house collection by private entrepreneurs. No statistics are available on the extent of this activity, although total newspaper collection statistics suggest it is large.

A*AS of September 1977, the EPA had identified ZOS separate collection programs, Only 177 of these contained enough information to be included in the sample. Since this date, the EPA has located an additional 13 programs. These were not included in the survey,

Table 23- Estimated Potential Gross Revenues From **Servirce Separtation Programs**

Material	Potential Unit revemie ($/ton)	Potential revenue per ton of MSW generated ($) 25% participation	50% participation
Newspaper	20-45	0.3390.73	0.88-1.48
Booksand magazines		0.0%0.12	0.08-0.23
Corrugated paper	I L ?	0.35=1.04	0.702.07
Office paper.	75-120	0.71 -1.14	1.43-2.28
Glass containers	20-30	0.48-0.89	0.92=1.38
Steel containers.	20-40	0.200.40	0.404.80
Aluminum containers.		0.30	0.80
Yard waste			
Total revenues		2.384.42	4.77-8.82
Credits for disposal avoidance.	2-10	0.28-1.38	0.55-2.76
Grand total revenues and credits		2.88-5.80	5.32-11.58

Revenues must be reduced to account for freight.

OTA esto,ates based on various industry sources. Ranges indicate

j~;c"% -w of y~w- }n Hw ~ ~n ~wrama is aaaumed to produoa only landfill oredlts and n@thW energy savings nor net revenues. This choke is made because Yard waste is quite varied seasonal ly and geographically and because experts disagree widely about the viability of yard waste utilization or sale. The effects of this choice are to under. estimate by • small mount the economic and energy potentials of source separation.

Table 24.—Separate Collection Programs (May 1978)

Federal regions of the United States	Numbers of programs
Rqionl•...•'	48
Region	74
Region III	12
Region V.	;
-~•**** *J•*••	4
Re@%t-w...••	$
Raf#qnv&. . * * ,, .. ?-,, $.	
@3@@n#f* ..-*	2
Region X	9
Total.	

SOURCE: Based on David M. Cohen, *Separate Collection Programs: A National Survey*, U.S. EPA, 1978, appendix B.

value of the materials, and the product demand. Tradeoffs are involved in the decision. On the one hand, as the number of segments to be separated is increased there is a drop-, off in participation and an increase in the complexity and thus cost of the equipment. On the other hand, however, the cost of subsequent processing is reduced and the quality and value of the products improve.

PARTICIPATION

Communities need to be sensitive to tradeoffs between material quality specifications on the one hand and household convenience and participation on the other. For example, programs that require the removal of labels and metal rings from glass containers, or residual organic matter from all containers may seriously deter cooperation. Reduced participation is traded against the fact that contaminated materials bring lower prices.

Some communities have designed special containers for newspaper disposal that are distributed to each household. Such containers reduce the time needed by each household, protect the papers in case of rain, and help remind each household of the separate collection program's objectives. Some programs, which separate waste into three or four segments, use a trash receptacle with several compartments. One such container was developed by a recycler in New Hampshire and marketed briefly by Sears, Roebuck & Company.

Various approaches have been suggested for increasing the participation in separate collection programs. One is to provide color-coded plastic bags for different waste segments, Another is to charge lower fees for collection of separated wastes, This latter approach was tested in an experimental l-year study by the Seattle Recycling Project under a grant from the Washington State Department of Ecology. In one of the project's test groups a monetary rebate was offered which was approximately equal to the estimated reduction in collection and disposal costs from separated wastes. One of the study's conclusions indicated that while the monetary incentive was most effective with respect to voluntary participation at the project's inception, it did not have a continuing effect through the entire test period.(6)

To stimulate participation, communities have also tried a variety of advertising and public awareness campaigns, Typical methods include development of a recycling program logotype to help citizens identify with the program, placing information in newspapers and community newsletters, utilizing neighborhood organizations to distribute program information, buying time on radio and television to announce the start of programs or changes in the pickup schedule, posters featuring program information, community calendars containing pickup schedules, and/or a letter to each household from the mayor or leading city official endorsing the source separation program. Leadership by elected officials is important, and personal contact by community volunteers can help explain programs and encourage participation,(7)

Another method for increasing public participation in separate collection programs is to pass ordinances that require participation and levy fines for noncompliance. EPA's national survey of separate collection programs found that 24 percent of the programs surveyed had ordinances mandating that residents separate recyclable materials from mixed refuse. It was found that with residents of similar socioeconomic characteristics, and using the same collection frequency and publicity campaigns, the likelihood of participation is greater in mandatory programs, At the same time, however, most communities indicated that separate collection ordinances are not strictly enforced owing to the difficult y of apprehending violators.

Scavengers— unauthorized persons who pick up recyclable material before the municipal or private collector arrives—also create problems for many separate collection programs, Their impact is the greatest when scrap material prices are high. Some communities have enacted antiscavenging ordinances, These usually state that it is unlawful for any unauthorized person or firm to collect the separated material or materials. Fines for noncompliance range between $25 and $250. Such ordinances need not necessarily prevent service, charitable, or religious organizations from collecting such items as newspapers in volunteer drives.

A number of communities have passed ordinances requiring that all collected MSW be delivered to a specified location as a means of assuring a steady flow of waste to a centralized resource recovery facility, This has been done, not to protect public health, but to guarantee the economic viability of centralized resource recovery plants in the face of competition from separate collection programs or lower cost landfill. According to the information presented above, it appears that such ordinances are unnecessary if adequate attention is paid in advance to the complementary roles of various disposal options. Furthermore, such requirements may act as a barrier to adoption of economically preferred recovery and disposal methods, (See chapter 8 for a discussion of current legal challenges to such ordinances.)

INCONVENIENCE AND ASPECTS OF HOUSEHOLDER COST

To participate in sepa'rate collection programs, residents must devote time, equipment, and storage space, whose costs are largely unknown and controversial. One problem is to differentiate clearly between

the costs of handling mixed waste and separated waste. Another is to put a value on both the time and the residential space required for waste segregation, since it is difficult to determine the value of alternative uses of such time and space.

Under an EPA grant, the League of Women Voters of Newton, Mass., kept a record of the time required to separate recycled materials, above the time normally required to dispose of waste. They found that it took an average of 15 minutes per week per family (range 1 to 20 minutes).(7) It has been argued, however, that the time spent in waste separation should be given a positive value since it may be associated with good feelings about contributing to conservation of resources, or it may be done by children and have some educational value. There is no agreement on the analysis or interpretation of these costs.

The inconvenience of storing recyclable materials depends on the frequency of collection. A biweekly collection program would create a smaller storage problem than one that collected on a monthly basis. EPA's survey of separate collection programs indicates that approximately 70 percent of the 177 programs surveyed collected recyclable at least twice a month, with the majority of programs collecting once a week.(8)

The value per square foot of the additional residential storage space that might be needed for the wastebaskets to be used for separate collection programs has been raised as a potential cost. For example, if separate collection of recyclable requires two extra containers that each occupy one square foot, the cost of extra waste container space for a family of four who pay $400 per month for a dwelling space of 1,200 square feet ($4 per square foot per year), would be $3.13 per ton of generated waste. (It should be noted that it would take this family approximately one-half year to generate a ton of waste.) It can be argued, however, that this cost is not real because there is a question about whether such wastebaskets would actually require additional residential space.

The cost of extra containers for separate collection programs can also be estimated. Two extra permanent containers might cost $4 each and last for 3 years. For a family of four, this would be equivalent to $1.04 per ton of generated waste. Separate collection programs might also require additional consumer expenditures for plastic trash bags, depending on the design of the system and the frequency of collection.

According to these estimates, the total additional consumer costs would be approximately $4 per ton. But the out-of-pocket costs would be much less, perhaps as little as $1.00 per ton for extra containers.

SEPARATE COLLECTION OF ONE RECYCLABLE AT CURBSIDE

The majority of separate collection programs in the United States collect just one recyclable material. EPA's data from its national survey on separate collection programs indicate that approximately 99 percent of the 177 programs surveyed collected some type of wastepaper.(9) Twenty-three percent of the programs surveyed collected some form of mixed wastepaper. Of the 133 programs that collected newspapers, 110 collected no other recyclable but newspapers. In addition, 32 of the 41 programs that collected mixed wastepaper collected only this one recyclable component. Apparently, a large number of communities only recycle newspapers because wastepaper markets are more readily available than markets for other recyclable, and because newspapers constitute a large and easily separable part of the waste stream. By removing them the lifetime of a community's landfill is increased. It should be noted that EPA's survey indicated that only three of the programs surveyed collected just glass or metals.

Various methods are used by municipalities and private haulers when collecting one material separately. These include using: separate trucks, racks attached to packer trucks, and trailers attached to the rear of a refuse collection vehicle.

The majority of programs (72 percent) use separate trucks, usually on a different day than the one for regular waste collection. This method has the advantage of low startup costs. Some of its disadvantages are: (a) recyclable must be collected on a separate day from regular waste collection—perhaps confusing residents about the waste collection schedule: (b) high operating costs—the revenue obtained from the collected recyclable material must offset the costs of collecting it: (c) trucks can be used for the collection of only one material at a time unless they are modified for the purpose: and the material must be unloaded by hand if noncompacting trucks are used.

A second method, referred to as the piggyback system, is used by 22 percent of the programs. One recyclable—usually newspaper—is collected in a rack attached to a packer truck. Startup costs for racks range from $80 to $250,(11) and operating costs are lower than for other collection methods.

A third method, used by 5 percent of the separate collection programs, is the use of trailers that have sufficient storage space (4 to 6 cubic yards) and can be unloaded mechanically, which are attached to the rear of a refuse collection vehicle. This method also permits the recyclable and the mixed refuse to be collected at the same time. Its operating costs are relatively low, but startup costs tend to be quite high, ranging from $3,000 to $3,500 for each trailer. There may also be a problem with maneuverability.

Madison, Wis,, has been recycling newspaper since 1968 when it initiated a pilot separate collection program involving half the city, The rest of the city joined the program in 1gi'o. At the start, the city made separate collection trips for newspapers. But collection costs were too high, so the piggyback method was adopted. Even though Madison does not mandate separation, in 1977 about 13 percent of the population participated. In that year 1,365 tons of newspaper were collected for which the gross revenues were $43,982. The cost of collecting the newspaper was $4.36 per ton, and the "profit" from its sale was $27.86 per ton.(12)

MULTIMATERIAL PROGRAMS

In May **1978,** about 40 multimaterial programs collected two or more recyclable materials at curbside. (The programs are listed in table 25.)(10) These included some combination of newspapers, magazines, corrugated paper, glass, and aluminum and steel cans. The majority of the multimaterial collection programs are located in the northeastern and western sections of the United States because of both the unusually high landfill costs ancl the availability of markets for the recovered materials in these regions.

Most of the programs that collect both color-mixed glass and cans handle either a stream combining the mixed glass and the cans or a stream of the mixed glass and a stream of the ferrous and nonferrous cans. Programs that collect both color-separated glass and cans collect at least two streams of glass; one clear and the other colored (amber and green). Both glass streams are usually mixed with cans. A third stream consisting only of cans may also be handled. Most multimaterial curbside programs use compartmentalized trucks, others use trailers attached to the rear of a refuse collection vehicle. An advantage of using compartmentalized trucks is that their operating cost is relatively low because recyclable materials are collected at the same time as mixed refuse. A disadvantage is that the startup cost is relatively high. In 1976, a compartmentalized truck cost approximately $20,000.

Two of the best known of the 40 multimaterial curbside collection programs are those in Somerville and Marblehead, Mass. In 1976, these communities were assisted by EPA grants to recover glass, cans, and paper from households. Marblehead is a relatively affluent suburban community that has been involved with recycling activities for some time. Somerville is a less affluent, densely populated urban community with no previous recycling experience. Marblehead passed an

Table 25.—Waste Components Recovered in Multimaterial Curbside Separate Collection Programs

Program	Waste component collected										
	Newspaper	Paper	Magazines	Glass	Clear glass	Colored glass	Corrugated paper	Cans	Aluminum cans	Metals	Other materials
Abington, Pa.	X				X						
Andover, Mass.		X			X			X			
Arcata, Calif.				X			X			X	
Atlantic, Ind.	X		X	X				X			
Bedford, Mass.	X			X				X			
Boulder, Colo.	X			X					X		X
Bound Brook, N.J.	X			X				X			
Bowie, Md.					X						
Brooklyn Center, Minn.	X							X			X
Clifton Heights, Pa.		X		X							
Davis, Calif.	X			X				X			
Downey, Calif.	X			X				X			
Durham-Middlefield, Conn.	X			X							
East Lyme, Conn.	X		X	X				X			
El Cerrito, Calif.	X		X	X			X	X			
Fresno, Calif.	X			X				X			
Greenbelt, Md.	X								X		
Hamilton, Mass.	X			X				X			
Hartford, Conn.	X									X	
Ithaca, N.Y.				X					X	X	
Livermore, Calif.				X			X			X	
Marlboro, Minn.	X							X			
Marshfield, Mass.	X			X				X			
Modesto, Calif.	X			X				X			X
New Hartford, Conn.		X		X				X			
Newington, Conn.	X				X						
Newton, Mass.	X			X				X			
Omak, Wash.	X			X				X			
Rockville, Md.	X									X	
Rutherford, N.J.	X				X						
San Anselmo, Calif.	X						X		X	X	
San Luis Obispo, Calif.	X			X				X			
Somerville, Mass.	X			X				X			
Summit, N.J.		X		X							
Topsfield, Mass.	X			X			X	X			
Wabash, Ind.	X			X				X			
Waltham, Mass.	X			X			X	X			
Waterbury, Conn.				X				X			
West Orange, N.J.	X			X							
Winchester, Conn.		X		X				X			

SOURCE: Based on David M. Cohen, *Separate Collection Programs:* A National Survey, U.S. EPA, 198, appendix C.

ordinance requiring source separation of recyclable, while Somerville's program was voluntary. A full-scale public education program was undertaken in both areas. Both communities obtained contracts for sale of the materials through competitive bidding.

In the first 9 months of operation, Marblehead recovered 23 to 33 percent of its residential waste each month, while Somerville recovered 7 to 9 percent.(12) In 1977, recovery rates for the residential waste stream averaged 25 percent in Marblehead and 5 percent in Somerville. These results imply participation rates considerably greater than these fractions, since only portions of the waste streams were to be recovered. Overall costs for solid waste management were reduced in Marblehead as a result of the separate collection program. Before the program was initiated Marblehead used four vehicles to collect waste twice per week. A contractor's report prepared for EPA found that because of the reduction in the amount of waste to be collected as a result of the separate collection program, Marblehead was able to change its collection frequency to once a week in May 1977 and to eliminate one of its four crews and one of its refuse-collection vehicles.

During 1977 Somerville received a total of $10,938 for the sale of its recycled materials and saved $14,456 by avoided landfill costs. Marblehead obtained $25,540 for its recycled materials and saved $41,084 through avoided disposal costs. (14)

Program costs and savings for both Somerville and Marblehead in 1977 were as follows:*

Somerville: Spent $146,470 for recycling program. However, some of the costs of personnel and equipment from the refuse-collection program could be transferred. Thus actual costs to the city were $80,122.

Somerville's program showed a net loss of$12 1,076 on a ''full-cost" basis (full cost of labor, equipment, and consumables used in recycling service: reflects recycling budget), and a loss of $54,728 on an "actual-cost" basis (additional costs actually incurred by community due to recycling program).

Marblehead: Spent $90,394 for its multimaterial program, Actual costs, however, were $49,836.

Marblehead's program showed a net loss of $23,760 on a full-cost basis, but a net gain of $16,788 on an actual-cost basis.

The multimaterial program in Andover, Mass., which collects residential newspaper, glass, and cans, showed a net additional cost of $3.22 per ton recovered by source separation ($0.56 per ton of waste managed). However, the cost analysis was based on newspaper revenues of $15 per ton, and an increase to $20 per ton would have allowed the program to break even. The Andover program covers a population of 26,000 that generates 57'9 tons per month of solid waste. A total of 101 tons per month of glass, cans, and newspapers were separately collected, for a recovery rate of 17.4 percent based on residential waste only. (Participation rates are much greater than 17 percent.)

Multimaterial Recovery in Community Recycling/Reclamation Centers

Another approach to source separation is through multimaterial community recycling centers. These differ from separate collection programs in that the participant is required to deliver waste materials to a central collection point. During the late 1960's, as environmental awareness spread, thousands of collection centers for recyclable were set up in the United States.

Just as with other source separation approaches, however, there must be an awareness of the interplay between adequate markets, the high cost of transporting recycled materials, the level of participation, and the program's success. Startup and operating costs are relatively low for recycling centers compared with those for high-technology re-

*The cost figures are based on reference (17).

source recovery plants, and the quality of the materials recovered can be high because they are handsorted by residents, (Supervision may be needed to assure that components are not contaminated both when they are dropped off and during their processing.)

A community recycling center can be sponsored by a municipality or by a private contractor, and can be run on either a mandatory or a voluntary basis. While most centers give local residents the opportunity to recycle a portion of their mixed refuse, they do not pay for recycled materials. Many of the centers, particularly those in rural areas, recover material in the solid waste stream that would otherwise be lost. The closing of open dumps, as required by the Resource Conservation Recovery Act, may increase the value to a community of a recycling center because the amount of mixed waste headed for its landfill or incinerator is reduced.

In New Hampshire, the towns of Plymouth, Nottingham, and Meredith, have multimaterial community recycling centers that combine recycling with incineration of nonrecovered mixed refuse. Recycling newspapers, clean mixed paper, glass, metal, and other rubbish is mandatory in both Plymouth and Nottingham. Plymouth also recovers corrugated paper. Meredith only requires separating glass from the rest of the waste stream.

Each of the towns sorts and processes its recycled materials differently. In Nottingham, glass is color sorted and the caps and rings are removed from glass bottles. Once sorted, the glass is mechanically crushed and transported to market. Both Plymouth, which color sorts some of its glass, and Meredith, which does no sorting, have their recycled glass picked up at the centers by its purchasers. Plymouth and Nottingham mechanically flatten recovered cans, and in all the systems the recovered corrugated paper and newspapers are baled.

The participation of residents ranges from about 95 percent in Nottingham and Plymouth, which have mandatory programs, to **25** to **50** percent in Meredith. Town officials feel that when a "substantial" portion of the waste stream is recovered through recycling, net costs are lower than they would be for any other environmentally acceptable system that does not involve recycling.

Multirnaterial Recovery in Industry Sponsored Recycling Programs

Source-separated materials are also recovered by industry-sponsored recycling centers in programs that vary from recovering only one material such as aluminum to multimaterial recycling. Unlike community-sponsored recycling programs, industry programs pay participants for recycled materials.

One multimaterial recycling program, the Beverage Industry Recycling Program (BIRP), has been operated throughout Arizona by the beverage industry since 1971. It has 10 recycling centers (3 more are in the planning stage) that accept aluminum and steel cans, newspapers, and corrugated paper. During 1977, 15,227 tons of materials were recovered, an increase of 70 percent, over 1976. (This is about I percent of Arizona's total waste load.) Participants were paid $2,390,000, an increase of 82 percent. BIRP also has a number of recycling centers in various stages of development in New Mexico.

Recycling centers that recover one material, aluminum, are operated by aluminum and beverage companies, which pay 15 to 17 cents per pound (about 23 cans). The first aluminum can recycling centers were opened in 1967. As of May 1978 there were 2,300 collection points. The cans are collected at both mobile and stationary centers and are shipped to secondary smelters.

The Aluminum Association estimated that in 1977 about 6.4 billion cans weighing 140,000 tons were returned for recycling. (In 1976, 1,312,006 tons of aluminum were recycled from all sources.) Reynolds Metal Company representatives forecast that in the absence of beverage container deposit legis-

lation from 30 to 50 percent of the aluminum cans produced will be recycled by 1980 and from 50 to 70 percent by 1985.(22) With a national beverage container deposit law, higher recycling percentages would be anticipated, but containers would be recovered through the deposit system, (See chapter 9.)

Wastepaper Recovery Through Office Recycling Programs

Many companies and Government agencies separately collect high-grade wastepaper from offices. This wastepaper, called "white ledger," consists of letterhead, dry copy paper, business forms, stationery, typing paper, tablet sheets, and computer tab cards and printout papers. Computer tab cards, which have a very high value, are usually boxed separately at computer centers and recycled.

The most successful method used in recycling wastepaper from offices is called the "desktop" program. A container is placed at each desk for high-grade wastepaper, which is periodically collected and taken to a central location to be baled and shipped to market. The EPA reports that in 1976, 450 organizations were participating in one recycling company's desktop office paper collection program—60 percent more than in 1975.(23) Approximately 100 Federal Government buildings, housing 125,000 employees were participating in such programs by October 2, 1978.(24) In addition, some 20 State governments, numerous cities, and the Canadian Government have all adopted this program.

An EPA-funded study of 12 private office wastepaper collection programs found a 12-percent average reduction in net solid waste management costs. Cost savings were greatest in programs that only recover white, high-grade paper. Costs included publicity, equipment, and labor. Participation averaged 80 percent for the programs studied, and ranged as high as 95 percent.

Commercial and Industrial Methods of Source Separation

Over the past few years, supermarkets, shopping malls, airports, hospitals, private businesses, and industrial facilities, such as auto assembly plants, have source separated such products as corrugated paper. The method used depends on the amount of paper generated, the space available for storage, and the investment required.

Data being prepared under contract for EPA indicate that most corrugated paper recovery takes place locally through neighborhood supermarket chains. For example, Safeway Stores, Inc., a national chain of supermarkets, is source separating the corrugated portion of its waste stream at most of its stores. One regional division, with 165 stores in Pennsylvania, Delaware, Maryland, northern Virginia, and Washington, D. C., source separated 23,000 tons of corrugated paper in 1977. This material was baled on site and sold to private haulers.

The same study found that large airports; shopping malls, hospitals, and commercial establishments were beginning to source separate their waste. Airports recover ferrous metals, while hospitals and shopping malls mainly recover corrugated paper. Most of the material recovered by commercial establishments was found to be high-grade paper.

Marketing Recovered Materials

The marketability of recovered materials must be taken into account by communities that undertake recycling programs. Both cans and glass, as well as some wastepaper, need to be upgraded by cleaning, sorting, and other processing in order to meet market specifications. Local communities that sponsor curbside recycling programs are faced with the decision of processing the materials themselves or selling their recycled materials to intermediate processors, which are firms

that purchase glass and cans from local communities and prepare them for the final market. Most communities are not doing the processing themselves.

The EPA's national survey of separate collection programs found that 39 percent of the programs surveyed had contracts with materials dealers or manufacturers to sell their recycled materials. Most of these contracts were for newspapers and mixed wastepaper and covered a period of 1 (75 percent) to 3 or more years. Other contract stipulations varied from those with both a floor price and a floating price above the floor price to those having only fixed-price provisions.

The price for recycled newspapers and mixed wastepaper has fluctuated throughout the history of separate collection programs. EPA found that during the 1974-75 recession, separate collection programs were seriously affected. Many were discontinued. Those communities that continued the programs reported that the price for recycled materials had been reduced.

A detailed discussion of the issues and problems related to marketing recycled materials can be found in the marketing section of chapter 3.

Interaction of Source Separation and Other Policies

Source Separation and Beverage Container Deposits

Source separation and beverage container deposits are both designed to reduce the amount of high-quality used products that get thrown away. An interesting consideration is whether establishing both approaches in the same region might detract from the attractiveness of either of them. Put another way, should source separation and beverage container deposits be viewed as competing or complementary?

Source separation and mandatory beverage container deposits might interact in several ways. A successful beverage container deposit law would reduce the glass and metal content of the solid waste stream and consequently the potential revenues from source separation would be reduced. A successful beverage container deposit law, however, would recover largely green and amber glass, leaving clear glass from food containers to be recovered by other means. Thus, a source separation program might recover only clear glass, which would have a higher market value than would a mixed-glass fraction containing green and amber glass as well.

If a residential source separation program is established, consumers who have returned beverage containers for environmental and conservation reasons may become less likely to do so. They may decide that separate collection is an acceptable alternative to landfill, even though glass bottles recovered in a curbside source separation program are likely to be broken and not reusable. Consumers who are motivated to return containers in response to the financial incentive of a deposit system are likely to continue to do so even if a source separation program is established.

In this analysis, it is assumed that, on balance, a source separation program will not affect the return rates and market shares for containers. Therefore, the focus is on the reduction in potential revenues from source separation if beverage container legislation is implemented.

The effect that beverage container deposit legislation (BCDL) might have on potential source separation revenues is estimated in the following way. In chapter 9, five scenarios are presented for the performance of the beverage delivery system under mandatory deposit legislation. Scenario I represents the actual situation in 1975. Changes in MSW composition are estimated for four other sets of return and recycle rates and market shares for containers, assuming that BCDL had been fully implemented in 1975. These

estimates are used here to evaluate the impact of BCDL on potential source separation program revenues in 1975 for each of the four scenarios, assuming a 50-percent participation in source separation for each component of the waste, and assuming average revenues per ton of the recovered material. *

Table 26 summarizes the calculation of potential revenues and credits from source separation using the five BCDL scenarios. (This table presents only revenues and not the effects of BCDL on the cost of separate collection, which would be small). For the base case without BCDL, the potential revenues and credits total $8,36 per ton of waste generated. Each of the four other scenarios shows a reduction in revenues and credits. The revenues and credits with BCDL range from $7.58 **to $7.81** per ton, for a reduction of 7 to 9 percent in revenues and credits per ton of waste generated. Since total waste tonnage decreased by as much as 3.6 percent, total revenues and credits might decrease by as much as 13 percent.

These reductions in source separation revenue with BcDL are relatively small because the contribution of container materials to revenues is, at most, only $2.29 per ton of generated waste. Beverage containers represent only a fraction of this, and BCDL is not expected to remove all beverage containers from MSW under any circumstances. ln fact, container revenue drops no lower than $1.41 per ton under any scenario.

Finally, it should be noted that the four BCDL scenarios span a wide range of system response from an all-glass-refillables system to a system with a high can-market share. Should BCDL be ineffective and return rates be very low, potential source separation revenues might remain the same or actually increase.

The preceding analysis is based on the adoption of a comprehensive residential and commercial source separation program. For a program limited to residential source separation, the impact of deposit legislation on source separation revenue would be more significant. Based on the data in table 24, a program picking up only newspapers, glass, and metal cans has a potential revenue of $3.35 per ton of generated waste without a deposit law and $2.51 to $2.75 per ton with a law. The maximum difference of 84 cents per ton of MSW generated corresponds to a drop in the potential gross revenue of 25 percent.

Source Separation and Centralized Resource Recovery

Source separation removes a fraction of materials from the waste stream. It may therefore reduce the potential revenue of an existing resource recovery plant. On the other hand, an effective source separation program can reduce the volume of waste to be disposed of and thus allow a smaller resource recovery plant to be built, while simultaneously reclaiming some resources of higher quality and value (particularly paper fiber, which, in many cases, has a higher value as a raw material than as a fuel).

The local economics of source separation and centralized resource recovery should be carefully investigated in order to judge whether either approach alone, or some combination of both, would be the most attractive. ** Nevertheless, some insight into the revenue and resource recovery implications of a dual system can be gained by examining the following example.

*For all the scenarios it is assumed that the components of MSW other than beverage containers are the gross discards (waste as discarded before recycling) presented in table 4. For Scenario I, the actual situation in 1975, beverage container waste components available for source separation are assumed to be included in the gross discards. For the four scenarios under BCDL, the beverage container waste components available are assumed to be the "net waste disposed of" because the remainder are returned through the deposit channel for reuse or direct recycling. In each case, the percentage composition of the waste is adjusted to reflect the new totals.

**Th, question of Compatibility between source separation and centralized resource recovery systems is currently being examined in detail by EPA in response to section 8002(e) of the Resource Conservation and Recovery Act of 1976.

Table 26.—Impact of Beverage Container Deposit Legislation on Potential Source Separation Revenues for Five BCDL Scenarios (Basis: 1975 and 50-percent participation)

Material	Potential unit revenue[a] ($/ton)	Potential source separation revenue per ton of waste generated at 50-percent participation for each scenario ($/ton)				
		I	II	III	IV	V
Newspaper	32.50	1.06	1.07	1.11	1.09	1.09
Books and magazines	12.50	0.14	0.14	0.15	0.15	0.14
Corrugated paper	30	1.38	1.40	1.43	1.43	1.41
Office paper	97.50	1.85	1.90	1.95	1.90	1.90
Glass containers	25	1.15	1.18	0.90	0.73	1.00
Steel containers	30	0.60	0.47	0.48	0.51	0.48
Aluminum containers	300	0.54	0.03	0.03	0.18	0.17
Yard waste	0[b]	0[b]	0[b]	0[b]	0[b]	0[b]
Total major source-separable materials revenues	—	6.72	6.19	6.05	5.99	6.19
Credit for disposal avoidance	6	1.64	1.62	1.58	1.59	1.60
Total revenues and credits	—	8.36	7.81	7.63	7.58	7.79

[a]Average of values in table 22.
[b]In this report recovery of yard waste in source separation programs is assumed to produce only landfill credits and neither energy savings nor net revenues. This choice is made because yard waste is quite varied seasonally and geographically and because experts disagree widely about the viability of yard waste utilization or sale. The effects of this choice are to underestimate by a small amount the economic and energy potentials of source separation.

Suppose that each person in a city with a population of 500,000 discards 3.5 pounds per day of MSW which has the national average composition. The city is considering three resource recovery options:

1. Construction of a centralized resource recovery plant to recover materials and refuse-derived fuel (RDF).
2. A multimaterial residential and commercial source separation program that recovers each of the materials included in table 21.
3. A combination of 1 and 2.

Estimates of materials and energy recovery and of revenues are summarized for each option in table 27. (It should be noted that this table only presents gross revenues and does not present the effects of various options on collection costs.)

Under option (l), an RDF plant with an average daily capacity of 875 tons is required. It would produce average daily revenues and disposal credits totaling $14,085.

Under option (2), if 50-percent participation occurs, a source separation program recovers 239 tons per day of materials and produces daily revenues and credits of $7,381.

Under option (3), if 50-percent participation in source separation occurs, an RDF plant with a daily capacity of 636 tons is needed. This option will produce combined revenues and disposal credits of $17,116, or $3,031 more than for option 1. At a processing cost of $15 per ton (see table 46), daily RDF processing costs are $3,585 less for the combined system than for the RDF system alone. If the additional costs for operating the source separation program are less than $6,616 per day ($3,031 plus $3,585) the combination in Option 3 is economically preferable to centralized resource recovery alone. Note that $6,616 per day is equivalent to $7.56 per ton of MSW collected and that source separation is generally thought to cost less than this to implement.

The input data for these comparisons are estimates and the results are by no means definitive. In addition, table 27 assumes that the technologies listed work, that the participation rate needed in Options 2 and 3 is achieved, and that there are markets for the

Table 27.—Recovery Rates and Revenues for Three Resource Recovery Option

Impact measure	option 1 RDF & materials	Option 2 source separation	Option 3 combination
RDF facility size (tpd)	875		636
Ferrous recovery (tpd)		18	67
Aluminum recovery	: ;	1.8	4.1
Glass recovery (tpd)		40	
Nonferrous recovery (tpd)	0[4];6		0.766
Paper recovery (tpd)		:	96
Yard waste recovery (tpd)	:	84	84
RDF productionc(tpd)	834	0	
RDF production (10* Btu\d)	7.88	0	454
Materials revenues ($/day)	3,693	5,947~	8,603e
Energy revenues ($/day)	5,910	0	3,893
Landfill credits ($/day @ $6/ton)	4,482	1,434	4,620
Total revenue & credits ($/day)	14,085	7,381	17,116

[a]Average unit revenues for source separation from table 26. Average unit revenues for centralized resource recovery from table 11. Recovery efficiencies for RDF system are: ferrous, 90%; aluminum and glass, 50%; nonferrous, 30%.
[b]Participation rate 50% in source separation.
[c]Heating value of RDF is 6,210 Btu per pound under Option 1 and 5,716 Btu per pound under Option 3, for a decrease of 8 percent.
[d]Assumes source separated paper and yard waste have heating values of 7,500 Btu per pound.
[e]Assumes no revenue for recovered yard waste.

materials recovered, Nevertheless, the table suggests that a combination of source separation and centralized resource recovery is on an almost equal, if not better, economic footing than centralized resource recovery alone. If this is true, there is no reason for a community to reject the possibility of a well-integrated source separation and resource recovery program on economic grounds, Furthermore, the joint program will require a lower total capital investment, and will produce revenues from the source separation program and reduce landfill costs almost immediately while construction of the resource recovery plant proceeds. In addition, source separation material revenues may grow more rapidly than those from centralized resource recovery owing to their higher quality. Of course, the success of resource recovery, either through centralized resource recovery or through source separation is highly dependent on the availability of existing markets for the recovered materials.

The analysis also makes clear that the resource recovery plant revenues would be smaller with source separation in place and that part of the revenues from the source separation program would have to pay for the higher net unit cost of resource recovery. A preexisting resource recovery plant designed to process the entire city's waste would experience a sharp decline in revenue if a source separation program were successfully introduced after the plant was built. For example, an RDF plant that depends on a large amount of burnable wastepaper might be severely affected by a source separation program that recovered newspapers and/or mixed wastepaper.

Source Separation and Economic Incentives

Source separation would be stimulated if the Federal Government implemented economic incentives to encourage recycling. Such incentives might include the establishment of a "product charge" on all products entering the municipal waste stream, modification or repeal of the percentage depletion allowance, and/or the institution of a Federal income tax credit for the purchase of recycled materials. These options are mechanisms to increase the demand for recycled materials by the producers of primary materials. As a consequence, a wide range of recycling activities, including source separation, would be encouraged. (See chapter 8 for a discussion of these economic incentives and their effectiveness in stimulating recycling and reducing the rate of waste disposal.)

Federal Policy and Source Separation

Source separation can be a desirable local or regional approach to recovering a portion of the solid waste stream. It is, therefore, of interest to consider the policy options available to the Federal Government for implementing or improving this approach. Such options should permit a range of responses at the State and local levels so that the different roles that source separation could play under various circumstances would be recognized.

No Additional Federal Action

ln the limited number of cases for which data are available, source separation appears to be self-sustaining, or nearly so, on an economic basis. Thus, there may be little need for Federal action, other than assuring that Federal agencies consider source separation, along with centralized resource recovery, as a viable component of solid waste management systems. In designing general policies toward solid waste management and materials conservation, Federal agencies should not arbitrarily rule out source separation approaches. For example, planning, demonstration, or financial incentive programs should include source separation along with centralized resource recovery.

Direct Federal Action

MANDATED SOURCE SEPARATION OF MATERIALS BY FEDERAL AGENCIES

The EPA issued guidelines in 1976 requiring separate collection of paper at any Federal agency that generates recoverable paper wastes, under the authority of section 209(a) of the Solid Waste Disposal Act, as amended by the Resource Recovery Act of 1970. The guidelines are recommended to State and local governments as well as to private organizations. They require that Federal office buildings with a minimum staff of 100, source-separate and recycle high-grade paper; that Federal facilities (such as military bases) housing 500 or more families recycle newspapers; and that corrugated containers from Federal facilities that generate 10 or more tons per month must be recycled.

INCENTIVES FOR INVESTMENT IN RECYCLING FACILITIES

Another option is to provide interest rate subsidies, cash grants, or other incentives to public agencies or to private firms for investment in recycling facilities. (See chapter 2 for a discussion of the additional 10-percent investment tax credit for recycling facilities passed into law in late 1978.) Intermediate processing industries for source-separated material would be included as candidates for such incentives. Proposals have been made for a bank that would lend funds for recycling facilities at 1 percent above the cost to the Government of lending the money. Such a proposal would help reduce interest rates on such loans thereby making investments in recycling facilities more attractive.

LABOR TAX CREDITS FOR RECYCLING PROGRAMS

A corporate income tax credit for some portion of the wages of additional employees hired to carry out recycling activities might stimulate all types of recycling. Such a program would tend to favor private sector source separation over centralized resource recovery because separate collection is more labor-intensive than other kinds of recycling.

FEDERAL SUPPORT FOR RESEARCH, DEVELOPMENT, AND DESIGN FOR SOURCE SEPARATION

Another option is to fund research, development, and design for source separation. Examples of possible project areas are: (a) developing well-documented educational material to be used in informing communities about source separation, (b) designing manuals to be used by communities or offices in setting up source-separation recycling programs, (c) developing mechanisms for motivating high participation rates for source separation, and (d) devising ways to improve the

removal of contaminants from wastepaper, glass, and cans.

FEDERAL FUNDING OF DEMONSTRATION PROJECTS

Funding for demonstration projects is another option available to the Federal Government. Such grants can be used to: (a) learn more about a particular new program, product, or process—"policy-formulating demonstrations;" (b) promote the use of a program, product, or process—"policy-implementing demonstrations;' and (c) provide a political compromise between those groups that prefer large-scale operating programs and those that prefer nothing.

Demonstration grants could improve a number of areas in the field of source separation. A major demonstration program is needed in a large eastern city, which would focus on collection, public awareness, processing/marketing, and waste utilization techniques. The purposes of such a program would be to test both the viability of source separation in a major metropolitan area and its interaction with other solid waste management options. Demonstration grants might also be provided to the intermediate processing industries in order to develop improved methods for removing contaminants from wastepaper, glass, and cans.

Currently EPA is sponsoring a demonstration grant to the Denver Regional Council of Governments for implementing a source separation program in Boulder, Colo. Other implementation grants previously sponsored by EPA included programs in Somerville and Marblehead, Mass., in Nez Pez County, Idaho, in Duluth, Minn., and in San Luis Obispo and Modesto, Calif,

Indirect Federal Action

FEDERAL PROCUREMENT

The Federal Government's expenditures on paper and other goods, while large, are small in comparison to those of the private sector. However, many procurement practices of the Federal Government are widely adopted by States, local municipalities, and industry. Consequently, a modification of Federal procurement specifications and procurement practices to require recycled paper or other goods will have a positive effect on the use of these recycled materials. Specifications that encourage greater use of recycled paper would stimulate demand for source separation programs, since recyclable paper can be produced from wastepaper only if it is kept separate from mixed MSW.

Section 6002 of the Resource Conservation and Recovery Act (RCRA) specifies that Federal agencies will be required to choose products that are composed of the highest percentage of recycled materials practicable, consistent with maintaining a satisfactory level of competition, after October 21, 1978. However, in developing guidelines in response to the Act, EPA has had difficulty in precisely defining a "recycled" material. The RCRA only defines a "recovered" material. It does not explicitly define the term "recycled. " As a result EPA is working to develop guidelines that will define, in some detail, the Act's intent with respect to the use of home scrap, prompt scrap, and postconsumer scrap in the recycling process.

At present, EPA is trying to tie the date for compliance by the Federal agencies to the issuance of its guidelines. This action requires that an amendment to RCRA changing the October 21, 1978 compliance date be passed, or that an oral agreement be reached between the affected Federal agencies and Congress. EPA's proposed guidelines are expected to be phased-in during FY 1978 and FY 1979. Four sets of guidelines will be issued so that industry's specific questions about what constitutes a "recycled" material can be answered in detail. The guidelines will be broken down into the following categories: (i) paper products, sanitary paper, computer paper, etc.; (ii) fly ash used in the manufacture of cement; (iii) other construction materials; and (iv) composted sewage sludge.

OTHER INDIRECT FEDERAL ACTIONS

A number of other incentives that could be adopted by the Federal Government to encourage recycling would stimulate source separation. These include: (i) establishment of "product charges" on all products entering the municipal waste stream; (ii) elimination of the capital gains tax treatment of income from timber sales; (iii) equalization of freight rates for virgin and secondary materials; (iv) modification or repeal of the percentage depletion allowance; (v) placement of a tax on virgin materials levied at the point of mining or harvest in proportion to some measure of the amount or value extracted, i.e., a severance tax; and (vi) a Federal income tax credit for the purchase of recycled materials. None of these options is unique to source separation. However, they are all possible ways to stimulate a wide range of recycling activities, including source separation, by increasing the demand for recycled materials by the producers of primary materials. These options are discussed in detail in chapters 3 and **8.**

Findings on Source Separation

Source separation for the recovery of recyclable materials from MSW is widely practiced in the United States today. It is the only available method with which wastepaper can be recovered for recycling into new paper products. It is also used to recover glass, ferrous and nonferrous metals, and yard waste for recycling. Nearly all of the MSW that is currently recovered for recycling is collected in source separation programs.

Source separation can produce sizable revenues and energy savings from MSW, but has only a limited effect on the total solid waste stream. For example, at 50-percent participation, a comprehensive residential and commercial program could recover around one-fourth of a community's MSW, leaving three-fourths for recovery or disposal by other means. With such a program in place, a community would still have ample opportunity to install a centralized system for materials and/or energy. Depending on the level of participation and on market conditions, a carefully planned combination of source separation and centralized resource recovery may be the optimal approach from an economic point of view.

Source separation programs currently operated by municipalities, industry, and volunteer groups include curbside separate collection programs, multimaterial recovery in community recycling centers, industry-sponsored recycling programs, and commercial and industrial methods of source separation. According to EPA, about 133 communities were collecting newspapers in curbside programs in May 1978. Another 40 were collecting other kinds of paper and/or glass and cans. Industry-sponsored programs collected 24.8 percent of all-aluminum beverage cans produced in 1977.

Although source separation has grown in popularity in the last decade, some programs have experienced technical or organizational problems. Many others, however, have failed owing to problems in marketing their products, and still others have faced indifference or hostility from proponents of alternative approaches. Nevertheless, a great deal of expertise has been developed for designing and operating such programs. Much of the activity has occurred in small towns and in moderate-sized cities. A residential source separation program encompassing a major urban area has yet to be demonstrated.

Nearly every potential Federal action to encourage recycling would stimulate source separation activities, unless specific barriers to its inclusion are raised. Specific Federal efforts to assist source separation activities would include funding of systems research, innovative program design, and improvement of equipment for intermediate processing or materials upgrading. One important option would be for Federal assistance to demonstrate curbside source separation in a major urban area in order to learn how to implement such a program, and, presuming success, to show other cities what might be done.

Finally, there are no major inherent conflicts among source separation. centralized resource recovery. and beverage container deposit legislation. However, to avoid possible revenue problems, capital-intensive, centralized systems must usually be designed to accommodate existing or future separate collection programs.

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